Enquiries and formal applications for admission should be directed to the:

Registrar,
University of Waterloo, Waterloo, Ontario, Canada N2L 3G1
Telephone: 885-1211 (Area Code 519)

The Registrar's Office is located on the second floor of the Ira G. Needles Hall.
Office hours are from 8:30 a.m. to 4:30 p.m. Monday through Friday. The office is not open on Saturday.

Federated and Affiliated Church Colleges Telephones
Conrad Grebel College 885-0220 (area code 519)
Renison College 884-4400 (area code 519)
University of St. Jerome's College 884-8110 (area code 519)
St. Paul's College 885-1460 (area code 519)

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

General Information
9 Campus Map
10 Academic Calendar of Events

1 The University of Waterloo
17 The Undergraduate Calendar
17 The University of Waterloo
19 University of St. Jerome's College
20 Renison College
20 Conrad Grebel College
20 St. Paul's College
21 Degrees Offered
22 Systems of Study
22 Part-time Studies
22 Correspondence Courses
23 Grading System
24 Cross-Registration with Wilfrid Laurier University
24 Continuing Education
24 Centre for Continuing Studies in Management Education
25 The Computing Centre
26 Office of Research Administration
26 Waterloo Research Institute
26 Office of Human Research

2 Admission Information and Requirements
29 General Admission Information
31 Applicants - Ontario Grade 13
34 Applicants Other Than Ontario Grade 13
37 Applications - Documents and Procedures

3 Fees and Registration
39 Fees and Registration

4 Scholarships, Bursaries, Prizes and Financial Aid
49 Scholarships, Bursaries, Prizes and Financial Aid

5 Student Services
67 Federation of Students
67 Cultural Programme Centre
69 Bookstore
69 Athletics
71 Counselling Services
72 Careers Information Centre
72 Health Services
73 Residence Information
77 Office of the Dean of Women
77 Office of the Registrar
78 Secondary School Liaison
78 Student Awards
University of Waterloo
Undergraduate Calendar
1974-75

General Information
1 University of Waterloo
2 Admission
3 Fees
4 Scholarships, Bursaries, Prizes & Financial Aids
5 Student Services
6 Co-ordination and Placement
7 Libraries

Undergraduate Programmes
8 Faculty of Arts
9 Faculty of Engineering
10 Faculty of Environmental Studies
11 Faculty of Human Kinetics and Leisure Studies
12 Programme of Integrated Studies
13 Inter-Faculty Studies
14 Faculty of Mathematics
15 Faculty of Science

Undergraduate Course Descriptions
16 Undergraduate Course Descriptions

Governing Bodies and Staff
17 Governing Bodies and Staff
# Contents

6 The Departments of Co-ordination and Career Planning and Placement

82 The Co-operative Plan
86 Student Advisory Council
86 Industrial Advisory Council
87 Organizations Employing Co-operative Students
99 Department of Career Planning and Placement

7 The University Libraries
103 The University Libraries

Undergraduate Programmes

8 Faculty of Arts
111 Degrees
111 Pass Programme
111 Honours Programme
112 Admission
112 Examinations and Standings
115 Academic Programmes
118 Non-Major General Arts Programmes
118 The General Programme
119 Minor Programmes
119 Honours Programmes

9 Faculty of Engineering
145 The Co-operative Engineering Programme
146 Degrees
146 Co-operative Programme
147 Admission
148 Examinations and Promotions
151 Academic Programmes
153 Chemical Engineering
158 Civil Engineering
162 Electrical Engineering
165 Mechanical Engineering
170 Systems Design

10 Faculty of Environmental Studies
181 Academic Programmes
182 School of Architecture
185 Department of Geography
190 Department of Man-Environment Studies
193 School of Urban and Regional Planning
197 Degrees
197 Admissions
198 Examinations and Standings

11 Faculty of Human Kinetics and Leisure Studies
205 Kinesiology
206 Recreation
206 Degrees
206 Regular Programme
206 Co-operative Programme
12 Programme of Integrated Studies
221 Programme of Integrated Studies

13 Inter-Faculty Studies
225 The Inter-Faculty Programme Board

14 Faculty of Mathematics
229 Admission
231 Part-time Studies
231 Correspondence Courses
231 Standings and Promotions
234 Degrees
235 Academic Programmes
239 Joint Mathematics Programmes with other Faculties
243 Co-operative Mathematics Programmes
246 Applied Analysis and Computer Science Department
247 The Applied Mathematics Department
247 The Department of Combinatorics and Optimization
248 The Department of Pure Mathematics
249 The Department of Statistics

15 Faculty of Science
253 Degrees
254 Admission
255 Examinations and Standings
261 Academic Programmes
261 First Year Programmes (Regular and Co-operative)
266 Honours Programmes
283 Optometry Programme
287 The Honours Science Programme
289 The General Science Programme

16 Undergraduate Course Descriptions
665 Anthropology
515 Applied Analysis and Computer Science
516 Applied Mathematics
401 Architecture
453 Art
301 Arts
305 Biology
312 Canadian Studies
316 Chemical Engineering
323 Chemistry
302 Chinese
335 Civil Engineering
344 Classics and Romance Languages
345 Classics
517 Combinatorics and Optimization
Contents

360 Communications Studies
509 Dance
364 Drama and Theatre Arts
369 Earth Sciences
374 Economics
384 Electrical Engineering
391 English
451 Environmental Studies
453 Fine Arts
350 French
463 General Engineering
416 Geography
466 German and Slavic Languages and Literatures
466 German
348 Greek
506 Health Studies
477 History
495 Human Relations and Counselling Studies
355 Italian
645 Interdisciplinary Social Science
498 Inter-Faculty Studies
501 Kinesiology
349 Latin
511 Management Sciences
434 Man-Environment Studies
515 Mathematics
553 Mechanical Engineering
563 Medieval Studies
460 Music
565 Optometry
572 Philosophy
586 Physics
442 Planning
600 Political Science
608 Psychology
518 Pure Mathematics
617 Recreation
623 Religious Studies
472 Russian
673 Science
643 Social Science (Applied) Programme
647 Social Work
649 Sociology and Anthropology
649 Sociology
356 Spanish
519 Statistics
673 Systems Design
364 Theatre Arts
475 Ukrainian
442 Urban and Regional Planning
682 Women’s Studies

17 Governing Bodies & Staff

687 The Board of Governors
688 The Senate
697 Administrative Offices
Campus Guide

* Information Kiosks
After hours please enquire at Security Office, Bldg. No. 15

Parking Lots
Visitor pay parking D (25¢ per hr.); N, M (25¢); visitor lot Optometry adjacent to O (25¢); H evenings and weekends (25¢).
Visitor pay parking in A, C (10¢).
Reserved parking in all other lots.
Free parking in E for UW permit holders only.

Academic Faculties

Arts
9 Arts Lecture Hall
5 Modern Languages
includes Theatre of the Arts; Art Gallery, coffee shop.
10 Isaiah Bowman Social Sciences
24 J. G. Hagey Hall of Humanities
includes Humanities theatre
8 Dana Porter Arts Library
includes Integrated Studies
30 Psychology

Engineering
1 Engineering 1
2 Engineering 2
3 Engineering 3
29 Engineering 4
11 Engineering Lecture Hall

Environmental Studies
10 Offices in Isaiah Bowman
Social Sciences
109 School of Architecture

Human Kinetics and Leisure Studies
17 Offices in Mathematics and Computer Building
18 Physical Activities Complex
includes Department of Athletics

Administration
32 Administrative Services
includes office of Vice-President, Finance and Operations; Administrative Services; Bookings;
Financial Services; Internal Audit; Operations Analysis; Personnel; Physical Resources Group;
Purchasing; Safety; coffee shop
31 Needles Hall
(formerly Student Services)
includes: office of President; office of Vice-President, Academic; Academic Services; Alumni;
Career Planning and Placement; Career Information Centre;
Chaplain's office; Co-ordination; Counselling Services; Development; Graduate Studies; Information Services; Office Services;
Registrar; Student Housing; University Secretariat; Waterloo Research Institute.

University Services
16 South Campus Hall
includes Food Services; Book Store; Centre for Continuing Management Education;
19 Campus Centre
includes student organizations; various commercial services; snack bar
27 Faculty Club
12 Central Services
14 Maintenance Stores
includes Graphic Services; Mail Services
15 Commissary; Security
40 Grounds Maintenance
includes Radio Waterloo; warehouse
104 Graduate Club
includes Graduate Student Union
22 Health Services
90 Seagram Stadium
91 Seagram Gymnasium

Integrated Studies Program
30 Offices in Psychology Building

Mathematics
17 Mathematics and Computer
includes computing centre; data processing; administrative offices for Human Kinetics and Leisure Studies; EMS Library
(Engineering, Mathematics and Science)

Science
4 Physics
6 Chemistry 1
28 Chemistry 2
7 Biology 1
includes Biology and Earth Sciences museum
13 Biology 2
33 Optometry
includes Optometry clinic (until mid December '73, clinic off-campus at 15A King St. N., Waterloo)

Church Colleges
84 Conrad Grebel College
82 Renison College
81 St. Jerome's College
80 Notre Dame Women's Residence
140 Resurrection College
83 St. Paul's College

Residences
20 Student Village 1
25 Student Village 2
21 Tutor's Apartments
23 Minota Hagey Women's Residence
26 Married Students' Apartments
149 Hammarskjold House (co-op)
150 Phillip St. Residence (co-op)
## Academic Calendar

### 1974

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>March 4, Monday</strong></td>
<td>Meeting – Senate Executive Committee</td>
</tr>
<tr>
<td><strong>March 11, Monday</strong></td>
<td>Supplemental Examinations Begin – Co-operative Programmes</td>
</tr>
<tr>
<td><strong>March 11, Monday</strong></td>
<td>Pre-registration Begins – Regular and Co-operative Students for Fall Term 1974</td>
</tr>
<tr>
<td><strong>March 15, Friday</strong></td>
<td>Pre-registration Ends – Regular and Co-operative Students for Fall Term 1974</td>
</tr>
<tr>
<td><strong>March 18, Monday</strong></td>
<td>Meeting – University Senate</td>
</tr>
<tr>
<td><strong>April 1, Monday</strong></td>
<td>Meeting – Senate Executive Committee</td>
</tr>
<tr>
<td><strong>April 2, Tuesday</strong></td>
<td>Meeting – Board of Governors</td>
</tr>
<tr>
<td><strong>April 3, Wednesday</strong></td>
<td>Lectures End – Winter Term</td>
</tr>
<tr>
<td><strong>April 6, Saturday</strong></td>
<td>Examinations Begin – Winter Term</td>
</tr>
<tr>
<td><strong>April 12, Friday</strong></td>
<td>Good Friday – University Closed</td>
</tr>
<tr>
<td><strong>April 15, Monday</strong></td>
<td>Meeting – University Senate</td>
</tr>
<tr>
<td><strong>April 26, Friday</strong></td>
<td>Examinations End – Winter Term</td>
</tr>
<tr>
<td><strong>April 26, Friday</strong></td>
<td>Winter Work Term Ends – Co-operative Programmes</td>
</tr>
<tr>
<td><strong>April 29, Monday</strong></td>
<td>Spring Work Term Begins – Co-operative Programmes</td>
</tr>
<tr>
<td><strong>April 30, Tuesday</strong></td>
<td>Registration – Undergraduate Co-operative Programmes</td>
</tr>
<tr>
<td><strong>April 30, Tuesday</strong></td>
<td>Registration – Graduate Studies – Spring Term</td>
</tr>
<tr>
<td><strong>May 1, Wednesday</strong></td>
<td>Lectures Begin – Spring Term</td>
</tr>
<tr>
<td><strong>May 6, Monday</strong></td>
<td>Meeting – Senate Executive Committee</td>
</tr>
<tr>
<td><strong>May 20, Monday</strong></td>
<td>Victoria Day – University Closed</td>
</tr>
<tr>
<td><strong>May 21, Tuesday</strong></td>
<td>Meeting – University Senate</td>
</tr>
<tr>
<td><strong>May 21, Tuesday</strong></td>
<td>End of Course Change Period – Spring Term</td>
</tr>
<tr>
<td><strong>May 23, Thursday</strong></td>
<td>Spring Convocation</td>
</tr>
<tr>
<td><strong>May 24, Friday</strong></td>
<td>Spring Convocation</td>
</tr>
<tr>
<td><strong>May 25, Saturday</strong></td>
<td>Spring Convocation</td>
</tr>
<tr>
<td><strong>May 27, Monday</strong></td>
<td>Pre-registration Begins – Co-operative Students for Winter Term 1975</td>
</tr>
<tr>
<td><strong>May 29, Wednesday</strong></td>
<td>Pre-registration Ends – Co-operative Students for Winter Term 1975</td>
</tr>
<tr>
<td><strong>June 3, Monday</strong></td>
<td>Meeting – Senate Executive Committee</td>
</tr>
<tr>
<td><strong>June 4, Tuesday</strong></td>
<td>Meeting – Board of Governors</td>
</tr>
<tr>
<td><strong>June 17, Monday</strong></td>
<td>Meeting – University Senate</td>
</tr>
<tr>
<td><strong>July 1, Monday</strong></td>
<td>University Closed – Dominion Day Observance</td>
</tr>
<tr>
<td><strong>July 2, Tuesday</strong></td>
<td>Registration – Summer Session</td>
</tr>
<tr>
<td><strong>July 2, Tuesday</strong></td>
<td>Lectures Begin – Summer Session</td>
</tr>
<tr>
<td><strong>July 15, Monday</strong></td>
<td>Supplemental Examinations Begin</td>
</tr>
<tr>
<td><strong>July 31, Wednesday</strong></td>
<td>Lectures End – Spring Term</td>
</tr>
<tr>
<td><strong>August 3, Saturday</strong></td>
<td>Examinations Begin – Spring Term</td>
</tr>
<tr>
<td><strong>August 5, Monday</strong></td>
<td>Civic Holiday – University Closed</td>
</tr>
<tr>
<td><strong>August 8, Thursday</strong></td>
<td>Lectures End – Summer Session</td>
</tr>
<tr>
<td><strong>August 9, Friday</strong></td>
<td>Examinations End – Spring Term</td>
</tr>
<tr>
<td><strong>August 9, Friday</strong></td>
<td>Examinations Begin – Summer Session</td>
</tr>
<tr>
<td><strong>August 10, Saturday</strong></td>
<td>Examinations End – Summer Session</td>
</tr>
<tr>
<td><strong>August 23, Friday</strong></td>
<td>Spring Work Term Ends – Co-operative Programmes</td>
</tr>
<tr>
<td><strong>August 26, Monday</strong></td>
<td>Fall Work Term Begins – Co-operative Programmes</td>
</tr>
</tbody>
</table>
September 2, Monday  
Labour Day – University Closed

September 3, Tuesday  
Registration Begins – Undergraduate Regular and Co-operative Programmes

September 3, Tuesday  
Meeting – Senate Executive Committee

September 6, Friday  
Registration – Graduate Studies – Fall Term

September 6, Friday  
Registration Ends – Undergraduate Regular and Co-operative Programmes

September 9, Monday  
Lectures Begin

September 16, Monday  
Meeting – University Senate

September 27, Friday  
End of Course Change Period – Fall Term

October 7, Monday  
Meeting – Senate Executive Committee

October 14, Monday  
Thanksgiving Day – University Closed

October 18, Friday  
Fall Convocation

October 21, Monday  
Meeting – University Senate

November 4, Monday  
Supplemental Examinations Begin – Co-operative Programmes

November 4, Monday  
Meeting – Senate Executive Committee

November 5, Tuesday  
Meeting – Board of Governors

November 6, Wednesday  
Pre-registration Begins – On-campus Co-operative Students for Spring Term 1975

November 8, Friday  
Pre-registration Ends – On-campus Co-operative Students for Spring Term 1975

November 18, Monday  
Meeting – University Senate

December 2, Monday  
Meeting – Senate Executive Committee

December 4, Wednesday  
Lectures End – Fall Term

December 7, Saturday  
Examinations Begin – Fall Term

December 16, Monday  
Meeting – University Senate

December 20, Friday  
Examinations End – Fall Term

December 20, Friday  
Fall Work Term Ends – Co-operative Programmes

December 23, Monday  
Winter Work Term Begins – Co-operative Programmes

December 25, Wednesday  
Christmas Day – University Closed

December 26, Thursday  
University Closed
1975

January 1, Wednesday New Year’s Day – University Closed
January 6, Monday Registration – Undergraduate Co-operative Programmes
January 6, Monday Registration – Winter Term – Graduate Studies
January 6, Monday Lectures Begin – Winter Term
January 6, Monday Meeting – Senate Executive Committee
January 20, Monday Meeting – University Senate
January 24, Friday End of Course Change Period – Winter Term
February 3, Monday Meeting – Senate Executive Committee
February 4, Tuesday Meeting – Board of Governors
February 17, Monday Meeting – University Senate
February 17, Monday Study Week Begins – Arts and Environmental Studies (Regular Programmes)
March 3, Monday Meeting – Senate Executive Committee
March 10, Monday Supplemental Examinations Begin – Co-operative Programmes
March 10, Monday Pre-registration Begins – Regular and Co-operative Students for Fall Term 1975
March 14, Friday Pre-registration Ends – Regular and Co-operative Students for Fall Term 1975
March 17, Monday Meeting – University Senate
March 28, Friday Good Friday – University Closed
April 1, Tuesday Meeting – Board of Governors
April 2, Wednesday Lectures End – Winter Term
April 5, Saturday Examinations Begin – Winter Term
April 7, Monday Meeting – Senate Executive Committee
April 21, Monday Meeting – University Senate
April 25, Friday Examinations End – Winter Term
April 25, Friday Winter Work Term Ends – Co-operative Programmes
April 28, Monday Spring Work Term Begins – Co-operative Programmes
April 29, Tuesday Registration – Undergraduate Co-operative Programmes
April 29, Tuesday Registration – Graduate Studies – Spring Term
April 30, Wednesday Lectures Begin – Spring Term
May 5, Monday Meeting – Senate Executive Committee
May 19, Monday Victoria Day – University Closed
May 20, Tuesday Meeting – University Senate
May 21, Wednesday End of Course Change Period – Spring Term
May 22, Thursday Spring Convocation
May 23, Friday Spring Convocation
May 24, Saturday Spring Convocation
May 26, Monday Pre-registration Begins – Co-operative Students for Winter Term 1976
May 28, Wednesday Pre-registration Ends – Co-operative Students for Winter Term 1976
General Information

1 The University of Waterloo
2 Admissions
3 Fees and Registration
4 Scholarships, Bursaries, Prizes and Financial Aid
5 Student Services
6 Co-ordination and Placement
7 Libraries
The University of Waterloo
The Undergraduate Calendar

The Undergraduate Calendar is published once a year by the Office of the Registrar, University of Waterloo. The Calendar serves to provide a current and official list of academic courses and programmes, policies, and regulations regarding admissions, examinations, and fees, as well as general information about the University. It also serves as an official and historical record of the University.

Candidates for admission and students currently enrolled in the University are encouraged to become familiar with the contents of the Calendar. If there is any doubt as to the interpretation of the contents of the Calendar, enquiries can be directed to the Registrar or to the person directly concerned with the area in question.

The Calendar is arranged in chapters which fall into four divisions. The first division contains general information about the University including services, systems of study, and library facilities. The second division outlines the undergraduate programmes offered at the University and the third division describes the courses offered in these programmes. All courses listed may not be offered in the current section, therefore, students are advised to consult the University course offerings list prior to arranging their programmes. The last division of the Calendar describes the general administrative structure of the University. A more detailed table of contents can be found at the beginning of the Calendar.

The information in this Calendar applies to the 1974-75 academic session which commences in September 1974. The Senate and the Board of Governors of the University of Waterloo reserve the right to make changes in the academic Calendar without prior notice.

The University also publishes:

* a Graduate Studies Calendar
* an Admissions Brochure
* a Summer Session Brochure
* an Extramural Brochure

The University

Classes at the University of Waterloo 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 offering courses at both the undergraduate and the graduate level. The University is co-educational and non-denominational. Programmes are now offered in Architecture, Arts, Engineering, Environmental Studies, Integrated Studies, Mathematics, Optometry, Human Kinetics and Leisure Studies, and Science. The University is a member of The Association of Universities and Colleges of Canada and of the Association of Commonwealth Universities.
The Campus
The University is situated on a beautiful 1,000 acre campus in the northwest section of the City of Waterloo. Waterloo, and its twin city Kitchener, are steadily growing industrial centres in mid-western Ontario with a combined population of approximately 150,000 people.

Since the opening of the first permanent structure on campus in 1958, the University has expanded steadily. The thirty teaching and service buildings presently on campus include a Computing Centre, a Physical Activities Complex, a stadium, extensive library facilities, two theatres, four residential Church Colleges, and a variety of modern residential accommodation.

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.

Motto
Concordia Cum Veritate — In Harmony with Truth

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.

The four-fold diversity is significant because of the four faculties existing at the time the 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 marvellous potential of a new individual life.
University Jurisdiction

The University exercises its statutory jurisdiction and authority with respect to the operation, protection and control of its property and plant and the regulation of persons on campus insofar as is necessary to ensure the orderly performance of a university's functions.

In addition it should be recognized that all members of the University, as members of all society at large, must expect to be subject to the general public, civil and criminal jurisdiction whether on or off campus.

Academic Organization

The University is organized under several academic units called Faculties as follows: The Faculty of Arts, The Faculty of Engineering, The Faculty of Environmental Studies, The Faculty of Human Kinetics and Leisure Studies, The Faculty of Mathematics, and The Faculty of Science. Within this framework are various departments and schools. Students who want to follow a more independent and unstructured course of study than the traditional one may wish to seek admission to the Integrated Studies Programme. Qualified students, registered in any Faculty in the University, may choose electives from among the multi-disciplinary courses offered by Inter-Faculty Studies.

Enrollment for each Faculty – 1973-74 (as of October, 1973)

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty of Arts</td>
<td>2,419</td>
</tr>
<tr>
<td>Faculty of Engineering</td>
<td>2,698</td>
</tr>
<tr>
<td>Faculty of Environmental Studies</td>
<td>1,140</td>
</tr>
<tr>
<td>Faculty of Human Kinetics and Leisure Studies</td>
<td>1,011</td>
</tr>
<tr>
<td>Integrated Studies Programme</td>
<td>73</td>
</tr>
<tr>
<td>Faculty of Mathematics</td>
<td>2,619</td>
</tr>
<tr>
<td>Faculty of Science</td>
<td>1,757</td>
</tr>
</tbody>
</table>

Total Undergraduate Enrollment (Full-Time) 11,717

Graduate Student Enrollment (Full-Time) 1,181

The Church Colleges

There are four church-related colleges associated with the University.

University of St. Jerome's College

The University of St. Jerome's College is a liberal arts college which had been affiliated with the University of Ottawa since 1947 and entered into federation with the University of Waterloo in July, 1960. It offers a complete range of undergraduate courses in the Faculty of Arts and registers students in regular Mathematics and certain programmes in the Faculty of Environmental Studies. Students registered at St. Jerome's College freely supplement their programmes with courses offered at the university and students registered at the university complement their programmes.
with courses offered uniquely by St. Jerome’s. Graduates of the college receive University of Waterloo degrees in accordance with the terms of the federation agreement. A continuous building programme since 1962 finds St. Jerome’s presently with a teaching and administration building, a library, a men’s residence accommodating 120 and a women’s residence, Notre Dame College, operated by the School Sisters of Notre Dame, which has room for 120 students. The University of St. Jerome’s College is conducted by the Congregation of the Resurrection.

Renison College Renison College was founded by a group of Anglicans committed to the principle of a small residence-teaching community which could emphasize the virtues of intimacy, creativity, and innovation with regard both to teaching and residential life.

Academic offerings at Renison include courses in two areas: (a) Applied Social Science Programme, and (b) General Arts. The former is an integrated programme of courses in the areas of Social Work, Psychology, and Sociology, with emphasis on both classroom study and community involvement. Within General Arts are courses in English, French, Geography, Psychology, Religious Studies, and Sociology.

The college has two residences accommodating 100 men and 80 women.

Conrad Grebel College Conrad Grebel College is a Mennonite school with residential, teaching, research, and community programmes. Its courses are open to all students on campus. In the Calendar, Conrad Grebel College courses have a G suffix, and they can be found under Arts, History, Music (Fine Arts), Religion and Sociology. Special emphases include peace studies in the various disciplines. The academic programme in music at the University is administered by Conrad Grebel College. There are several choirs, choral, and instrumental ensembles.

St. Paul's College St. Paul's United College is a teaching and residential community of 150 men and women. It offers a limited number of courses in Religious Studies which are available for academic credit to any student enrolled in the University. Resident life in the College provides a valuable contribution to university experience beyond that which comes from courses taken for credit. Through a programme of athletics, community dinners, a congregation and interest groups engaged in various projects and issues relating to the University, the Church, personal life and society, members of the College and associates participate in a vital and enriching community.

Information regarding admission to the Church Colleges residences can be found under “Residences” in Chapter 5 of this calendar.
Degrees Offered

The University of Waterloo offers the following undergraduate degrees:

- Bachelor of Architecture (B.Arch.)
- Bachelor of Arts (B.A.)
- Bachelor of Applied Science (B.A.Sc.)
- Bachelor of Environmental Studies (B.E.S.)
- Bachelor of Independent Studies (B.I.S.)
- Bachelor of Mathematics (B.Math.)
- Bachelor of Science (B.Sc.)
- Doctor of Optometry (O.D.)

Further information concerning these degrees and their related programmes is available in the faculty sections of this Calendar.

The University of Waterloo offers the following graduate degrees:

- Master of Arts (M.A.)
- Master of Applied Science (M.A.Sc.)
- Master of Science (M.Sc.)
- Master of Philosophy (M.Phil.)
- Doctor of Philosophy (Ph.D.)

Further information concerning these degrees and their related programmes is available in the Graduate Calendar.

Honorary Degrees

The following honorary degrees are conferred by the Senate of the University:

- Doctor of Laws (L.L.D.)
- Doctor of Science (D.Sc.)
- Doctor of Letters (D.Litt.)
- Doctor of Mathematics (D.Math.)
- Doctor of Engineering (D.Eng.)
- Doctor of Environmental Studies (D.E.S.)

Systems of Study

The University offers its students two different systems of study, the Regular System and the Co-operative System. Some programmes are offered under one system only while others are offered under either system. Each of the Programme sections in this Calendar contains information concerning the System of Study that can be followed for the programme described.

Regular System

Under the Regular System of Study the student follows the conventional eight-month academic year from September to April.
Co-operative System

Students studying under the Co-operative System spend alternating terms of four months duration on the campus for academic studies, and with business, industry, or government for off-campus practical training. The standard Co-operative Programme consists of eight four-month terms of study and six four-month terms of employment. Some programmes vary from this standard arrangement. The necessary arrangements for the work terms are handled by the Co-ordination Department. Further information about the Co-operative System can be found in the section of this Calendar that deals with the Co-ordination Department.

Part-time Studies

Opportunities for part-time studies are available primarily through the Faculty of Arts, and to a limited extent through the other faculties. There is no distinction between part-time and full-time students as to admission requirements, grading practices, or promotion policies.

Courses of interest to part-time students are offered during the day, in the evenings, on Saturdays, and during a six-week Summer Session commencing in July of each year. Information regarding the availability of courses can be obtained from the Office of the Registrar.

Correspondence Courses

The University of Waterloo offers degree credit courses by correspondence in Biology, Chemistry, Earth Sciences, Physics, Mathematics, Economics, English, French, Psychology and Classical Civilization. Other Arts courses such as History are contemplated. Lectures are recorded on magnetic tape and are accompanied by supplementary material.

The Correspondence Programme is designed primarily to assist elementary and secondary school teachers in upgrading their teaching qualifications. However, the courses may be taken by anyone with a suitable academic background and can be used for credit towards a degree at the University of Waterloo. A maximum of two correspondence courses per year may be taken at the University of Waterloo, for credit towards a degree, for a total of six such courses in a three-year General Programme and eight in a four-year General Programme. Further information can be obtained from:

The Director,
Correspondence Programme,
University of Waterloo,
Waterloo, Ontario. N2L 3G1
Grading System

The University uses a grading system whereby grades for all courses appear on grade reports and transcripts either as one of 15 letter grades from A-plus through F-minus or as numeric marks on a 100-point scale. Each Faculty (or comparable academic unit) chooses to display the grades obtained in each course by the grades or numeric marks. All Departments within the Faculty then use the system chosen.

<table>
<thead>
<tr>
<th>Letter Grades</th>
<th>Percentage Ranges</th>
<th>Weighting Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>90-100</td>
<td>95</td>
</tr>
<tr>
<td>A</td>
<td>85-89</td>
<td>89</td>
</tr>
<tr>
<td>A-</td>
<td>80-84</td>
<td>83</td>
</tr>
<tr>
<td>B+</td>
<td>77-79</td>
<td>78</td>
</tr>
<tr>
<td>B</td>
<td>73-76</td>
<td>75</td>
</tr>
<tr>
<td>B-</td>
<td>70-72</td>
<td>72</td>
</tr>
<tr>
<td>C+</td>
<td>67-69</td>
<td>68</td>
</tr>
<tr>
<td>C</td>
<td>63-66</td>
<td>65</td>
</tr>
<tr>
<td>C-</td>
<td>60-62</td>
<td>62</td>
</tr>
<tr>
<td>D+</td>
<td>57-59</td>
<td>58</td>
</tr>
<tr>
<td>D</td>
<td>53-56</td>
<td>55</td>
</tr>
<tr>
<td>D-</td>
<td>50-52</td>
<td>52</td>
</tr>
<tr>
<td>F+</td>
<td>42-49</td>
<td>46</td>
</tr>
<tr>
<td>F</td>
<td>35-41</td>
<td>38</td>
</tr>
<tr>
<td>F-</td>
<td>0-34</td>
<td>32</td>
</tr>
</tbody>
</table>

Interpretation of Averages

<table>
<thead>
<tr>
<th>Honours</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-100</td>
<td>First Class Honours</td>
</tr>
<tr>
<td>70-79.99</td>
<td>Second Class Honours</td>
</tr>
<tr>
<td>60-69.99</td>
<td>Third Class Honours</td>
</tr>
<tr>
<td>50-59.99</td>
<td>Passing</td>
</tr>
<tr>
<td>0-49</td>
<td>Failure</td>
</tr>
</tbody>
</table>

Non-Graded Standings

| CR   | Credit Granted |
| AEG  | Aegrotat, credit granted due to illness |
| NCR  | No credit granted |
| INC  | Incomplete course work, no credit granted |
| DNW  | Did not write examination, no credit granted |
| AUD  | Audit only, no credit granted |
| NMR  | Decision pending, no credit granted |
Cross Registration With Wilfrid Laurier University

Cross Registration procedures have been developed through a joint co-operative advisory council to enable full-time students to take advantage of courses available at both the University of Waterloo and Wilfrid Laurier University.

Both Universities conduct pre-registration in February or March for their own students who plan to return in the next academic year. Course limits are adjusted on the basis of the demand indicated and tentative space is provided for Cross-Registered students in the courses concerned. Formal requests to Cross-Register are accepted only after the academic timetables are finalized in August.

Students must pay all fees at their home University, regardless of the number of courses taken by cross-Registration. Grades are reported to the student's home University based on the grading system of the host University and are combined with the results of the student's other courses to complete his examination report. A student's overall academic standing is determined solely by his home University.

Continuing Education

Through a number of channels the University recognizes its responsibility for the continuing education of adults.

A brochure outlining the many credit courses offered by correspondence, or on the campus, at times convenient to members of the outside community, is available from the Office of the Registrar.

A number of academic departments sponsor special lecture series of interest to all persons in the community. Information regarding these series can be obtained from the department concerned or from the Information Services Department.

Through its Bookings Office the University makes its facilities available at reasonable cost to those organizations or groups who desire to conduct educational functions on the campus. Many such conferences, symposia, and workshops are held on the campus each year.

The activities of the Centre for Continuing Management Education are outlined below.

Centre for Continuing Management Education

The Centre for Continuing Management Education offers short courses, seminars, and workshops for the business community in both marketing and management. They are designed to help managers do a better job in their current assignments, to better prepare them for the job ahead and to give them new perspectives, through exposure to their peers, in a wide range of business, industry, and government service.

In addition, the Centre’s staff assists in the preparation of management development programmes to meet the particular needs of an organization.

No degree courses are offered by the Centre and no courses involve degree credits.
The programme has grown from the original Advanced Course in Marketing and Sales Management in 1962 to more than eighty offerings in 1974 in the areas of Sales Marketing and Management Techniques.

The Centre is also responsible for the administration of the Canadian Institute of Management programme and the Certified General Accountants programme. These are four and five year courses respectively leading to recognition by these Associations.

Further information can be obtained from the Centre for Continuing Management Education, University of Waterloo.

The Computing Centre

The Computing Centre, located on the first two floors of the Mathematics and Computing Centre building, provides computing facilities for faculty, staff, graduate and undergraduate students. Such facilities include keypunch rooms and programme-preparation areas, programme submission areas for several batch-computing services, a number of typewriter-terminals for interactive computing services, an incremental plotting facility, an experimental control service capable of performing various functions in laboratory experiments on campus, and a variety of computing hardware and software chosen to handle the wide range of computing applications in a university community. Faculty, academic staff, graduate and undergraduate students use the computing facilities to aid them in their research; in addition, many academic courses require the use of the computer in course assignments. Administration and staff also use the computer in applications such as student records, course timetables, examination results, library circulation control, and payroll processing.

Faculty, staff, and students who use the batch-computing services soon become familiar with what is known as the DEBUG Service. This service is accessed via DEBUG Terminals which consist of high-speed card readers and printers set up to service a cafeteria-style lineup of computer users. This concept was developed at the University of Waterloo to provide simple and fast access to the computer as both an educational and a computational device for students throughout the University. A wide variety of programming languages and applications packages are available through the DEBUG Service. This cafeteria-style concept enables a great many programmes to be run with minimal waiting periods for output; it is a concept which has since been adopted by many Universities to quickly process the large volume of programmes submitted by both graduate and undergraduate students as part of academic course assignments.

In addition to operating the computing equipment and maintaining the computing software, the Computing Centre provides many “user services.” Programming consultation, non-credit courses and seminars, documentation, computer reference room facilities, and newsletters are provided by the Services personnel of the Centre to help make using the computer an easier and more efficient process for all members of the university community.
Office of Research Administration

The Office of Research Administration, now located on the third floor of the Student Services Building, is responsible for faculty grant applications and contract research, as well as the distribution of grant information and regulations.

Among the functions of the ORA are the following: to ensure that university policies and agency/sponsor requirements are met, to provide faculty with information and application forms, to forward applications and proposals to appropriate agencies, to act as a centre of communications between granting agencies and faculty, and to assist faculty in obtaining grants and contracts for undertaking research.

The ORA also administers the university's patent assistance programme.

Waterloo Research Institute

Established as the Industrial Research Institute in December, 1967, the Waterloo Research Institute is an organization within the University of Waterloo which provides research and development assistance to organizations wishing to obtain such help on a contract basis. The essential purpose of the WRI is to provide a working liaison between the university and all organizations in which contracted research and development offers potential assistance.

The WRI stimulates, arranges and manages the execution of research and development programmes sponsored by industry and other organizations. The Institute draws upon the resources of all faculties of the university to achieve this purpose.

The scope of research available through the WRI is as broad as the range of academic studies at the university. There are many special research strengths at the university and they are frequently brought together in interdisciplinary studies. Competence in many disciplines abounds among the university faculty and students and the Waterloo Research Institute identifies those who are best able to assist with specific problems.

Office of Human Research

The Office of Human Research reviews university research programmes involving human subjects, as to ethical acceptability, legal liability and medical advisability. As the official liaison office between the university and local public and separate school boards, the OHR is responsible for obtaining school age children as subjects for suitable university research programmes.
2

Admissions
Admission Information and Requirements

Applicants seeking admission to undergraduate programmes are required to have suitable and adequate preparation to enable them to successfully undertake studies at the University. Before submitting an application, prospective students should read carefully the description of the programme they wish to study and then review the admission requirements to determine whether their background qualifies them for consideration.

Candidates may apply for admission to the programmes listed in the various faculty sections of this Calendar. All applicants will be considered for admission to the University unless St. Jerome's College or Renison College is specified.

All correspondence should be directed to the Assistant Registrar for the Faculty to which the candidate is applying.

More detailed information regarding admission requirements is available from the

Office of the Registrar,
University of Waterloo,
Waterloo, Ontario.
N2L 3G1

Applicants are advised to outline thoroughly their educational background in order to facilitate the admission process. The admission information and requirements set forth in this Calendar are applicable for admission beginning in September 1974.

St. Jerome’s College

Applicants may apply for programmes in Arts, Environmental Studies (Geography and Man Environment Studies), and Mathematics (regular programme only) through St. Jerome’s College. All applicants should indicate clearly “St. Jerome’s College” on their application form.

Inquiries and correspondence should be directed to:

The Registrar,
St. Jerome’s College,
University of Waterloo,
Waterloo, Ontario.
N2L 3G2

Renison College

Applicants may apply for programmes in Arts through Renison College as well as through the University. Renison College applicants should indicate “Renison College” clearly on the application form.

Inquiries and correspondence regarding admissions should be directed to:

Assistant Registrar – Arts
Registrar's Office,
University of Waterloo,
Waterloo, Ontario.
N2L 3G1
Part-Time Studies  Students wishing to pursue degree studies on a part-time basis may enrol in regularly scheduled day courses as well as evening or Saturday classes. Although courses given in the evenings and on Saturdays have been arranged for the convenience of part-time students, some students who are studying on a part-time basis may find it more convenient to attend classes that are held during regular school hours. In addition, the University offers a six week summer programme under the Faculty of Arts as well as courses under a correspondence format in Biology, Chemistry, Mathematics, Physics, Classics, Economics, English, French and Psychology.

There are no distinctive admission requirements for part-time students. The admission requirements outlined in this chapter apply equally to applicants to full-time or part-time studies. Students engaged in study on a part-time basis are allowed to take a maximum of two courses per session.

Applicants interested in part-time study should refer to the section in Chapter 1 which outlines the various part-time programmes. Applicants applying under the Adult Student category should refer to page 34 of this chapter.

Application Dates  Application forms and supporting documents for full or part-time studies commencing in September, 1974, should be submitted by July 1st, 1974. Applicants currently enrolled in Ontario Grade 13 who wish to be considered for Early Admission must apply before December 31, 1973. Applicants to Summer School must apply prior to June 1st, 1974. For those programmes such as Architecture, Urban and Regional Planning, and Integrated Studies, which require an interview, applicants are encouraged to apply 3-4 months prior to these dates in order to receive proper consideration of their applications. Applicants applying or sending in supporting documents after these dates cannot be guaranteed consideration of their applications.

Release of Academic Information  The University may, on request from a Secondary School in Ontario, release the following academic information about the student without written approval of the student; the student's name, the programme in which the student is registered, and one of the four academic decisions for the particular year — passed, failed, supplementals required, withdrawn. Students not wishing to have this information released should contact the Registrar's Office accordingly.

Limited Enrollment  In some programmes the number of qualified applicants may exceed the number of places available. The possession of the minimum requirements does not in itself guarantee admission to any of the programmes.

Authority to Admit  All applicants for admission to the University will be considered by the Admissions Committee for the Faculty to which admission is sought. No final decision regarding the acceptability of any applicant will be made by any individual or group other than the appropriate Admissions Committee.

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.
Applicants – Ontario Grade 13

In order to be considered for admission, applicants to all programmes will normally be required to achieve a 60% overall average in their Grade 13 standings. The University expects to fill the majority of places available to Grade 13 applicants using the following criteria:

- Grade 13 interim standing
- Grade 12 final standing
- Principal’s recommendation

The overall University requirement will be assurance from the applicant’s Secondary School that the prerequisites for the Secondary School Honour Graduation Diploma have been satisfied.

Applicants are not required to present the results of SACU Aptitude and Achievement Tests for purposes of admission to the University. The presence or absence of SACU Test Scores will neither add to nor detract from an applicant’s chances of admission to the University.

All Ontario Grade 13 applicants will be notified on or after May 31, 1974, of the status of their application for admission. Grade 13 applicants who do not receive an offer of admission at this time will have their applications deferred until their final Grade 13 marks are received by the University. When these marks have been received, qualified applicants will be admitted until the remaining places are filled.

Ontario Grade 13 applicants who receive an early offer of admission are encouraged to confirm as soon as possible but are not required to respond before June 17, 1974.

The University reserves the right to withdraw the offer of admission if the applicant fails to complete his year satisfactorily.

Applicants who have spent more than the normal length of time in Secondary School to complete their University preparation may be required to present a higher admission average than 60%. Applicants who complete their secondary school studies in less than the normal period of time will be considered providing that the Grade 13 admission prerequisites have been satisfied.

Preparation for University

Each Faculty or School, at the University has specific requirements over and above the basic University requirements. It is recommended that applicants normally present a Grade 13 programme that has involved preparation in more than three subject areas.

It is expected that applicants will present a balanced selection of Grade 13 courses.

Please note that these recommendations are made in order to assist students in their preparation for study at University. Where recommendations are stated, the University will consider all applications regardless of the applicant’s Grade 13 programme. Where a Faculty area states specific requirements, it is expected that applicants will include these requirements in their Grade 13 programme.

Recommendations and specific requirements for admission to the various Faculties are described on the following chart. As well, each Faculty Programme section of the Calendar will contain the recommendations or specific requirements for that particular Faculty area.
Admission Requirements for Applicants from Ontario Grade 13

Although the programmes listed below specify Grade 13 requirements, the overall University requirement for all programmes will be assurance from the Secondary School that the prerequisites for the Secondary School Honour Graduation Diploma have been satisfied. A minimum overall average of 60% will normally be required for all programmes.

Recommendations

Where the University has recommended certain courses to be included in the applicant's background, it means that it would be beneficial to the applicant in his first year of study at the University to have these courses in his background. These are recommendations only and it does not mean that the applicant's admission decision will be jeopardized if the recommended courses are not taken.

Specific Faculty/Programme Recommendations and Requirements

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Specific Gr. 13 Requirements</th>
<th>Special Averages</th>
<th>Recommendations and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts</td>
<td></td>
<td></td>
<td>It is recommended that applicants select Arts related courses in their Grade 13 programme such as English, History, languages (other than English), etc.</td>
</tr>
<tr>
<td>Engineering</td>
<td>Relations and Functions</td>
<td>60% overall average in specific requirements.</td>
<td>Applicants who do not have the specific Grade 13 requirements but who have a high overall standing including at least Relations and Functions and Calculus are also encouraged to apply for admission.</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>Relations and Functions</td>
<td></td>
<td>Selected applicants to the Architecture and Urban and Regional Planning programmes may be required to come to the University for an interview.</td>
</tr>
<tr>
<td>Architecture pre-professional programme</td>
<td>Relations and Functions</td>
<td></td>
<td>It is recommended that applicants to the Geography programme include Geography in their Grade 13 programme.</td>
</tr>
<tr>
<td>Man Environment Studies</td>
<td></td>
<td></td>
<td>Because of the increasing use of statistics and quantitative methods in environmental research, it is recommended but not required that students present at least one Grade 13 Mathematics course for admission to programmes in Environmental Studies.</td>
</tr>
<tr>
<td>Urban and Regional Planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty</td>
<td>Specific Gr. 13 Requirements</td>
<td>Special Averages</td>
<td>Recommendations and Notes</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------------------</td>
<td>-----------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Human Kinetics and Leisure Studies</td>
<td></td>
<td></td>
<td>It is recommended that applicants select a Grade 13 programme that includes one or more of the following courses: Calculus, Biology, Chemistry, Physics.</td>
</tr>
<tr>
<td>Kinesiology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recreation</td>
<td></td>
<td></td>
<td>It is recommended that applicants include both Biology and Geography in their Grade 13 programme.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated Studies</td>
<td></td>
<td></td>
<td>Due to the nature of the Programme, each applicant to Integrated Studies is considered on the basis of a personal interview with a committee composed of Faculty and students. Those who show the strongest aptitude for self-direction and independent study and the ability to flourish in an unstructured academic setting will be given strongest consideration.</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Relations and Functions</td>
<td>The Regular Programme requires a 60% overall average in specific requirements. The Co-operative Programme requires a 66% overall average in specific requirements.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Calculus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Algebra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science (including Optometry)</td>
<td>Relations and Functions</td>
<td>60% overall average in specific requirements.</td>
<td>It is recommended that applicants include both Chemistry and Physics in their Grade 13 programme.</td>
</tr>
<tr>
<td></td>
<td>Calculus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Science courses, one of which must be Physics or Chemistry</td>
<td>70% in Mathematics and Physics for the Co-operative Applied Physics Programme.</td>
<td></td>
</tr>
</tbody>
</table>
Adult Students

Individuals of mature age who have been away from formal education for more than two years and who do not possess the minimum requirements for admission may apply as adult students. It is recommended that applicants who are applying to enter the University as adult students, attempt to obtain standing in at least one Ontario Grade 13 level subject or its equivalent. This preparation should relate to the programme the applicant wishes to study at University.

Mature students who cannot meet the requirements for degree candidacy, or who are uninterested in pursuing a degree at this time, may apply on a non-degree basis. Such students may take as many as two courses per session for University credit, up to a total of six. Courses taken under this provision will count toward a degree if the student is admitted later as a degree candidate.

Each application will be considered on its own merits by the Admissions Committee.

Advanced Standing

Applicants to advanced years must specify the Faculty to which they are seeking admission, the programme they wish to study, and the level of admission sought. All faculties, with the exception of Engineering, operate on a course credit system where a student’s progress is measured by courses completed rather than by years completed. Applicants to faculties which operate under the course credit system will have previous work evaluated on an individual course basis. Applicants are asked to provide additional information such as course descriptions, etc., in addition to their official academic transcript. The provision of such information will greatly facilitate the evaluation of previous work and the consideration of possible transfer credits.

Transfer Credit

Transfer credit will depend upon the programme applied to, the relevancy of the previous programme studied, and approval from the appropriate department that such courses are to be credited to the student’s programme.

Generally transfer credit is given for courses in which a grade of 60% or better was obtained. Students transferring from other institutions may have their transferred courses count toward the University of Waterloo degree; however, marks obtained in these courses will not be included in the calculation of the student’s average.

Students transferring from Faculties within the University, or former University of Waterloo students returning after an absence, generally have the option of either transferring previous UW courses with 60% (C) or better without including these in the cumulative average or transferring all relevant courses passed and including all courses passed and failed in the cumulative average. The specific transfer credit policies vary with each Faculty and students are advised to refer to the Faculty sections in the calendar for detailed regulations.
Landed Immigrant Status  Because of the nature of the Co-operative programmes at the University, where a student alternates four months of study on campus with four months of practical work experience in business, industry, or government, applicants from other countries must obtain Landed Immigrant Status in Canada before applying for admission to a Co-operative programme. Exceptions can be made on an individual basis at the request of a government agency or other employer. Until such proof is received, applicants will be considered for a comparable programme offered under the Regular system of study. Immigrants from other countries are expected to have one year’s residency, with suitable work experience, in Canada before applying for admission to a Co-operative programme.

Applicants from Ontario Colleges of Applied Arts and Technology  As a general policy, applicants who have achieved first class honours or high second class honours in each of the three years of a programme at an Ontario College of Applied Arts and Technology are considered for admission to Year Two of a relevant programme at the University of Waterloo.

Applicants who have completed two years with first class honours or high second class honours are considered for admission to Year One.

Each application will be considered on its merits by the Admissions Committee.

Applicants from Other Canadian Provinces  Applicants from a Canadian Secondary School system who are applying to Year One must have the equivalent of the Ontario Grade 13 programme in course requirements and averages.

Equivalent Certificates  The following certificates or their equivalents will be considered.

<table>
<thead>
<tr>
<th>Province</th>
<th>Certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>British Columbia</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>Year 1 Memorial University</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>Year 1 University of P.E.I.</td>
</tr>
<tr>
<td>Quebec</td>
<td>First Year CEGEP programme or equivalent</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>Senior Matriculation (Grade 12)</td>
</tr>
</tbody>
</table>

Applications from Other Countries  Applicants should submit certificates indicating subjects studied and grades received. Documents submitted in a language other than English must be accompanied by a notarized English translation.
### Equivalent Certificates

The following is a list of certificates or degrees which are considered to be equivalent to completion of Ontario Grade 13. *Applicants are normally required to have at least a "C" standing in courses presented for purposes of admission. The requirements are general University requirements. Applicants from countries listed below as well as applicants from other countries can obtain detailed admission requirements from the Office of the Registrar.*

<table>
<thead>
<tr>
<th>Country</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>United Kingdom and Commonwealth</strong></td>
<td>General Certificate of Education with passes in at least 5 subjects, 2 of which must be at the Advanced level.</td>
</tr>
<tr>
<td><strong>United States of America</strong></td>
<td>Secondary School Graduation plus an additional year of formal study in subjects comparable to Ontario Grade 13.</td>
</tr>
<tr>
<td><strong>Hong Kong</strong></td>
<td>Hong Kong Certificates of Education (English) and University of Hong Kong Matriculation (Advanced Level) with passes in at least 5 subjects, 2 of which must be at the Advanced Level. (Applicants with 3 or more University of Hong Kong Advanced Level subjects will also be considered.) Chinese University of Hong Kong – First Year standing with courses appropriate to programme.</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td>B.A. or B.A.Sc. (first or second division)</td>
</tr>
<tr>
<td><strong>Europe</strong></td>
<td>Maturity or Matriculation Certificate</td>
</tr>
<tr>
<td><strong>Central and South America</strong></td>
<td>First year University with a standing of at least (B-)</td>
</tr>
<tr>
<td><strong>Countries Using French Educational System</strong></td>
<td>Baccalaureate Passable</td>
</tr>
</tbody>
</table>
**English Proficiency Test** Applicants from non-English speaking countries may be required to take the “Test of English as a Foreign Language” (TOEFL). Other equivalent English proficiency tests will be accepted. The results of these TOEFL tests must satisfy the Admissions Committee that the applicant's knowledge of the English language is adequate to enable him to pursue his studies successfully. In addition, applicants to Co-operative programmes must satisfy the Admissions Committee that they can perform satisfactorily in their work terms. The expenses involved in administering the test must be borne by the applicant.

**Applications – Documents and Procedures**

The following points describe the various documents required by the University for admission and outline the procedures which are followed.

**Ontario Universities’ Application Centre**

A candidate planning to enrol in the first post-Grade 13 year at an Ontario university will submit an application through the Ontario Universities’ Application Centre who in turn will forward the application to the University. All applications received by the University through the Ontario Universities’ Application Centre will be acknowledged by the University.

**Ontario Grade 13 Applicants**

All applicants currently registered in Ontario Grade 13 (Year 5) courses should apply on forms supplied by their Secondary School in conjunction with the Ontario Universities’ Application Centre. In programmes which require an interview, additional letters of reference may be required.

**Applicants Other Than Ontario Grade 13**

All applicants who are not currently enrolled in an Ontario Grade 13 programme should make application on the appropriate application form available from the Office of the Registrar. When completing this application form, candidates should keep the following points in mind:

*No application will be considered until the necessary supporting documents have been received. It is the applicant’s responsibility to ensure that all such documents are submitted.*

*All personal data requested on the application form must be filled in completely and correctly.*

*Advanced students should indicate their major field of study. Applicants must supply all the information requested. Incomplete application forms will be returned to the applicants.*

**Supporting Documents**

Application for admission to the University of Waterloo should be made as early in the year as possible. Academic transcripts (not diplomas) and other supporting documents should be forwarded as soon as they become available. Admission cannot be granted until all the requirements have been met and all the required documents submitted.
Confidential Letter of Reference

Applicants are required to submit two confidential letters of reference. The forms for these letters will be mailed with the application form to the applicant. These letters should be filled in by two different referees and returned directly to the University by the referees. A referee must be someone who can judge the applicant's scholastic ability (preferably a teacher). If such a person is unavailable, the applicant may then ask a person of responsibility (who has reason to know him academically) to be his referee.

Secondary School Records

Applicants who are not currently enrolled in an Ontario Grade 13 programme must arrange to have their secondary school records sent directly to the University from the school.

The records must be on the school's forms. Records of any other educational achievements beyond the elementary level must be submitted directly from the academic institutions to the Assistant Registrar for the Faculty to which the candidate is applying at the University of Waterloo.

Ontario Grade 13 Results

The University requires a record of every Grade 13 (Year 5) paper (passing or failing) ever written by the applicant.

Applicants from Ontario who are not currently registered in a full-time Grade 13 programme but who have attended Ontario Grade 13 at some time must ensure that all of their Grade 13 results are included in the records submitted directly to the University by the secondary school. Photostat copies of these documents will be accepted if they are properly certified by an appropriate school official.

Academic Transcripts

- Transfer Students

Students from other universities or post-secondary institutions who wish to transfer to the University of Waterloo must arrange to have certified transcripts of their academic records sent directly from the institution they attended to the Assistant Registrar for the Faculty to which they are applying at the University of Waterloo. All such transcripts must be submitted regardless of the level of entry sought. Students who wish to transfer into studies at an advanced level will facilitate the processing of their applications if they include a letter outlining their background and providing official Calendar descriptions of each course they have studied and wish credit for. Applicants with transcripts from foreign institutions must arrange to have certified English translations of the documents submitted.

Supplement to the Application

Any candidate for admission who has had his education interrupted for any reason must arrange to supplement his academic application with a résumé of employment, etc., since leaving the last educational institution he attended. It is necessary to declare and verify by documentation any educational courses taken or institutions attended.
Processing of an Application

In order to complete the processing of an application to the University of Waterloo, it is mandatory that all required documents (i.e. transcripts, letters of reference, etc.) plus an application for undergraduate admission are on file in the appropriate Faculty area in the Office of the Registrar. The application will then be presented to the Admissions Committee.

Applicants who are not currently enrolled in an Ontario Grade 13 programme can expect to wait several weeks before receiving a decision on their application. Some programmes require applicants to come to the University for an admission interview and a decision cannot be made in such programmes until after the interview has been accomplished and the Admissions Committee has had ample opportunity to consider all of the information that has been presented to them. Applicants who feel there has been an undue delay in the consideration of their application should check to ensure that all required documents have been sent to the appropriate Faculty area in the Registrar's Office.

Registration and Fees

Once admitted to the University, students are advised to pre-register for their courses well in advance of the beginning of lectures. First year students select their courses in conjunction with a member of the Dean's office; advanced year students select their courses on the advice of their departmental undergraduate advisor. Information regarding pre-registration is outlined when the student is admitted. Students are encouraged, where possible, to pre-register and pay their fees by mail. For those students who do not register by mail, a registration period is held on campus immediately prior to the beginning of lectures each term.

A schedule of fees is outlined in Chapter 3, page 45 of this calendar.
3

Fees and Registration
Fees and Registration

All students are required to pre-register in advance for courses they anticipate taking in the subsequent session/term. For students under the regular system of study this is done usually in March. For students in co-operative programmes, pre-registration is done during the on-campus term. First year students have the opportunity to pre-register during the summer months prior to September.

This action of pre-registration will produce the Student Schedule-Fee Statement. Students must then register, using this Fee Statement. Registration is not complete until the student's fee statement is receipted by Financial Services.

Academic fees are due and payable on or before the final date of registration. Students who receive their fee statement by mail are normally expected to make payment by mail. Detailed instructions outlining the payment procedures will be included with the fee statement.

For those students who cannot register by mail, a registration period is held on campus prior to the beginning of lectures for each term. The dates of pre-registration, registration and beginning of lectures are listed on page 10 of the calendar.

Students who have received a “Student Award Statement” under the Ontario Student Awards Programme and are relying upon this source of funds for the payment of their fees may make arrangements by mail, to direct payment to the University up to the value of the award. Where notice of assistance has not been received, consideration will be extended toward arrangement of fees at the on-campus registration centre provided an Application for Award has been filed with the Awards Office on or before the following dates:

Co-operative Students - 15 July 1974 for the Fall 1974 term;
15 Nov. 1974 for the Winter 1975 term;
14 March 1975 for the Spring 1975 term.

Fees may be paid by money order or certified cheque payable to “University of Waterloo”.

Fees may be paid in two instalments, but an extra charge of $10.00 for regular students, $5.00 for co-operative, and $4.00 for part-time students will then be added to the first instalment. The first instalment is to be paid at the time of registration and must be a minimum of 60% of the tuition fees plus 100% of the incidental fees. The balance is to be paid as follows:

Regular Students - On or before the first day of the second term.
Co-operative Students - On or before the first day of the eighth week of the current term.

Arrangement for payment of fees by scholarships, bursaries or by methods other than those outlined above must be authorized by the University Credit Manager.

Students who fail to fulfill fee payment arrangements will be assessed a 5% surcharge on the total fees outstanding plus a 1% per month service charge applied to the balance outstanding and calculated from the due date.
Fees and Registration

Students who register after the start of classes will be assessed the following penalty:

<table>
<thead>
<tr>
<th>Full Time</th>
<th>Part Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Day</strong></td>
<td><strong>First 2 Weeks</strong></td>
</tr>
<tr>
<td>$10.00</td>
<td>$5.00</td>
</tr>
<tr>
<td><strong>Second Day</strong></td>
<td><strong>Third Week</strong></td>
</tr>
<tr>
<td>$15.00</td>
<td>$10.00</td>
</tr>
<tr>
<td><strong>Third Day</strong></td>
<td><strong>Fourth Week</strong></td>
</tr>
<tr>
<td>$20.00</td>
<td>$15.00</td>
</tr>
<tr>
<td><strong>Fourth Day</strong></td>
<td><strong>Fifth Week</strong></td>
</tr>
<tr>
<td>$25.00</td>
<td>$20.00</td>
</tr>
<tr>
<td><strong>Thereafter</strong></td>
<td><strong>Sixth Week</strong></td>
</tr>
<tr>
<td>$25.00 plus*</td>
<td>$25.00</td>
</tr>
<tr>
<td></td>
<td>$25.00 plus*</td>
</tr>
</tbody>
</table>

*a 1% per month service charge applied to the balance outstanding and calculated from the due date.

Under no circumstances will a student (including part-time, correspondence, or multi-media) be allowed to register after the following dates:

<table>
<thead>
<tr>
<th>Session/Term Starting</th>
<th>Last Date to Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 1974</td>
<td>15 November 1974</td>
</tr>
<tr>
<td>January 1975</td>
<td>31 January 1975</td>
</tr>
<tr>
<td>May 1975</td>
<td>13 June 1975</td>
</tr>
<tr>
<td>July 1975</td>
<td>15 July 1975</td>
</tr>
</tbody>
</table>

Failure to register by the above dates will indicate that the student is not returning for the current session/term and will result in cancellation of all academic privileges for the current session/term.

Failure to pay all outstanding fees, accounts, or other assessments such as library fines before conclusion of lectures may bar a student from writing examinations and will result in withholding of credit and transcripts for previous work.

Students must register on or before the start of classes whether or not a final class schedule has been received. Late fees commence the first day of classes. See page 10 for appropriate dates. Students who subsequently change programmes must re-register with the new fee statement within 5 days if the fees assessed have changed. No refunds will be processed unless this re-registration is completed. The original registration receipt must be produced at the time of re-registration.

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, will entitle him to a refund of a portion of his fees on the following basis:

a) Total tuition fee, less registration charge of $50.00, on a diminishing basis, calculated weekly over a total of 27 weeks for regular session students and 13 weeks for co-operative student terms.

b) Incidental fees for Federation of Students, Intercollegiate Athletics on a pro rata basis over 13 weeks for regular students and 6 weeks for co-operative student terms.

c) Original fee receipt must be turned in at the time of withdrawal. A revised receipt will be issued after the withdrawal procedure is completed.

d) No fees will be refunded unless the above procedure is followed.
The fee schedule shown is the one proposed for the 1974-75 year, and at the time of printing is still subject to review and possible change. If a fee change is made, a notice will be issued with a new fee schedule; however, the University does not undertake or accept responsibility to so notify all recipients of this calendar. The Board of Governors reserves the right to make changes in the published schedule of fees without notice.

Schedule of Fees – Undergraduate Programmes Tuition and Incidentals For All Years

<table>
<thead>
<tr>
<th>Faculty or School</th>
<th>Session Term</th>
<th>Tuition Fees</th>
<th>Incidental Fees</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts</td>
<td>Session</td>
<td>$624.80</td>
<td>$47.50</td>
<td>$672.30</td>
</tr>
<tr>
<td>Engineering</td>
<td>Term</td>
<td>$390.20</td>
<td>$26.50</td>
<td>$416.70</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Regular</td>
<td>Session</td>
<td>$624.80</td>
<td>$49.50</td>
<td>$674.30</td>
</tr>
<tr>
<td>- Architecture - Yr 1</td>
<td>Session</td>
<td>$659.80</td>
<td>$49.50</td>
<td>$709.30</td>
</tr>
<tr>
<td>- Architecture - Upper Yrs</td>
<td>Term</td>
<td>$390.20</td>
<td>$24.75</td>
<td>$414.95</td>
</tr>
<tr>
<td>Integrated Studies</td>
<td>Session</td>
<td>$624.80</td>
<td>$45.00</td>
<td>$669.80</td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Regular</td>
<td>Session</td>
<td>$624.80</td>
<td>$50.00</td>
<td>$674.80</td>
</tr>
<tr>
<td>- Co-op</td>
<td>Term</td>
<td>$372.70</td>
<td>$25.00</td>
<td>$397.70</td>
</tr>
<tr>
<td>Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Regular</td>
<td>Session</td>
<td>$624.80</td>
<td>$49.00</td>
<td>$673.80</td>
</tr>
<tr>
<td>- Co-op</td>
<td>Term</td>
<td>$372.70</td>
<td>$24.50</td>
<td>$397.20</td>
</tr>
<tr>
<td>Optometry</td>
<td>Session</td>
<td>$624.80</td>
<td>$49.00</td>
<td>$673.80</td>
</tr>
<tr>
<td>Human Kinetics &amp; Leisure Studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Regular</td>
<td>Session</td>
<td>$624.80</td>
<td>$49.00</td>
<td>$673.80</td>
</tr>
<tr>
<td>- Co-op</td>
<td>Term</td>
<td>$372.70</td>
<td>$24.50</td>
<td>$397.20</td>
</tr>
<tr>
<td>Part-Time Students</td>
<td>Per Course</td>
<td>$120.00</td>
<td></td>
<td>$120.00</td>
</tr>
<tr>
<td>Summer School</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 1 course</td>
<td></td>
<td>$126.00</td>
<td></td>
<td>$126.00</td>
</tr>
<tr>
<td>- 2 courses</td>
<td></td>
<td>$246.00</td>
<td></td>
<td>$246.00</td>
</tr>
</tbody>
</table>

- *Session represents the traditional 8 month (September - April) period of study.*
- *Term represents the 4 month academic term for students registered in Co-operative programmes.*

<table>
<thead>
<tr>
<th>Incidental Fees</th>
<th>Regular</th>
<th>Co-operative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federation of Students</td>
<td>$22.00</td>
<td>$11.00</td>
</tr>
<tr>
<td>Intercollegiate Athletics</td>
<td>$20.00</td>
<td>$10.00</td>
</tr>
<tr>
<td>O.P.I.R.G. (See Note 1)</td>
<td>$3.00</td>
<td>$1.50</td>
</tr>
<tr>
<td>Society Fees (See Note 2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Note 1 – O.P.I.R.G. (Ontario Public Interest Research Group)

In June 1973, the Federation of Students petitioned the Board of Governors to assess each undergraduate student $3.00 per session for regular students and $1.50 per term for co-operative students as a contribution to O.P.I.R.G. This fee is voluntary, refundable, and not a requirement for registration. Requests for refunds or questions concerning O.P.I.R.G. should be directed to the on-campus O.P.I.R.G. office.

Note 2 – Society Fees

The following schedule of fees applies:

<table>
<thead>
<tr>
<th>Regular Session</th>
<th>Co-operative Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts</td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
</tr>
<tr>
<td>Human Kinetics and</td>
<td></td>
</tr>
<tr>
<td>Leisure Studies</td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
</tr>
<tr>
<td>Environmental Studies</td>
<td></td>
</tr>
<tr>
<td>Science (including Optometry)</td>
<td></td>
</tr>
</tbody>
</table>

Payment of the Society Fee is required at registration but a student who does not wish to participate may obtain a refund by applying to the respective Society within three (3) weeks after the close of registration.

Miscellaneous Fees

- Examination Supplemental each paper $10.00
- Presiding fee (at outside centre each half day) $7.00
- Returned Cheques – Handling charge of $10.00 plus late registration penalty as below.

Late Registration – Students who register after the final date of registration will be assessed the following penalty:

<table>
<thead>
<tr>
<th>Full Time</th>
<th>Part Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Day $10.00</td>
<td>First 2 Weeks $5.00</td>
</tr>
<tr>
<td>Second Day $15.00</td>
<td>Third Week $10.00</td>
</tr>
<tr>
<td>Third Day $20.00</td>
<td>Fourth Week $15.00</td>
</tr>
<tr>
<td>Fourth Day $25.00</td>
<td>Fifth Week $20.00</td>
</tr>
<tr>
<td>Thereafter $25.00 plus*</td>
<td>Sixth Week $25.00</td>
</tr>
<tr>
<td>Thereafter $25.00 plus*</td>
<td></td>
</tr>
</tbody>
</table>

* a 1% per month service charge applied to the balance outstanding and calculated from the due date.

- Duplicate fee receipt (per request) $2.00
- Transcript of record (per request) $1.00

Residence Fees

Residence fees are payable by term and are due in full on the day of residence registration. Students who have received notice of assistance under any awards programme may apply to residence fees only those funds which are to be received during the term in question.

Further information concerning residences may be found in Chapter 5.

Enquiries

Enquiries concerning payment of fees should be directed to "Student Accounts, Financial Services.”
4

Scholarships, Bursaries, Prizes and Financial Aid
Undergraduate Scholarships

The Alberta Optometric Association Scholarships
The Alberta Optometric Association presents two scholarships in the amount of $250 to each of two students admitted to Year 2 (the First Professional Year) of the School of Optometry. These are awarded on the basis of academic achievement to students who are residents of Alberta. No application is necessary.

Allied Chemical Canada Limited Scholarship
This scholarship is awarded annually to one student not otherwise holding a scholarship, entering final year of undergraduate studies in Chemical Engineering or majoring in Chemistry. Based on merit, the award is in the amount of $750 and made with the recommendations of both the Faculties of Engineering and Science. No application is necessary.

The American Optical Company of Canada Limited Scholarship
AOCCO Limited presents annually a scholarship to a Canadian student admitted to Year 2 (the First Professional Year) of the School of Optometry. This award is made on the basis of academic achievement. The value is $600. No application is necessary.

Arts Faculty Scholarships
The Faculty of Arts, University of Waterloo is offering several entrance and upper year scholarships in order to recognize academic excellence. Entrance awards will be in the amount of $700, and will be awarded on the basis of Senior Matriculation marks along with secondary school recommendations. Second year awards will be based on previous years standing and in consultation with first year instructors. Third and fourth year scholarships will be based on previous years standing and will require the recommendation of the candidates' department. All upper year awards are valued at $600. Several other awards of a lesser amount will be available to both freshmen and upper year students. The amounts and successful candidates will be left to the discretion of the faculty. No application is necessary.

Association of Professional Engineers Entrance Award
The Association of Professional Engineers of the Province of Ontario provides a $500 Entrance Award to the student who has the highest academic standing in Grade 13 examinations and who is entering an accredited engineering programme at the University of Waterloo. No application is necessary.

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 programme who has the highest average in the examinations for his year. No application is necessary.

The British Columbia Optometric Association Scholarships
The British Columbia Optometric Association presents two scholarships in the amount of $250 to each of two students admitted to Year 2 (the First Professional Year) of the School of Optometry. These awards are made to students who are residents of British Columbia. They are awarded on the basis of academic achievement. No application is necessary.
The Centennial Optical Company offers two scholarships in the amount of $250 to each of two students admitted to Year 2 (the First Professional Year) of the School of Optometry. These awards are made on the basis of academic achievement. Recommendation for these awards is made by the Scholarship Committee of the School of Optometry.

No application is necessary.

The Department of Chemistry offers Chem 13 News Research Assistantships to recognize academic excellence in students proceeding to a degree in Chemistry. The awards are made for one year at a time and are valued at $500 for one year. Award holders are required to work with a professor or his research group within the Department. Awards to students entering Year 1 are made on the basis of performance on an examination held in April. Students entering Upper Years in Honours Chemistry (Co-operative or Regular timetable) are automatically considered for the award.

The Department of Chemistry awards Year One Chemistry Scholarships annually. Selection is mainly on the basis of a CHEM 13 NEWS/Exam written in Ontario secondary schools. Values are $2,000 and $1,500 for one year. Chemistry Scholarships of $500, $400, $300 and $200 are also awarded to the top four students entering Years Two, Three and Four in Honours Chemistry, (Regular or Co-op). These scholarships may be subject to the condition that no other awards be held concurrently.

The above scholarships will be awarded subject to the availability of funds and the attainment of a minimum academic standard by candidates.

Candidates for Year One awards must write the CHEM 13 NEWS/Exam. No application is necessary for awards for Years Two, Three and Four.

To assist in ensuring a continuing supply of qualified graduates in fields vital to industry in Canada, Cominco Ltd. has established a programme of twenty-four scholarships at specified Universities in Canada. One of these scholarships will be awarded annually in the form of a two-year award of $800 per year at the University of Waterloo. It is open to students who, in the Fall, will enter the penultimate undergraduate year of a course leading to a degree in Chemical Engineering, Honours Geology, Geological Engineering, Mining, Mineral Engineering, Metallurgy, Metallurgical Engineering, Soil Science or Agronomy. Students must apply to the University of Waterloo by November 1st, on forms obtainable from the Awards Officer, University of Waterloo, Waterloo, Ontario. Renewals for the second year will be subject to attainment of academic standards satisfactory to the Scholarship Committee of the University.

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.
Charles E. De Leuw
Transportation Scholarship
The De Leuw Cather and Company of Canada Limited, in memory of the Company's founder, is making an annual award available to a 4th year Civil Engineering student with the transportation option. The award is in the amount of $500 and will be given to the student showing high academic achievement, good character, and financial need. The Senate Committee on Scholarships and Student Aid will work in conjunction with the Department of Civil Engineering in determining the winner. Application forms should be requested from the Awards Office.

Rene Descartes Scholarships, Fellowships, and Bursaries
Awards in varying amounts are offered through the Faculty of Mathematics to first year students enrolled in that Faculty and showing the University of Waterloo as their first choice on the application for admission to the university. In order to be eligible, a student must write the Ontario Senior Mathematics Problems Competition. Applications may be received through the Associate Dean, Faculty of Mathematics.

E.L. Ruddy Company Limited 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 Honours Urban and Regional Planning programme. The student must have attained high academic standing and indicate an interest in planning. Application should be made to the Awards Officer.

Earth Sciences Scholarships
The Department of Earth Sciences awards a number of scholarships valued at approximately $300 each to students in the Earth Sciences Department. The scholarships will be awarded to students in each of the four academic years. The awards in the upper years will be based on academic standing in the previous year. The Year One awards will be based on academic performance in the Fall term of Year One. These scholarships may be subject to the condition that no other scholarships are held concurrently. No application is necessary.

Elgin County Council Award
One award in the amount of $100 is offered to the student attaining the highest academic standing in any university year. The student will normally be a resident of Elgin County. Residents of the City of St. Thomas are ineligible. No application is necessary.

G. Elmore Reaman Scholarship (History)
A scholarship in the value of $300 is offered each year to a 3rd or 4th year student of the University for study and research in the Social History of Upper Canada, from the earliest time to 1818. The award will be made by the Department of History, on the basis of a formal research paper prepared by the candidate.

Environmental Studies Faculty and Staff Scholarships
A limited number of entrance and upper year scholarships will be made available to students enrolled in the Faculty of Environmental Studies. The amounts of each award will vary and in general the scholarships are awarded on the basis of academic achievement in prior years. Further information may be obtained from the Awards Officer. No application is necessary.
Undergraduate Scholarships

**Friedrich Lehner Scholarship**

This scholarship will be awarded to a third or fourth year undergraduate student of German Literature and Language. The value of this award is $100 and is provided annually by Mr. Friedrich Lehner of Lehner Travel Service, Toronto, Ontario, Canada.

**Human Kinetics and Leisure Studies Faculty and Staff Scholarships**

A limited number of entrance and upper year scholarships will be made available beginning in Fall, 1974. The amount of each award is yet to be determined. Scholarships will be based on academic achievement in the previous year. No application is necessary.

**Huron County Scholarship**

Huron County Council is offering two $100 Scholarships to be awarded to the male and female from Huron County who obtain the highest standing regardless of the year in which he or she is registered. No formal application is necessary.

**Sir Isaac Newton Scholarships**

The Department of Physics awards two freshman Sir Isaac Newton (SIN) Scholarships annually, based mainly on the results of the SIN Physics test written in Ontario Secondary Schools. Values are $2,000. and $1,500. respectively for one year, with an additional $1,950. over three more years as a SIN Assistant. SIN Scholarships are awarded annually to the top four students entering each of second, third and fourth years in Honours Physics, both Regular and Co-op. Values are $500., $400., $300., $200., in each year. No application is necessary to be considered for the scholarships in the upper years. (These scholarships may be subject to the condition that no other scholarships are held concurrently). No application is necessary to be considered for the scholarships in the Upper Years.

**Sir Isaac Newton Assistantships**

The Department of Physics offers Sir Isaac Newton (SIN) Assistantships to recognize and encourage academic excellence in students proceeding towards an Honours Physics degree. The awards are normally made to freshmen, and are valued at $2,600. payable $650. per year. Renewal is based on satisfactory academic standing. About ten new awards are given each year, based mainly on the results of the SIN test mentioned above. Recipients of this award are required to undertake a minor academic or research project within the Department.

**J.P. Bickell Foundation Scholarships**

The Trustees of the J.P. Bickell Foundation provide a number of J.P. Bickell Foundation scholarships of $1,500. each to be awarded to qualified students in the Chemical Engineering Department and the Earth Sciences Department in any of the second, third or fourth years of the programme. To be eligible for one of these scholarships a student must obtain an average of 75% in the previous term's or year's examinations and maintain this standing throughout the programme. The scholarship will be paid at the rate of $250. a term. Awards will be made by the Scholarship Committee. No application is necessary.
Optometry Scholarships

The School of Optometry awards scholarships annually to students admitted to the School of Optometry from Year One Regular Science at the University of Waterloo. These awards will be made chiefly on the basis of scholastic achievement and as funds permit in Year Two Optometry, Year Three Optometry, Year Four Optometry and Year Five Optometry. *No application is necessary.*

The Percy Hermant Centennial Bursary Scholarships

These awards are the gift of Sydney Hermant. The Bursary Scholarships are awarded on the basis of financial need and academic achievement in First Year General Science at any Canadian University to a student who is proceeding into Year 2, School of Optometry. Six scholarships are available, each of a total possible value of $1200, being $300 per year over the four professional years (Years 2, 3, 4 and 5) provided a satisfactory standing is maintained. One scholarship is awarded to a student who is a resident of one of the Maritime provinces; two scholarships are awarded to students who are residents of Ontario; three scholarships are awarded to students who are residents of one of the Western provinces. The various Provincial Optometrical Associations are consulted in awarding these Bursary Scholarships. *Applications should be submitted to the Scholarship Committee of the School of Optometry before August 31st, of each year.*

The Saskatchewan Optometric Association Scholarships

The Saskatchewan Optometric Association presents two scholarships in the amount of $250 to each of two students admitted to Year 2 (the First Professional Year) of the School of Optometry. These awards are made to students who are residents of Saskatchewan. They are awarded on the basis of academic achievement. *No application is necessary.*

Science Society Scholarship

The Science Society, University of Waterloo, is offering four $50 scholarships to the undergraduate students attaining the highest mark in the Faculty of Science in any academic year. This award may not be held concurrently with other scholarships or merit awards.

Ukrainian Credit Union "Buduchnist" Scholarship in Ukrainian Studies

The Scholarship of $100 will be awarded annually to an outstanding full-time student who attains the highest academic standing in a Ukrainian course.

University of Waterloo Engineering Scholarships

Several scholarships, each in the amount of $500, will be made available to both entering and upper year students in the Faculty of Engineering. For students entering Year 1, the decisions will be based on results from either the Ontario Senior Mathematics Problem Competition, the CHEM 13 Competition or the Sir Isaac Newton Competition and in addition, on the students' overall academic record. For all other students, the decisions will be based on the individual's academic record at the University of Waterloo. *No application is necessary.*
University of Waterloo Undergraduate Research Assistantships

These Assistantships are made available by the Faculty of Engineering to give the opportunity to outstanding students to become involved in non-classroom activities associated with research being done within the Faculty. The student must have an outstanding academic record and be interested in spending time during the academic term on activities not associated with the prescribed curriculum. The value of this award is $500 per term on campus.

St. Jerome's College Awards

Five awards in varying amounts are awarded annually to first year students registered at St. Jerome's College who combine high academic achievement, based on final Grade 13 marks, with financial need.

Application should be made through the Office of the Dean, St. Jerome's College.

The Father John Bullbrook Scholarships

These awards are the gift of the members of the Congregation of the Resurrection residing at St. Jerome's College given in honour of the late Rev. John Bullbrook, C.R. who taught at the College. Five annual scholarships of $150 each are awarded to deserving students who combine academic excellence and contribution to College life.

No application is necessary.

The Newman Scholarships

Two awards of $250 each are provided annually to students in their graduating year who have demonstrated consistent academic excellence and contribution to College life.

No application is necessary.

The following awards are available to students studying for the priesthood who demonstrate academic excellence and financial need:

The Schill Awards

Two awards in the value of $300 each are awarded annually to students registered through St. Jerome's College in any year.

The J.J. Gnam Award

For candidates for the Congregation of the Resurrection. One awarded annually in the value of $300.

The M. Wintermeyer Award

One awarded annually in the value of $300.

The August and Ann Lang Award

One awarded annually in the value of $300.

The Kehoe-Cosgrove Awards

For candidates for the Diocese of Hamilton. Two awarded annually in the value of $200 each.

Application for these awards should be made through the Office of the Dean, St. Jerome's College.
Bursaries

**Note** Second class standing is normally required of applicants for bursary assistance. As well, students with student visas who have not been in Canada for more than one year will not normally be considered. Applications must be submitted by the end of the first month of first term unless otherwise indicated. All bursaries are applied for on a common University of Waterloo application form unless otherwise stipulated.

A.F. (Tony) Pickard Memorial Award
An award has been established in memory of A.F. (Tony) Pickard, former research co-ordinator, Applied Analysis and Computer Science, at the University of Waterloo. The amount of the award will vary from year to year depending upon the capital investment income. Undergraduates enrolled in the Faculty of Mathematics who have an active interest in computer science and show academic promise combined with financial need may apply for this award. The recipient is determined by the Senate Committee on Scholarships and Student Aid in conjunction with the Faculty of Mathematics.

*Application should be made to the Awards Officer.*

ASHRAE, Ontario Chapter Bursaries (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Ontario Chapter)
The American Society of Heating, Refrigeration & Air Conditioning Engineers, Ontario Chapter is making available annually a sum of money to be distributed in bursary form. Applicants must be normal residents of Metropolitan Toronto or adjacent municipalities, and be enrolling in 2nd or 3rd Year Mechanical or Electrical Engineering. Recipients will be determined in conjunction with the related Departments and subject to verification by the Senate Committee on Scholarships and Student Aid.

*Applications on regular University forms must be submitted to Awards Office.*

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 customer gift-giving at Christmas to bursaries for deserving and 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 Scholarship Committee. Application for a bursary should be made through the Awards Office.*

Atkinson Charitable Foundation Bursaries
The Atkinson Charitable Foundation has established a bursary programme which gives assistance to students of merit and proven financial need. 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 Awards Office.*
**Bursaries**

**Birks Family Foundation Bursary**
The Birks Family Foundation has established a plan of annual contributions to the Student Aid Fund of recognized Canadian Universities for the creation of the Birks Family Foundation Bursaries. The Bursaries are awarded by the Foundation on the recommendation of the University Scholarship Committee and are not restricted to faculty or year and may be renewed. The number and amount of such awards may vary annually, depending upon the funds available for the purpose from the Foundation. *Applications should be forwarded to the Awards Office.*

**Canada Packers Award**
Canada Packers Limited is making available two $100 awards to fourth year Chemical Engineering students having attained high academic achievement in third year. One award will be made in each of stream 'A' and stream 'B'. Other determining factors include personal characteristics, financial need and extra curricular activities. The winners will be determined by the Senate Committee on Scholarships and Student Aid in conjunction with the Chemical Engineering Department. *No application is necessary.*

**The Canadian Bechtel Limited Bursary**
The Canadian Bechtel Limited has made available two bursaries, each in the amount of $500. to be awarded to two students entering first year Engineering at the University of Waterloo. Each award will be disbursed in a manner that shall not serve to reduce the amount of any Federal or Provincial loan and/or grant to which any recipient may otherwise be eligible. Financial need and scholastic standing shall be criteria employed in determining award winners. *Applications should be directed to the Awards Officer.*

**Roberta Golightly Bursary**
A bursary, in the amount of $100. is offered annually by the Citizens' Committee for Pollution Control, Burlington, Ontario. The bursary may be awarded to a student who is resident of the town of Burlington, who is enrolled in the Faculty of Environmental Studies and who has a good academic standing. *Application should be made through the Awards Office.*

**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 the 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. *Students should make application through their high school or direct inquiries to the Awards Office.*

**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 Scholarship Committee. *Applications should be made through the Awards Office.*
The University of Waterloo has been invited to participate in the IBM - Thomas J. Watson Memorial Bursary Programme, established by the IBM Canada Limited. The objective of the programme is to provide financial assistance to needy undergraduate students 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 Awards Office.

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 who are in need of financial assistance. The company has stipulated that at least 50% of the funds granted must go to students in the applied sciences. Preference will also be given to students whose normal residence is Canada or the U.S.A. Application for a bursary should be made through the Awards Office.

The Foundation is making available a sum of money to be used in providing bursary assistance to Chemical Engineering and Earth Science 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 Awards Office.

In honour of J.G. Hagey, President Emeritus of the University of Waterloo, the Alumni Association has, in recognition of his significant contributions to post-secondary education, established a bursary fund. Several bursaries to a maximum of $150 each will be awarded annually from the fund to students showing financial need. All students attaining a 60% or equivalent standing in their previous academic years and who have not entered Canada on a student visa are eligible to apply. Applications should be directed to the Awards Office, University of Waterloo.

The Canadian Federation of University Women has established a bursary fund at the University of Waterloo to assist one or more women in second, third or fourth year, who have attained Second Class Standing and are in need of financial assistance. Preference will be given to women not holding tuition scholarships. Application should be made on the forms provided by the Awards Office.

Lambton County Council offers two bursaries valued at $100 each to students from the county, excluding residents of the City of Sarnia. Application should be made through the Awards Office.
Litton Systems Bursary

A bursary, to the value of $500., is offered annually by Litton Systems (Canada) Limited. The bursary may be awarded to students in the Faculty of Engineering with preference being given to those in the electronic or electro-mechanical fields. It is intended to provide financial assistance to undergraduates in need and may be held concurrently with other awards where the need exists.

*Applications for a bursary should be made to the Awards Office.*

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 Awards Office. Selection will be made by the Senate Committee on Scholarships and Student Aid.*

Oxford County Bursaries

Oxford County Council has granted the University of Waterloo an amount of $1,000. to be distributed to Oxford County students excluding those from the municipalities of Woodstock and Ingersoll. Students must be of good academic standing and in need of financial assistance.

*Application should be made through the Awards Office.*

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 Awards Office.*

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 Awards Office.*

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 Awards Office, University of Waterloo.*
Uniroyal (1966) Ltd. Student Aid Plan

Beginning with the academic year 1961-62 Uniroyal has included the University of Waterloo in its programme of aid to education. Awards will be made by the Scholarship 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 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 Awards Office.

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 programme 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.

The Canadian Ophthalmic Laboratories' and Suppliers' Prizes

The Canadian Ophthalmic Laboratories' and Suppliers' provide funds to award the following prizes. Since the amount in the fund varies from year to year, they will be awarded in sequence until the fund is exhausted each year:

a) Four General Proficiency Prizes (value $250 each) awarded to the student in the School of Optometry standing highest in General Proficiency in each of the second, third, fourth and fifth years;

b) Four General Proficiency Prizes (value $150 each) awarded to the student in the School of Optometry standing second highest in General Proficiency in each of the second, third, fourth and fifth years;

c) In addition to the above, prizes are awarded for highest academic standing in certain second, third and fourth year subjects as funds allow.

All of the above prizes are made available through contributions of the following Canadian Suppliers and Laboratories:

Amber Optical Co., Toronto, Ontario
Bausch and Lomb Optical Company (Canada) Limited, Toronto, Ontario
Canadian Optical Supply Co.
Dominion Contact Lens Laboratory, New Toronto, Ontario
Eastern Optical Laboratories Limited, Dartmouth, Nova Scotia
Kahn Optical Company Limited, Toronto, Ontario
KDS Optical Co., Toronto, Ontario
Monarch Optical Co., Toronto, Ontario
O mau Optical Co., Toronto, Ontario
Perfect Optical Co., Toronto, Ontario
Plastic Contact Lens Co., Toronto, Ontario
Professional Optical Co., Willowdale, Ontario
Superlite Optical Co., Toronto, Ontario
<table>
<thead>
<tr>
<th>Prizes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classics Prize</strong></td>
</tr>
<tr>
<td>The Classics Prize of $50. will be awarded annually to the student who attains the highest mark</td>
</tr>
<tr>
<td>in either Latin 190 or Greek 200. To qualify for the prize the student must enroll in a further</td>
</tr>
<tr>
<td>Latin or Greek course at the 200 level.</td>
</tr>
<tr>
<td><strong>The Optometrical Women's Auxiliary Prize</strong></td>
</tr>
<tr>
<td>(value $200.00)</td>
</tr>
<tr>
<td>The gift of the Women's Auxiliary to the Optometrical Association of Ontario is awarded to the</td>
</tr>
<tr>
<td>student in the first professional year in the School of Optometry standing highest in the</td>
</tr>
<tr>
<td>subject of Physiological Optics (Optometry 211).</td>
</tr>
<tr>
<td><strong>The Optometrical Women's Auxiliary Prize</strong></td>
</tr>
<tr>
<td>(value $200.00)</td>
</tr>
<tr>
<td>The gift of the Women's Auxiliary to the Optometrical Association of Ontario is awarded to the</td>
</tr>
<tr>
<td>student in the second professional year in the School of Optometry standing highest in the</td>
</tr>
<tr>
<td>subject of Optometry (Optometry 302-312).</td>
</tr>
<tr>
<td><strong>Political Science Third Year Prize</strong></td>
</tr>
<tr>
<td>This prize of $50. will be awarded by the Political Science Department to the fourth year</td>
</tr>
<tr>
<td>Political Science major with the highest cumulative average in his or her Political Science</td>
</tr>
<tr>
<td>courses at the end of third year. No application is necessary.</td>
</tr>
<tr>
<td><strong>The J.C. Thompson Memorial Prize</strong></td>
</tr>
<tr>
<td>(value $125.00)</td>
</tr>
<tr>
<td>The award of the Alumni Association in memory of the late Dean J.C. Thompson is made to the</td>
</tr>
<tr>
<td>final year student in the School of Optometry who has ranked highest in Optometry (Optometry</td>
</tr>
<tr>
<td>302, 312, etc.).</td>
</tr>
<tr>
<td><strong>The Percy Hermant General Proficiency Prizes</strong></td>
</tr>
<tr>
<td>(value $200.00 and $100.00)</td>
</tr>
<tr>
<td>The gifts of Sydney Hermant are awarded to the final year students in the School of Optometry</td>
</tr>
<tr>
<td>ranking first and second in general proficiency.</td>
</tr>
<tr>
<td><strong>The General Proficiency Medal</strong></td>
</tr>
<tr>
<td>The gift of the Board of Directors, College of Optometrists of Ontario is awarded to the final</td>
</tr>
<tr>
<td>year student in the School of Optometry ranking highest in general proficiency.</td>
</tr>
<tr>
<td><strong>The T.T. Beattie Medal</strong></td>
</tr>
<tr>
<td>The bequest of T.T. Beattie is awarded to the final year student in the School of Optometry</td>
</tr>
<tr>
<td>ranking highest in Orthoptics or Visual Training. The award is made once every three years,</td>
</tr>
<tr>
<td>approximately, as funds permit.</td>
</tr>
<tr>
<td><strong>The E.F. Attridge Prize</strong></td>
</tr>
<tr>
<td>The gift of E.F. Attridge is awarded to the final year student in the School of Optometry</td>
</tr>
<tr>
<td>ranking highest in Pathology.</td>
</tr>
<tr>
<td><strong>The K-W Optical Company Limited Prizes</strong></td>
</tr>
<tr>
<td>Awards are made to the two students in each of the second, third and fourth professional years</td>
</tr>
<tr>
<td>who have shown the greatest improvement in academic standing. In the fourth professional year</td>
</tr>
<tr>
<td>the awards are for $250. and $200. In the other years the awards are for $200. and $150.</td>
</tr>
<tr>
<td><strong>The Canadian Contact Lens Society Prize</strong></td>
</tr>
<tr>
<td>(value approximately $75.00)</td>
</tr>
<tr>
<td>The proceeds of a fund invested on behalf of the Canadian Contact Lens Society will be awarded</td>
</tr>
<tr>
<td>to a final year student in the School of Optometry who shows the greatest proficiency in the</td>
</tr>
<tr>
<td>theoretical and practical application of Contact Lenses.</td>
</tr>
</tbody>
</table>
Prizes

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 the 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 Jerome T. Miller Memorial Prize  This book prize was established in 1968 by relatives and friends in memory of the late Jerome Thomas Miller, B.Sc., M.Sc. (1966) – Honours Chemistry and Physics. The book is to be awarded each year, on the basis of marks, to the student in third year of a programme which combines studies in Chemistry and Physics.

Pennsylvania German Folklore Society of Ontario Prize in German  This prize of $50. will be awarded annually to the student in the Faculty of Arts, born in Canada, who has made the most progress in German during the year.

The Bobby Bauer Memorial Award  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 programme at a Canadian university.

Application should be made prior to August 31 on forms provided by the Foundation. A letter of reference from a person actively involved in Hockey must accompany each application.

Inquiries and applications should be sent directly to:
Bobby Bauer Memorial Foundation,
60 Victoria Street North,
Kitchener, Ontario.

The Bruce Wyler 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 Programme at the end of the Second year to two students, one registered with Biology as his major subject and one registered with Chemistry as his major subject. Qualifications are (a) a clear pass standing and (b) highest standing in Biology with a minimum of B standing in Chemistry or highest standing courses taken with a minimum of B standing in the average of these courses.

The Engineering Institute of Canada Student Prize  The E.I.C. Student Prize is awarded to a Student Member of the Institute in the year prior to the graduating year on the basis of the marks made in his academic year and his activities in the student engineering organization or in the local branch of a recognized engineering society.

The Chemical Institute of Canada Prize  Two awards, one each to a Chemistry and a Chemical Engineering student, are made annually by the Institute. The awards, consisting of an inscribed medal and a $25. gift, are given to the student standing at the top of the penultimate year of either course.

No application is necessary.
Government and Institutional 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 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 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 post-secondary institutions. When completed in accordance with the instructions on the application form the required number of copies should be sent to:

Awards Office
Office of the Registrar
University of Waterloo
Waterloo, Ontario, N2L 3G1

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 should be submitted prior to July 15. Applications submitted after this date may also be processed in time for registration but, to ensure this, the forms should be received by the date specified.
Grants Under Ontario Student Awards Programme

The Province of Ontario offers a grant to meet part of the need as determined by the criteria for the Canada Student Loans Plan as set out above.

Alumni Association Student Assistance Plan

This Loan Fund has been instituted by the Alumni Association, University of Waterloo. Loans up to $100, with repayment periods of up to 4 months are available to students in all faculties. 
Further information may be obtained from the Awards Office.

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 Awards Office.

Engineering Society “A” Loan Fund

This fund was established by the Engineering Society “A” to assist students in need of short term loans.
Further inquiries should be directed to the Awards Office.

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 Awards Office.

David Cook Memorial Fund

The University of Waterloo Mathematics Society has made an amount available to be used as an addition to the University's Emergency Loan Programme. The Society's contribution is intended to provide short-term, interest free loans to Mathematics students who have been faced with unexpected expenses during their academic year.
Further information may be obtained from the Awards Office.

Environmental Studies Society Loan Fund

Short term non-interest bearing loans are available to full time undergraduate students enrolled in the Division of Environmental Studies. The maximum loan is normally $100. These funds are made available by the Society and represent a part of the proceeds of functions sponsored by the Society.
Application should be made to the Awards Office.

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 Awards Office.
Graham, Myall, Thomson Memorial Fund  A memorial fund has been instituted by the classmates of the late J. Graham, M. Myall and J. Thomson, who lost their lives in an auto accident in 1969. The fund represents contributions received from their classmates and other interested donors. Loans are made available to students enrolled in the Engineering Faculty and to those who have completed at least one full year of academic study. Maximum loans are $200. with repayment terms extending up to 90 days.

*Further information may be obtained from the Awards Office.*

John Faber Memorial Fund  This fund was established by the Circle K Club at the University of Waterloo in memory of John Faber, former club member. Short term loans are offered to full time students at the University of Waterloo.

*For further information, inquiries should be directed to the Awards Office.*

Co-operative Lecture Emergency Loan Fund  This fund was established by Canadian politician T.C. Douglas in 1970. It is intended to provide short term, interest free loans to needy students who have been faced with unexpected expenses during their academic year.
5

Student Services
Student Services

Introduction
The following brief descriptions will introduce readers to the administrative departments, organizations and services with which students are likely to have the most contact during their years at the University.

Further and more detailed information concerning these services can be obtained by contacting the group concerned.

Federation of Students

"The philosophers have only interpreted the world, in various ways; the point, however, is to change it." Marx

The complementary education received from participation in extracurricular activities, in many cases, has a 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, for those who wish to take advantage of it, by the Federation of Students and its various agencies. All students of the University of Waterloo are members of the Federation of Students. The Charter of the Federation of Students which guarantees certain rights and privileges to students was approved by the Board of Governors of the University and then by the Provincial Secretary on April 27, 1967. It supercedes the Constitution of the Federation which was approved in a campus-wide referendum in 1964.

Objects
The principal "Objects" of the Federation are:
To promote the welfare and interests of the students of the University of Waterloo in all matters respecting their common interests.
To act as the representative of the students.
To promote and maintain responsible student government.
To promote and co-ordinate student participation in athletics, cultural and social activities.
To promote and maintain communication between the student body and the duly elected and appointed authorities of the University of Waterloo.

The Students' Council
Twenty-five elected members plus officers make up the Students' Council which is the governing body of the Federation. Members representing all faculties, societies and colleges are included.

The functions of the Students' Council, the governing body of the Federation, include upholding the objects of the Federation, administration and control of finance, and operation and control of all Boards and Committees of the Council. Almost all of the social and cultural activities of the student body are managed by the Students' Council as well as off-campus representation of the student body.

Organization
The activities of the Students' Council are carried out by its various boards and committees which are directed by a student chairman.
The Executive Board

The Executive Board is composed of the principal officers of the Students' Council including the President, Vice-President, Treasurer, and all Board Chairmen. The Board controls day-to-day administration, finance, and recommends policy to the Students' Council. It also co-ordinates the activities and programmes of all other Boards and provides liaison between them.

The Creative Arts Board

The Creative Arts Board, whose membership includes students, faculty and staff, provides participating activities in music, drama and dance. Groups in each area are assisted by professional directors to prepare for evening and noonhour presentations. Included are: Music — Concert Choir, Chamber Choir, Concert Band, Little Symphony Orchestra, Stage Band, Warriors Band and Folk Song Club. Drama — University Players. Dance — Ballet Club, Modern Dance Club, and U of W Repertory Company.

The Board of External Relations

The Board of External Relations represents the Federation of Students, and handles its activities, programmes and organizations in all areas that are outer-directed in relation to the campus; activities which connect and relate the student to the local, national, and international communities. Board functions are roughly divided into three commissions: Domestic Affairs, International Affairs and Information and Services, and a Hosting Committee which welcomes official student groups from other Canadian campuses and other countries. In the past the Board, through its Commissions, has provided or worked for: a high school tutorial service, overseas travel service, C.U.S. Life Insurance, seminars on the Canadian Indian, speakers from foreign countries, a court of revision on campus for provincial elections, a Waterloo drop-in centre, a study of Red China, and many other activities within its broad area of concern. Through the International Affairs Commission the Board also provides support for the Student United Nations Association of Canada (S.U.N.A.C.), Canadian University Services Overseas (C.U.S.O), Conference on Inter-American Student Projects (C.I.A.S.P.), and others.

The Board of Education

The Board of Education sponsors programmes to examine and improve the quality of education. These activities include anti-calendars, course critiques, speakers, seminars, films, research, and attempts to organize and co-ordinate student activities to promote social change.

The Board of Entertainment

The Board of Entertainment co-ordinates and supervises all campus-wide programmes, including, Freshman Orientation, Homecoming, Winter Weekend, Grad Ball and Summer Weekend. The Board also maintains a classical record collection for the use of all students, supports the House of Debates, the Flying Club (which operates three aircraft and a flying school), and assists the operation of over thirty clubs whose membership is open to all members of the Federation.

Persons wishing more information on any aspect of Federation activities are advised to write:

The Federation of Students
University of Waterloo
Waterloo, Ontario, Canada N2L 3G1
Cultural Programme Centre

The Cultural Programme Centre, room 254 in the Modern Languages Building, is the home of cultural programming and activities on the university campus.

A Creative Arts Board, under the jurisdiction of the Federation of Students, provides participating activities in music, drama and dance. Professional directors assist these groups to prepare for evening and noon hour presentations.

A number of professional attractions are presented throughout the year. Brochures and calendars are available upon request.

The Central Box Office handles all the Cultural Programme Centre's tickets for professional and participating programmes. As a service to the university community, tickets are also sold on behalf of other organizations sponsoring events of general interest.

The Theatre of the Arts, and the Humanities Theatre are available as educational and cultural resources. Contact the Reservations office in the Centre for booking information.

The Art Gallery arranges a series of 10-12 exhibitions each year. Its permanent collection, now in excess of one hundred works, is distributed throughout the university to enrich campus life.

Book Store

University of Waterloo students may purchase text books, stationery and engineering supplies at the University's modern Book Store located on the main floor of the South Campus Hall. The Book Store is open weekdays from 8:30 a.m. to 5:00 p.m. throughout the year. Book Store hours are extended in the months of September and October. Students are advised to watch the bulletin board for further notices. In addition to text books, reference material, paper supplies, crestied gift and souvenir items, and drawing materials, the University of Waterloo Book Store also features the largest display of quality paperbacks in Kitchener and Waterloo.

Athletics Department

Director
C.A.W. Totzke, B.A. (McGill)

Assistant Director (men)
W.A. Delahey, B.A. (Western)

Assistant Director (women)
P.A. Davis, B.P.H.E. (Toronto), M.Ed. (North Carolina)

Staff
P.G. Condon, B.A. (Western)
P. D. Hopkins, B.A. (Carleton), B.P.E. (Waterloo)
S.E. Kemp, B.A. (Sir George Williams)
I.A. Moore, B.A. (Western Michigan), M.Sc. (North Carolina)
R.C. McKillop, B.A., B.P.E. (Waterloo)
D.G. McCrae, B.A. (Western), B.P.E. (McMaster)

The Athletic Department offers a full and complete programme of intercollegiate and intramural activities for the enjoyment of the university community. "Something for everyone," has often been coined as the motto.
On the intercollegiate scene, students at the University of Waterloo have the opportunity of participating in what are generally described as the best intercollegiate leagues in the country. The male intercollegiate teams participate in the Ontario Universities' Athletic Association while the female teams compete in the Ontario Women's Intercollegiate Athletic Association.

The Warriors, as the male teams are named, compete intercollegiately in over twenty activities, ranging from the traditional football, basketball and hockey to the not-so-well-known judo, fencing and karate.

The female teams are known as the Athenas. Presently they compete in over eleven activities also from the traditional basketball, volleyball to the lesser-known synchronized swimming and field hockey.

For those students not wishing to participate in the intercollegiate programme, the Athletic Department offers a full and extremely varied intramural programme. In general, the intramural programme which is open to both males and females, is divided into four broad spheres of activity. They are: a competitive programme, a recreational programme, an instructional programme and a club programme.

The competitive intramural programme is the most structured level of intramural activities. The campus is divided into competitive units and competition takes place in both individual activities and team sports. The competition is very keen as the students strive to make their unit the leading one on the campus. There are over 24 activities offered in the competitive programme.

The recreational programme is geared to the leisure-time pursuits of the students. The competition is much less structured than in the competitive programme. Team sports are offered to any group of students that wish to form a team. Individual activities e.g. squash are scheduled for the students and a large amount of free time is made available in the athletic facilities during which the students may "do their thing."

The instructional programme is intended to impart some basic knowledge of various activities in which the students have shown an interest. For example, many students come to the University of Waterloo without ever having learned how to swim. In order to satisfy their desire to learn how to swim, an instructional programme has been set up in that area. Similar programmes are offered in such areas as golf, squash, judo, karate and many, many more.

The club programme at the University of Waterloo attempts to bring together those persons interested in furthering their skill or even developing a skill in a group setting i.e. learn with your peers. Club activities vary from bowling to white-water canoeing.

It is the desire of the Athletic Department to provide students at the University of Waterloo with the opportunity to make their stay at Waterloo a full and enjoyable one through experiences and endeavours outside the classroom. The Department, with student input, is continually reviewing and revising its programme to accomplish this objective.
Counselling Services

Director
W.W. Dick, B.A., B.D. (Toronto), M.A., Ph.D. (Ottawa)
A.L. Evans, B.A., B.D. (Toronto), S.T.M., D.Min. (Boston)
J.B. Goodman, B.Sc. (Toronto), M.A., Ph.D. (Waterloo)
J.C. Hawkins, B.A. (Western Ontario)
J.L. Hayashi, (Ms) B.A., M.A. (Manitoba)
R.L. Knight, B.A. (Antioch)
R.P. Kunkle, B.A. (Oregon College of Education), M.S. (Oregon)
S. Minas, (Ms) B.A. (Wayne State), M.A. (Ohio)
I.J.H. Smart, B.A. (R.M.C.), B.A. (Queen’s), M.A.Sc. (Waterloo)
R.J. Walsh, B.A. (Queen’s), M.A.Sc. (Waterloo)
O. Weizmann, (Ms) B.A. (Ohio State), M.Ed., Ph.D. (Illinois)
J.L. Williams, B.A., M.A. (Alberta), Ph.D. (Missouri)
J.J. Wine, B.A. (Bridgewater), M.S. (Iowa State), Ph.D. (Alberta)

The goal of the University Counselling Services is to provide effective assistance to individual students. More specifically, professionally trained counsellors wish to help the student with his/her university years. Our aim, first and foremost, is to help the student develop his/her own resources and is based on the philosophy that the resources and responsibility for change lie within the student. Successful counselling should result in a student being able to generalize methods he/she learns to a variety of other situations and relationships.

Counselling Services offers a wide variety of programmes and techniques (including individual and/or group counselling, psychological and vocational testing, reading and study skills, and a self-serve reference and loan library of occupational, educational and personal information etc.) which aim to help the student better understand him/her self in relation to the world around him/her.

The Counselling Service Centre is located on the 2nd Floor of the Ira G. Needles Hall. Appointments can be made by dropping in to the main office (Room 2080) or by phoning 885-1211, ext. 2655 any time from 9:00 - 5:00, Monday through Friday. Counsellors are associated with the faculties of Arts, Engineering, Environmental Studies, Human Kinetics and Leisure Studies, Mathematics, Science and with Health Services.

Counselling Services also assists student managed programmes that apply the concept of “peer-counselling.” These programmes include:

1) Hi-Line. A telephone “help” service that handles calls concerning many types of problems from 7:00 p.m. to 7:00 a.m. any night of the week.
2) Birth Control Centre. Assistance and information are provided on topics of contraception, venereal disease and abortion.
3) Countryman Counselling. Volunteers are available to discuss with newly arrived countrymen various aspects of becoming accustomed to Canadian life.

The International Student Office is located at the Counselling Service Centre. Any international students who require information, e.g. Immigration laws, etc. may feel free to visit the office.
Careers Information Centre

**Supervisor**  M.S. Anisman (Ms), B.A. (Sir George Williams)

The Careers Information Centre assists students in their personal development and educational and career planning. It is sponsored by the Departments of Co-ordination, Counselling, and Career Planning and Placement.

Information is available to students regarding their current personal circumstances as well as plans for the future. In addition to educational and career information, a wide range of books, pamphlets, magazines and brochures is on hand covering topics such as interpersonal relations, sexuality, drugs, marriage, academic skills, travel, women's roles, etc. Also supplied are up-to-date facts on special programmes such as CUSO, Company of Young Canadians, etc.

The Centre contains literature on a broad range of potential employers – institutional, governmental and industrial. This can be quite helpful prior to interviews for either graduating or co-op undergraduate students. The calendar shelves provide current material from universities, professional schools, and community and teachers colleges.

The Careers Information Centre is located on the first floor of the Ira G. Needles Hall.

Campus Health Services

**Medical Director**  Daniel E. Andrew, B.A., M.D., F.R.C.P. (C)

**Head Nurse**  Shirley M. Gutenberg, R.N., R.P.N.

Health Services is a medical clinic, situated near the centre of the campus, which provides health care to full-time registered students. It also provides nursing services to faculty and staff, and emergency care to anyone on the campus.

Health Services operates an out-patient clinic, a 12-bed infirmary, and a vision clinic. During most of the year nurses are on duty 24 hours daily. Health Services works closely with Counselling Services and a counsellor has an office in the clinic.

The medical staff consists of two full-time doctors, as well as several family physicians and gynecologists who attend on a part-time basis. Referrals are made to local specialists, and Kitchener contains two excellent hospitals. There is always a doctor on call for Health Services, and each hospital has a physician on duty constantly in its emergency department.

Several lectures and panel discussions on current health topics are sponsored yearly by Health Services. These include such topics as sex education, abortion, drug abuse, and venereal disease.

Preventive medicine is a prime concern of Health Services, as shown by an active programme on birth control.

Health Services' budget is provided partly from medical insurance plans and in part from the general University budget. Physicians' services are covered by OHIP or other medical insurance plans. A student not carrying health insurance is responsible for paying his doctor's fees.
Students should make every effort to be aware of the complexities of medical and hospital insurance to be certain that they are insured and that they are taking full advantage of the premium assistance. As part of the tuition fee paid at each registration, the student purchases an inexpensive insurance plan which provides coverage over and above OHIP. A booklet containing more details of Health Services' functions and outlining the medical insurance plans is available at Health Services.

Residence Information

(All fee listed in this section are subject to change)

Three autonomous housing operations exist at the University which together accommodate approximately 4,000 students annually in Residence. These are:

1) University Operated Residences and Off-Campus Housing
2) Federated and Affiliated Colleges.
3) Student Co-operative Residences

Students who wish to apply for residence in the University operated residences – Village 1, Village 2, and Minota Hagey, must have been academically accepted by the University and have received a “Permit to Register” before a residence application form will be sent to them.

Apartments for married students and their families are available on campus in the Married Students' Apartment Complex. The Complex is operated by the University through the office of the Director of Housing and Residence Operations.

Those wishing to secure off-campus accommodation should attempt to do so as soon as possible. By late July almost all accommodation close to the University is rented. The best time to secure accommodation is during the period April - May. Off-campus housing must be negotiated on a personal basis between landlord and student (tenant). Current lists are available from the Housing and Residence Operations Office on campus, however, the University neither inspects nor approves off-campus housing.

The Housing Office, located in the Ira G. Needles Hall, is open between the hours of 8:30 a.m. and 4:30 p.m., Monday to Friday.

Residences – University Operated

The University of Waterloo Residences (non-denominational) known as “Student Village 1”, “Student Village 2” and “Minota Hagey” are adjacent to the teaching facilities of the campus and are under the jurisdiction of the Warden.

Village 1 The residence portion consists of 26 houses with a total of 1236 rooms of which 875 are single rooms, 372 interconnecting rooms and 8 are double rooms. Each House is under supervision of a Don. Accommodation is available for 908 men and 355 women.
Village 2 Consists of 480 double rooms which will accommodate 960 residents. In addition, 20 Don's suites are available as well as accommodation for 2 tutors.

<table>
<thead>
<tr>
<th>Fees</th>
<th>Per Academic Year</th>
<th>Per Academic Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$1340</td>
<td>$670</td>
</tr>
<tr>
<td>Interconnecting</td>
<td>$1290</td>
<td>$645</td>
</tr>
<tr>
<td>Double</td>
<td>$1240</td>
<td>$620</td>
</tr>
</tbody>
</table>

Minota Hagey Residence The Minota Hagey Residence can accommodate 72 women graduate students. There are no major dining facilities included, and residents can use the facilities available in the nearby Food Services Building.

<table>
<thead>
<tr>
<th>Fees</th>
<th>Per 4 Month Academic Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>$360</td>
</tr>
</tbody>
</table>

Residences – Federated and Affiliated Colleges

Students applying for residence in the Federated and Affiliated College residences are encouraged to apply to the College of their choice as early in the year as possible. Applications for residence in the Colleges are welcomed early in the Winter, and provisional offers of admission are made by some of the Colleges (i.e., Conrad Grebel and St. Paul’s) before academic acceptance by the University. Of course, final confirmation of admission is given only after students have received academic admission to the University.

Conrad Grebel Residence Conrad Grebel is a Mennonite residential and teaching college and a student centre. It welcomes students who are attracted to its small, people-oriented programme and its contributions to the U of W in Arts, History, Music, Religion, and Sociology.

The residence is open especially to students who wish to examine within a Christian context value questions confronting them in the university and society. The faculty of the school are very personally a part of this quest.

The residence provides accommodation for 100 students in double rooms and facilities for non-resident students who want to become a part of the College.

Students are encouraged to apply for residence when they apply for admission to the University, even though their admission to Conrad Grebel College depends on their acceptance by the University of Waterloo.

<table>
<thead>
<tr>
<th>Fees Per Academic Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double $1200</td>
</tr>
<tr>
<td>Fees per Term (Fall and Winter) $600</td>
</tr>
<tr>
<td>Fees for Spring Term</td>
</tr>
<tr>
<td>Single $500</td>
</tr>
<tr>
<td>Double $425</td>
</tr>
</tbody>
</table>
Renison College
Renison College is an Anglican undergraduate arts college affiliated with the University of Waterloo since 1960. The College provides accommodation on campus for 97 men and 80 women. Admission to residence is open to students enrolled in Renison College General Arts Courses and Social Science (Applied) Programme, and others registered in any faculty of the University.

Fees: Per Academic Year  Per Academic Term
Single $1350  $675
Double $1230  $615

Spring Term Only: 7 day occupancy, 5 days meals.
Single $425  Double $400

St. Jerome's College
St. Jerome's College is a Roman Catholic liberal arts college federated with the University of Waterloo. Its residence is in the heart of the campus and offers both single and double accommodation to 120 men. Consideration is granted first to applicants registered at St. Jerome's College with the remaining rooms being allocated to those registered in faculties at the University.

Fees: Per Academic Year  Per Academic Term
Single $1300  $650
Double $1200  $600

Notre Dame College
Notre Dame College is an independent Roman Catholic women's residence conducted by the School Sisters of Notre Dame. Situated on the same piece of land as St. Jerome's College its twenty single and fifty-one double rooms accommodate one hundred and twenty-two students. Prior consideration is granted to those students who are registered at St. Jerome's College but traditionally the makeup of Notre Dame has been representative of all the faculties of the University.

Fees: Per Academic Year  Per Academic Term
Single $1300  $650
Double $1200  $600

St. Paul's College
St. Paul's is a residential and teaching affiliate of the University, sponsored by the United Church. Through a programme of student activities, including a students' council, intramural sports teams, community dinners, a chapel group and interest groups engaged in a variety of activities and social projects within and outside of the University, the College seeks to bring students from a variety of backgrounds into a meaningful community life.

The residence provides accommodation in seventy-five semi-private rooms for 150 men and women. A limited number of Associate (non-resident) members of the College are admitted each term. St. Paul's offers courses in Religious Studies for academic credit.
Student Services

Fees:
- Semi-Private: $1250
- Spring Term 75 only: 7-day occupancy, 5 days meals: $400 (1974), (1975 to be announced)
- Per Academic Year: $625

Student Co-operative Residences

Waterloo Co-operative Residence Incorporated is a student built, owned, and operated residence community offering co-ed residence accommodation to both single and married students.

Hammarskjold House
- 105 students
- 15 singles: $540
- 90 doubles: $490

Phillip Street Residence
- 288 students
- 96 singles: $570
- 192 doubles: $520

Phillip Street Apartments
- 63 units

<table>
<thead>
<tr>
<th>Lease</th>
<th>1 Bedroom per month</th>
<th>2 Bedroom per month</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 month</td>
<td>$145.</td>
<td>$165.</td>
</tr>
<tr>
<td>8 month</td>
<td>$140.</td>
<td>$160.</td>
</tr>
<tr>
<td>12 month</td>
<td>$135.</td>
<td>$155.</td>
</tr>
</tbody>
</table>

Individual meal plans are also available for non-resident students at both Hammarskjold House or Phillip Street.

Married Students’ Apartments

Location
- The Married Students’ Apartments at the University of Waterloo are located on the South East corner of the Main Campus between University Avenue West and Seagram Drive. The Complex consists of 2 fourteen storey high rise towers each containing 120 one-bedroom apartments and 4 three storey courts each containing 90 two-bedroom walk-up apartments.

How to Apply
- Applications Forms are available from the Manager to whom the completed application form should be returned.

<table>
<thead>
<tr>
<th>Lease</th>
<th>1 Bedroom per month</th>
<th>2 Bedroom per month</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Month lease</td>
<td>$140.</td>
<td>$160.</td>
</tr>
<tr>
<td>8 Month lease</td>
<td>$135.</td>
<td>$155.</td>
</tr>
<tr>
<td>12 Month lease</td>
<td>$130.</td>
<td>$150.</td>
</tr>
</tbody>
</table>
Enquiries  The Manager's Office is located on the first floor of the West Tower in the Married Students' Apartment complex and is open from 8:00 a.m. to 5:00 p.m. Monday to Friday. Telephone: 884-0310
or write:
The Manager, Married Students' Apartments,
Room 0104
159 University Avenue West
Waterloo, Ontario, Canada.
N2L 3E8

Office of the Dean of Women

The Office of the Dean of Women serves as a general information and advisory centre for all students. The office is open to students at regular hours and initial contact with women students is made through pre-arranged informal interviews.
Because most questions concern the academic life of the student, this office acts as liaison between faculty/administration and students in matters of course or programme changes, study habits, meeting deadlines and effects of personal problems on academic performance – in short, the office helps the student to achieve her academic goal.

Office of the Registrar

The Office of the Registrar is basically responsible for the administration of academic policies and procedures as they relate to undergraduate students in the university. These responsibilities include admissions, registration, student records, transcripts, scheduling of courses and examinations, convocation, student awards, secondary school liaison, and publications such as the academic calendar and admission brochures. The office is organized primarily according to the faculty structure of the University. There are four Assistant Registrars, each with a clerical staff, who are responsible for the duties that relate to a particular faculty area.
The primary contact that a student will have with this office will be with the Assistant Registrar who is responsible for the faculty area in which the student is registered.
A listing of the organization of the office is found at the back of this calendar.
The Office of the Registrar also serves as the primary contact of the University for general inquiries regarding undergraduate programmes. Prospective applicants and students currently enrolled in the University are encouraged to contact the office for assistance regarding any aspect of student admission/academic records.
Secondary School Liaison

Secondary School Liaison at the University of Waterloo is regarded as having two major areas of involvement: those activities taking place essentially on campus, and those efforts designed to reach students in their own geographical areas across the Province.

In the first instance, there are thousands of visitors annually attending two major on-going Faculty-initiated programmes: Computer Science Days and Science Waterloo Days. Also, of prime importance, are the large number of visitors who request either a tour of the campus, or an interview within a specific interest area. These latter contacts are handled by the Secondary School Liaison Office, which is ably assisted by student tour guides from the Circle "K" Club.

The University's primary off-campus involvement is that of attending a large number of University Information Programmes and Dialogues, which take place from early fall to mid-winter in every country area of Ontario. Further, many Departmental, Faculty or individual presentations are made annually at functions such as, Conferences, Commencements, or Professional Development Days.

Information may be obtained by writing:

Secondary School Liaison Officer
Office of the Registrar
University of Waterloo
Waterloo, Ontario
N2L 3G1

or by calling 885-1211 ext. 2582 or 2583

Student Awards

The Student Awards office is responsible for the administration of undergraduate awards to full-time students. This includes the Ontario Student Awards Programme as well as bursaries. Scholarships are very limited and under the direct jurisdiction of the individual faculties. Students should contact the Associate Dean of the faculty in which they plan to enroll concerning information on scholarships.

Any student interested in types of financial assistance available at the University of Waterloo should not hesitate to contact the Student Awards Office either in person or by correspondence. Detailed information concerning scholarships and bursaries may be found in Chapter 4 of this Calendar.
The Departments of Co-ordination, and Career Planning and Placement
Departments of Co-ordination, and Career Planning and Placement

Department of Co-ordination

The Department of Co-ordination is responsible for the work terms in the Co-operative Programmes.

The staff of the department is comprised of professional personnel having extensive experience related to their fields of service.

Director R.J. Wieser, B.E. (Saskatchewan), P.Eng.

Engineering

Programme Administrator, Faculty Liaison D.H. Copp, B.A.Sc. (Toronto), P.Eng.
Assistant to Programme Administrator R. Mateyk, B.A.Sc. (Toronto), P.Eng.
Co-ordinators D.G.S. Anderson, B.A.Sc. (Toronto), P.Eng.
G.P. Berthin, B.Sc. (Manitoba), Eng.
G.P. Dobbin, B.A.Sc. (Toronto), P.Eng.
A.T. Girard, B.A.Sc. (Toronto), P.Eng.
R.A. Grant, B.Sc. (Queen's), P.Eng.
R. Grant, B.A.Sc. (Toronto), P.Eng.
D.S. Harris, B.Eng. (McGill), P.Eng.
L.B. Jones, B.A.Sc. (Toronto), P.Eng.
A.L. Lind, B.Sc. (Queen's), Eng.
R. McDowell, B.Sc. (Saskatchewan), P.Eng.
W.A. Runge, B.Sc. (Queen's), P.Eng.
M.M. Smith, B.Sc. (Queen's), P.Eng.
F.A. Subosits, B.Sc. (Mich. Technological Univ.)

Applied Science

Programme Administrator R.A. Pullin, B.S.A. (Toronto)
Co-ordinators L.R. Bricker, B.Sc., M.Sc. (Waterloo)
W.J. Palmer, B.Sc. (St. Francis Xavier), M.Sc. (Dalhousie)

Co-operative Mathematics

Options in Actuarial Science

Computer Science, Optimization, Business, Teaching, Chartered Accounting and Statistics

Programme Administrator B.A. McCallum, B.A. (Western)
Assistant to Programme Administrator E.P. Whelan
The Co-operative Plan

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 career interest, while the academic terms can more properly be devoted to fundamental and theoretical studies. At Waterloo, most programmes consist of eight four-month academic 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 to 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 terms, and 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, and generally the whole management of the co-operative employment scheme is the responsibility of the Department of Co-ordination. The Co-ordinators counsel the students, visit them on the job, and assist them to adjust to work situations and professional development.

The Work-Study Sequence

In most of the co-operative programmes at Waterloo, all year 1 students enroll 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 for con-
Departments of Co-ordination, and Career Planning and Placement

The continuity of employment opportunity in 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 final choice of group is made by students during interviews with co-ordinators shortly after registration. As far as possible students’ choices will be honoured, but in the case of a major imbalance, students may be requested to enter the deficient group. Precise dates for the beginning and end of various terms are shown in the Academic Calendar.

The eight terms of study and six terms of employment provided in the co-operative programmes are arranged as shown in the diagram.

<table>
<thead>
<tr>
<th>1974</th>
<th>1975</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>First Term</td>
<td>Second Term</td>
<td>Work Term</td>
</tr>
<tr>
<td>1A</td>
<td>1B</td>
<td>2A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1977</th>
<th>1978</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Fifth Term</td>
<td>Sixth Term</td>
<td>Work Term</td>
</tr>
<tr>
<td>3A</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Term</th>
<th>Fifth Term</th>
<th>Sixth Term</th>
<th>Work Term</th>
<th>Seventh Term</th>
<th>Eighth Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3A</td>
<td>5</td>
<td>3B</td>
<td>6</td>
<td>4A</td>
</tr>
</tbody>
</table>

Exceptions occur in the co-op pattern for some programmes. In Kinesiology and Recreation, all first year students remain on campus for eight months and proceed on their first work term in the Spring. In Systems Design (Engineering) and Chartered Accounting (Mathematics), first year students are at the University for four months and have their first work term in the Winter. In Earth Sciences the Co-operative Programme consists of a single group and begins in the student’s second year. Variations of the standard programme are used in Applied Physics, Environmental Studies – Architecture and the option in Co-operative Mathematics for Prospective High School Teachers.

Work Terms

A basic requirement of the Co-Operative Programmes at the University of Waterloo is satisfactory performance during co-operative work terms.

Registration in a co-operative programme commits students to the acceptance of employment 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.

By registering in a co-operative programme, students give permission for the release of their grades to employers and to prospective employers.

Students and employers choose each other through the following process. Job notices are posted on Co-ordination Department bulletin boards and students are asked to examine the notices and indicate their interest by applying for interviews. Students make these applications by completing and returning to the Department specially designed computer cards which are made available to them.

Following receipt of these applications, each employer is mailed the record of all students who have applied for interviews with that organization. These student records consist of the academic grades and the work term performance grades, and a resume if provided by the student. For first year students, Grade 13 marks are the only academic grades sent. For new students in upper years, marks from previous institutions are not included. A list of the students whom the employer wishes to interview is returned and, from these, a schedule of interviews is drawn up.

Interviews arranged through this procedure are conducted on campus in the offices of the Department.

When students have completed all their interviews they rank (on cards provided by the Department and given them by the interviewers) in order of preference, the companies by whom they were interviewed. These cards are then submitted to the Department. In the same manner students are ranked by employers and a computer is used at this point to match the interests of both parties. Under this procedure, there will be companies and students who do not obtain students and/or jobs. In such cases the Department will make every effort to place these students and satisfy the employers where the best interests of each can be served. If in the course of the interviews or while making the preference selection, it becomes apparent that the student is unable to accept a particular job (or two maximum) this must be discussed with the Department of Co-ordination before refusing the job(s). Failure to do so may result in the student being removed from the placement procedures.

It should be noted that a student is obligated to accept the employment obtained through the above procedures unless extenuating circumstances prevail, in which case the Co-ordination Department must be consulted and permission obtained before the job is refused.

Salaries paid co-operative students are determined within the employer's own wage structure, although employers may consult with the Co-ordination Department. Wages can be expected to increase when merited as the student progresses through the course and assumes more responsibility. However, the student should not expect the income from the work terms to provide complete self-support.

Students in co-operative programmes are required to return for a second work term when acceptable to employers. First work terms with employers include learning periods varying in length with the complexity of the jobs. Second work terms provide the students with an opportunity for better assessment of the jobs and provide
the employers with the benefits of increased productivity. In many instances the second term also offers students some new duties and responsibilities. Valid reasons for exceptions to this rule will be considered by the Co-ordination Department. Additional work terms with co-operative organizations are a matter of mutual agreement between employers and students.

The student is required to prepare written reports which normally cover some phase of the employment during work terms. Such 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 for analysis. The work report is designed to help train the students to think, to organize and to express themselves on paper in a clear, logical and concise form. When possible it should be a project of benefit to the employer as well as the student.

**Evaluation**

At the end of each work term, it is recommended that each student have an exit interview with the supervisor. During this interview, they should discuss together the student's work term performance using the "Employer's Evaluation of Co-operative Student" as a guide. For students in some programmes, this discussion may include the student's work report. The evaluation of the work report will be given by either the Department of Co-ordination or the Faculty. Both these evaluations (performance and work report) subsequently will be maintained in the student's record.

**Conduct and Responsibilities**

The satisfactory completion of co-operative work terms is a requisite of graduation. It is emphasized that during the work terms the student carries a responsibility to build and maintain a good personal reputation as well as that of the University.

No student may continue in a co-operative programme at the University of Waterloo if acceptable progress is not achieved during the work terms. A student who fails to honour an agreement to work with an employer or who leaves the co-operative employment without prior approval from the Co-ordination Department, or whose conduct while on the job purposely causes dismissal, may be suspended immediately from the Co-operative programme.

Unsatisfactory performance by a student in two work terms will result in a thorough investigation of suitability for professional training and withdrawal from the programme may be required.

The foregoing has been written with the assistance of the Student Advisory Council to the Department of Co-ordination. The Council strongly recommends that applicants interested in co-operative education read a brochure designed to supplement the Calendar, entitled "Where it's at with Co-op Education" before deciding whether such a programme is designed to best further their academic interests. The brochure presents more details about Co-op in areas solely relevant to students, and should be available in most High School Guidance Departments or upon request from the Department of Co-ordination.
Departments of Co-ordination; and Career Planning and Placement

Student Advisory Council to the Department of Co-ordination

The Student Advisory Council advises the Department of Co-ordination on matters of interest and policy from the students' points of view. Members of Council also act as liaison between the student body and the Department. Council membership is by Society appointment as follows:

- 4 students Faculty of Engineering
- 2 students Faculty of Mathematics
- 2 students Faculty of Human Kinetics and Leisure Studies
- 1 student Department of Physics
- 1 student Department of Chemistry
- 1 student School of Architecture
- 1 student Department of Earth Sciences

Industrial Advisory Council for Co-Operative Engineering and Applied Science

The Industrial Advisory Council of the University of Waterloo was established in 1958 to bring guidance from industry to the University of Waterloo. The Council meets twice each year to discuss problems and make recommendations relative to the University's co-operative programmes in Engineering, Applied Chemistry and Applied Physics.

- Mr. W.L. McDonald Black and McDonald Limited
  *Chairman*
- Mr. J.M. Lawrence B.P. Refinery Canada Limited
  *Vice-Chairman*
- Mr. S.W. Sheldon Standard Brands Limited
  *Secretary*
- Mr. W. Bobbie B.F.Goodrich Canada Limited
- Mr. W.C. Bradbury Westinghouse Canada Limited
- Mr. G.C. Brown The Price Company Limited
- Mr. R.A. Carlyle International Nickel Co. Canada Limited
- Mr. D. Friesen Dofasco
- Mr. B. Jones Chicago Rawhide Limited
- Mr. A.S. Jones Lubrizol of Canada Limited
- Mr. T. Larson Borden Chemical Company (Canada) Limited
- Dr. H.B. Marshall Domtar Limited

- Mr. C.C. Midwinter Sandwell and Company Limited
- Mr. D. McKenzie Ford Motor Company of Canada Limited
- Mr. H.A. Nightingale Canada Post Office
- Mr. K.H. Rapsey Allen-Bradley Canada Limited
- Mr. G. Roelofson Montgomery Elevator Company Limited
- Mr. D.W. Roughley The Corporation of the City of Hamilton
- Mr. R.W. Selater The Giffels Group
- Mr. D.H. Scott David H. Scott Consultants Limited
- Mr. V. Skof Frankel Structural Steel
- Mr. A.E. Speers Canadian National Railways
- Mr. W.L.W. Taylor Falconbridge Nickel Mines Limited
- Mr. D.H. Wilson McIntyre-Porcupine Mines Limited
### Departments of Co-ordination, and Career Planning and Placement

### Organizations Employing Co-Operative Engineering, Applied Physics and Applied Chemistry Students

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Company Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abex Industries of Canada Ltd.</td>
<td>Baton Broadcasting Ltd.</td>
</tr>
<tr>
<td>Abitibi Paper Company Ltd.</td>
<td>Bauer Bros. Company (Can.) Ltd.</td>
</tr>
<tr>
<td>Abitibi Provincial Paper Ltd.</td>
<td>T. W. Beak Consultants Ltd.</td>
</tr>
<tr>
<td>Acel Compounds Ltd.</td>
<td>Beaver Engineering Ltd.</td>
</tr>
<tr>
<td>Acres Consulting Services Ltd.</td>
<td>Beavers Dental Products Ltd.</td>
</tr>
<tr>
<td>The Adams Mine</td>
<td>Bekarnt Industrial Ltd.</td>
</tr>
<tr>
<td>Addiction Research Foundation</td>
<td>Bell Canada</td>
</tr>
<tr>
<td>Adjeleian &amp; Associates</td>
<td>Bell-Northern Research</td>
</tr>
<tr>
<td>Aerovox Canada Limited</td>
<td>Belmont Property Management</td>
</tr>
<tr>
<td>Ainley &amp; Associates Limited</td>
<td>Bennett &amp; Wright Eastern Ltd.</td>
</tr>
<tr>
<td>Air Canada</td>
<td>Bennett Paving &amp; Materials Ltd.</td>
</tr>
<tr>
<td>Ajax Engineers Ltd.</td>
<td>Bibby Foundry Ltd.</td>
</tr>
<tr>
<td>Alcan Research &amp; Development</td>
<td>Black &amp; McDonald Ltd.</td>
</tr>
<tr>
<td>Algoma Steel Corporation, Ltd.</td>
<td>Burden Chemical Co. (Can.) Ltd.</td>
</tr>
<tr>
<td>Allan Crawford Associates Ltd.</td>
<td>Borg Fabrics Ltd.</td>
</tr>
<tr>
<td>Allen-Bradley Can. Ltd.</td>
<td>Borough of East York</td>
</tr>
<tr>
<td>Allied Canada Ltd.</td>
<td>Borough of Etobicoke</td>
</tr>
<tr>
<td>Almax Ceramic Industries Ltd.</td>
<td>Borough of Scarborough</td>
</tr>
<tr>
<td>Aluminium Company of Canada, Ltd.</td>
<td>J. P. Bowman</td>
</tr>
<tr>
<td>American Can of Canada Ltd.</td>
<td>Boyle-Midway (Can.) Ltd.</td>
</tr>
<tr>
<td>Ampex of Canada Ltd.</td>
<td>B. P. Refinery Can. Ltd.</td>
</tr>
<tr>
<td>Anaconda Canada Ltd.</td>
<td>Brampton Hydro Electric Commission</td>
</tr>
<tr>
<td>R. V. Anderson Associates Ltd.</td>
<td>Brant County Board of Education</td>
</tr>
<tr>
<td>Andrew Antenna Company Ltd.</td>
<td>Bruce Evans Ltd.</td>
</tr>
<tr>
<td>Angelstone Ltd.</td>
<td>The Budd Automotive Co. of Can. Ltd.</td>
</tr>
<tr>
<td>A. P. Parts Canada Ltd.</td>
<td>R. J. Burnside &amp; Associates</td>
</tr>
<tr>
<td>Applied Electronics Ltd.</td>
<td>Butler Manufacturing Company (Can.) Ltd.</td>
</tr>
<tr>
<td>Arnott Construction Ltd.</td>
<td>Butts Magwood &amp; Hall Ltd.</td>
</tr>
<tr>
<td>Arthur G. McKee &amp; Co. of Can. Ltd.</td>
<td>Campbell Red Lake Mines</td>
</tr>
<tr>
<td>Ashland Chemical Company Ltd.</td>
<td>Canada Crushed Stone</td>
</tr>
<tr>
<td>Associated Tube Industries Ltd.</td>
<td>Canada Machinery Corp. Ltd.</td>
</tr>
<tr>
<td>Atlas Steel Company, Div. of Rio Algom Mines Ltd.</td>
<td>Canada Metal Co. Ltd.</td>
</tr>
<tr>
<td>Atomic Energy of Can. Ltd.</td>
<td>Canada Packers Ltd.</td>
</tr>
<tr>
<td>Automatic Electric (Can.) Ltd.</td>
<td>Canada Sand Papers Ltd.</td>
</tr>
<tr>
<td>Automatic Electronic Systems</td>
<td>The Canada Starch Co. Ltd.</td>
</tr>
<tr>
<td>Automotive Hardware Ltd.</td>
<td>Canada Wire &amp; Cable Co. Ltd.</td>
</tr>
<tr>
<td>Babcock &amp; Wilcox Can. Ltd.</td>
<td>Canadian Bechtel Ltd.</td>
</tr>
<tr>
<td>Bacon Engineering Ltd.</td>
<td>Canadian Bluebird Coach Ltd.</td>
</tr>
<tr>
<td>Bailey Construction Ltd.</td>
<td>Canadian Brass Ltd.</td>
</tr>
<tr>
<td>Bank of Montreal</td>
<td>Canadian Broadcasting Corp.</td>
</tr>
<tr>
<td>Barringer Research Ltd.</td>
<td>Canadian Carborundum Co. Ltd.</td>
</tr>
<tr>
<td>Barton Tubes Ltd.</td>
<td></td>
</tr>
</tbody>
</table>
Canadian Coleman Co. Ltd.
Canadian Erectors Ltd.
Canadian Fram Ltd.
Canadian General Electric Company Ltd.
Canadian General Tower Ltd.
Canadian Heat Treaters Ltd.
Canadian Industries Ltd.
Canadian Johns-Manville Co., Ltd.
Canadian Material Handling Group
Canadian National Railways
Canadian Office & School Furniture Ltd.
Canadian Pacific
Canadian Pittsburgh Industries Ltd.
Canadian Refractories Division, Dresser Industries Can. Ltd.
Canadian Vegetable Oil Processing Ltd.
Canadian Wallpaper Manufactures Ltd.
Canron Ltd.
E. G. M. Cape & Company Ltd.
Carling O'Keefe
Centerline (Windsor) Ltd.
Centrum Avionics Ltd.
Chicago Rawhide Ltd.
Chinook Chemicals Corp. Ltd.
Chrysler Canada Ltd.
Churchill Forest Industries
Cities Service Chemicals Ltd.
City of Barrie
City of Brantford
City of Brockville
City of Cambridge
City of Chatham
City of Guelph
City of Hamilton
City of Kitchener
City of London
City of Niagara Falls
City of Oshawa
City of Peterborough
City of Sault Ste. Marie
City of Sudbury
City of Thunder Bay
City of Toronto
City of Welland
City of Windsor
City of Woodstock
CKCO TV Station
Cole Sherman & Associates Ltd.
Columbus McKinnon Ltd.
Collins Radio Company of Canada Ltd.
Cominco Ltd.
Computing Devices of Canada Ltd.
Comstock International Ltd.
Consolidated Bathurst Ltd.
Consolidated Canadian Faraday
Consolidated Computer Ltd.
The Consumers' Gas Co.
Consumers Glass Co. Ltd.
Continental Can Company of Canada Ltd.
V. B. Cook Company Ltd.
Cooper Construction Co.
Eastern Ltd.
Copeland Laboratories Ltd.
Couler Copper & Brass Ltd.
County of Brant
County of Halton
County of Lambton
County of Peel
CP Telecommunications
Crane Canada Ltd.
Crane Packing Co. Ltd.
Crone Geophysics Ltd.
Crowe Foundry Ltd.
Datagen of Canada Ltd.
Dataline Systems Ltd.
Dayco (Can.) Ltd.
Daymond Ltd.
Dearden & Stanton
Decca Radar Ltd.
Decor Metal Products Ltd.
DeLaval Company Ltd.
Delta-Benco Cascade
Denison Mines Ltd.
Derek W. Moore
Desitron Co. Ltd.
Diamond Clay Products
Diesel Equipment Ltd.
Digital Equipment of Canada Ltd.
Digital Methods Ltd.
M. M. Dillon Ltd.
Dineen Construction Ltd.
Dinsmore Construction Co. Ltd.
Direct Digital Industries Ltd.
Doehler Canada Ltd.
Doerner Products Ltd.
Dominion Aluminum Fabricating Ltd.
Dominion Bridge Co. Ltd.
Dominion Dairies Ltd.
Dominion Engineering Works Ltd.
Departments of Co-ordination, and Career Planning and Placement

Dominion Foundries & Steel Ltd.
Dominion Road Machinery Co. Ltd.
Dominion Soil Investigation Ltd.
Domtar Chemical Ltd.
Domtar Construction Materials Ltd.
Domtar Fine Papers Ltd.
Domtar Ltd.
Domtar Newsprint Ltd.
J. T. Donald & Co.
Dorr-Oliver-Long Ltd.
Douglas Aircraft Co. of Can. Ltd.
Dover Corporation Can. Ltd.
Dresser Industries of Can. Ltd.
Dryden Chemicals Ltd.
Dryden Paper Co. Ltd.
Dufferin Materials & Construction Ltd.
Dunker Construction Ltd.
Dunlop Research Centre
Dupont of Can. Ltd.
Eastern Steel Products Co.
Eaton Yale Ltd.
Ebasco Services of Can. Ltd.
Eclipse Fuel Engineering Co.
Ecostall Mining Co. Ltd.
Eddy Forest Products Ltd.
Edmunde Newhall Associates Ltd.
Electrohome Ltd.
Electronics Corporation of American (Can.) Ltd.
Eli Lilly & Co. Can. Ltd.
Ellis-Don Ltd.
Erns-Leitz (Can.) Ltd.
Esso Chemical Can.
Ethicon Sutures Ltd.
Fabricon Manufacturing Ltd.
FAG Bearings Ltd.
Falconbridge Nickel Mines Ltd.
Falk Corporation of Can. Ltd.
Fathom Oceanology Ltd.
Fermar Paving Ltd.
Ferrco Engineering Ltd.
Fiberglas Can. Ltd.
Firestone Tire & Rubber Co. of Can. Ltd.
Firth Brown Tools Can. Ltd.
Fischbach & Moore of Can. Ltd.
Fisher Controls Co. of Can. Ltd.
Fleck Manufacturing Co.
FMC of Canada Ltd.
Ford Motor Co. of Can. Ltd.
Formpac Can. Ltd.
Foseco Can. Ltd.
Foundation General Engineering Construction
E. S. Fox Ltd.
The Foxboro Co. Ltd.
Francis Hankin & Co. Ltd.
Frankel Structural Steel Ltd.
Fruehauf Trailer Co. of Can. Ltd.
Fullerren Ltd.
Functcraft Vehicles Ltd.
Galt Metal Industries Ltd.
Galt-Brantford Malleable Ltd.
Garlock Co. of Can. Ltd.
Garrett Manufacturing Ltd.
Gaspé Copper Mines Ltd.
Geac Computer Corp. Ltd.
General Co-Axial Services Ltd.
General Foods Ltd.
General Gear Co.
General Motors of Can. Ltd.
George Cluthe Manufacturing Co. Ltd.
Gidon Industries Ltd.
The Giffels Group
Gilvesy Construction Ltd.
T. Gledhill
The Glidden Co. Ltd.
GNC Homes Ltd.
H. Q. Golder & Associates Ltd.
B. F. Goodrich Canada Ltd.
Goodyear Tire & Rubber Co.
of Can. Ltd.
Gore & Storrie Ltd.
Gould National Batteries of Canada Ltd.
Grand River Conservation Authority
Grandview Industries Ltd.
G. Granek & Associates
Great Can. Oil Sands Ltd.
Great Lakes Paper Co. Ltd.
Great West Steel Industries Ltd.
A. P. Green Refractories Can. Ltd.
GSW Research Centre
Guaranty Trust Co. of Can.
Guelph Engineering Company
Guelph Hydro
Gulf Oil Can. Ltd.
Government of Canada
Canada Post Office
Departments of Co-ordination, 
and Career Planning and Placement

Canadian Carbonization Research Association
Dept. of Agriculture
Dept. of Communications
Dept. of Environment
Dept. of Public Works
Dept. of Consumer & Corporate Affairs
Dept. of Energy, Mines & Resources
Dept. of Indian Affairs & Northern Development
Dept. of National Defence
Dept. of National Health & Welfare
Dept. of Supply & Service
Ministry of Transport
Hamilton Paint & Varnish Co.
Hamilton-Wentworth Suburban Roads Commission
Hammond International (Can.) Ltd.
Harding Carpets Ltd.
Hart Chemicals Ltd.
Hatch Associates Ltd.
J. A. Haugh Manufacturing Co. Ltd.
Hayes-Dana Ltd.
Hi-Lo Equipment (Can.) Ltd.
Hi-Test Instruments Ltd.
R. R. Higgins & Associates Ltd.
Highway Trailers of Can. Ltd.
Holderbank Technical Services Ltd.
Holstead & Orendorff
Honeywell Controls Ltd.
Hoover Co. Ltd.
Hospital & Kitchen Equipment Co. Ltd.
Hospital for Sick Children
Hostess Foods Products Ltd.
Huntec Ltd.
Hydro Mississauga
Hydro-Electric Commission of Welland
Hydrology Consultants Ltd.
IBM Canada Ltd.
ICN-Empire
Ideal Vendors, Div. of Eddy Match Co. Ltd.
Imperial Oil Enterprises Ltd.
Imperial Tobacco Products Ltd.
Indueon Consultants of Can. Ltd.
Indusmin Limited
Industrial Fasteners Ltd.
Industrial Wire & Cable (1970) Ltd.
Inspec-Sol Ltd.
The International Nickel Co. of Can., Ltd.
International Scanning Devices Inc.
International Systemos Ltd.
Interroyal Corporation Ltd.
Iron Ore Co. of Can.
ITT Canada Ltd.
James F. MacLaren Ltd.
John A. Huston Co. Ltd.
John C. Parkin
John Deere Welland Works
John Inglis Co. Ltd.
John Metz
John T. Hepburn Co. Ltd.
S. C. Johnson & Sons Ltd.
G. N. Johnston Equipment Co. Ltd.
Jones Kirwan Associates Ltd.
Joseph E. Seagram & Sons Ltd.
Joy Manufacturing Co. (Can.) Ltd.
Kafko Manufacturing Ltd.
Kanmet Ltd.
Kearney-National (Can.) Ltd.
Keprier Products Ltd.
Kilborn Engineering Ltd.
Kimberly-Clark of Can. Ltd.
Kimberly-Clark Pulp & Paper Co. Ltd.
Kitchener Water Commission
Kitchener-Waterloo Hospital
G. V. Kleinfeldt & Associates (Kitchener) Ltd.
Knox Martin Kretch Ltd.
Kodak Canada Ltd.
Koehring-Waterous Ltd.
H. J. Koester Ltd.
Konforti & McCavour Ltd.
Kuntz Electroplating Ltd.
Labatt Breweries of Can. Ltd.
Lakehead Board of Education
Lambert-Hoppen Ltd.
Laura Secord Candy Shops Ltd.
J. D. Lee Engineering Ltd.
Leigh Instruments Ltd.
Lincoln Electric Co. of Can. Ltd.
Linsay CATV System Ltd.
Lindsay Specialty Products Ltd.
Link Belt Ltd.
Lipe Metal Products
Litton Systems (Can.) Ltd.
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Department Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOF Glass of Can. Ltd.</td>
<td>Traffic Control Centre</td>
</tr>
<tr>
<td>London Concrete Machinery Co.</td>
<td>Roads &amp; Traffic Dept.</td>
</tr>
<tr>
<td>Looby Construction Ltd.</td>
<td>Nashua Can. Ltd.</td>
</tr>
<tr>
<td>Lummus Co. Can. Ltd.</td>
<td>of Can. Ltd.</td>
</tr>
<tr>
<td>Lunar Co. Ltd.</td>
<td>National Research Council</td>
</tr>
<tr>
<td>M&amp;T Products of Can. Ltd.</td>
<td>Personnel Services Branch</td>
</tr>
<tr>
<td>MacKinnon Mitchell &amp; Associates Ltd.</td>
<td>Tech. Information Services</td>
</tr>
<tr>
<td>MacLean-Illunter Cable TV Ltd.</td>
<td>National Sewer Pipe Ltd.</td>
</tr>
<tr>
<td>Malcolm Condensing Co. Ltd.</td>
<td>Neilson Engineering Ltd.</td>
</tr>
<tr>
<td>Marshall Macklin Monaghan Ltd.</td>
<td>Nelco (Kitchener) Ltd.</td>
</tr>
<tr>
<td>E. S. Martin Construction Co. Ltd.</td>
<td>New Dundee Co-op Creamery</td>
</tr>
<tr>
<td>V. K. Mason Construction Co. Ltd.</td>
<td>Niagara Regional Conservation Authority</td>
</tr>
<tr>
<td>Mathews Conveyor Co. Ltd.</td>
<td>Nixon Plate Coils Ltd.</td>
</tr>
<tr>
<td>Mattabi Mines Ltd.</td>
<td>Noram Testing Technology Ltd.</td>
</tr>
<tr>
<td>Mattagami Lae Mines Ltd.</td>
<td>Noranda Metal Industries Ltd.</td>
</tr>
<tr>
<td>Matthews Group Ltd.</td>
<td>Noranda Mines Ltd.</td>
</tr>
<tr>
<td>McAsphalt Engineering Services</td>
<td>Geco Div.</td>
</tr>
<tr>
<td>R. T. McBride Ltd.</td>
<td>Horne Division</td>
</tr>
<tr>
<td>J. McCleary &amp; Co. Ltd.</td>
<td>Noranda Research Centre</td>
</tr>
<tr>
<td>McCormick Rankin &amp; Associates Ltd.</td>
<td>North American Plastics</td>
</tr>
<tr>
<td>P.F. McGaw &amp; Associates</td>
<td>North York Hydro</td>
</tr>
<tr>
<td>McIntyre Porcupine Mines Ltd.</td>
<td>Northland Engineering Ltd.</td>
</tr>
<tr>
<td>McLean Bessemer Ind. Ltd.</td>
<td>Nortown Air Systems</td>
</tr>
<tr>
<td>McMaster University</td>
<td>Norwich Pharmaceutical Co. Ltd.</td>
</tr>
<tr>
<td>Mel-Ron Construction Ltd.</td>
<td>Oliver Lloyd and Assoc. Ltd.</td>
</tr>
<tr>
<td>Memorial University of Nfld.</td>
<td>Ont. Crippled Children's Centre</td>
</tr>
<tr>
<td>Metal Koting</td>
<td>Province of Ontario</td>
</tr>
<tr>
<td>Microsystems International Ltd.</td>
<td>Min. of Natural Resources</td>
</tr>
<tr>
<td>Minnesota Mining and Mfg. of Can. Ltd.</td>
<td>Min. of Consumers &amp; Commercial Relations</td>
</tr>
<tr>
<td>Mississauga Water Commission</td>
<td>Min. of Environment</td>
</tr>
<tr>
<td>Mitchell Construction Co.</td>
<td>Min. of Government Services</td>
</tr>
<tr>
<td>Moldex Co. Ltd.</td>
<td>Min. of Transportation &amp; Communications</td>
</tr>
<tr>
<td>Moloney Electric Co. Can. Ltd.</td>
<td>Min. of Treasury, Economics &amp; Intergovern't Affairs</td>
</tr>
<tr>
<td>Molson's Brewery (Ont.) Ltd.</td>
<td>Min. of Solicitor General</td>
</tr>
<tr>
<td>Mowtech Ingram Engineering</td>
<td>Min. of Revenue</td>
</tr>
<tr>
<td>Montgomery Elevator Co. Ltd.</td>
<td>Ontario Cancer Institute</td>
</tr>
<tr>
<td>Motor Wheel Industries (Chatham) Ltd.</td>
<td>Ontario Hydro</td>
</tr>
<tr>
<td>Motorola Electronics Sales Ltd.</td>
<td>Ontario Malleable Iron Co. Ltd.</td>
</tr>
<tr>
<td>MTD Products Can., Schl Engineering Ltd.</td>
<td>The Ontario Minnesota Pulp and Paper Co. Ltd.</td>
</tr>
<tr>
<td>Multi-State Devices Ltd.</td>
<td>Ontario Northland Railway</td>
</tr>
<tr>
<td>Municipality of Metro Toronto Dept. of Works</td>
<td>The Ontario Paper Co. Ltd.</td>
</tr>
<tr>
<td>Municipality of Metro Toronto Personnel Dept.</td>
<td>Ontario Research Foundation</td>
</tr>
<tr>
<td></td>
<td>Ortho Pharmaceutical (Can.) Ltd.</td>
</tr>
<tr>
<td></td>
<td>Otaco Ltd.</td>
</tr>
<tr>
<td></td>
<td>Otis Elevator Co. Ltd.</td>
</tr>
</tbody>
</table>
Outboard Marine Corp. Can. Ltd.
Famour Porcupine Mines Ltd.
Paul Theil Associates
Peto Associates Ltd.
Philip Doyle Ltd.
Philips-Lau Products Ltd.
Picker X-Ray Mfg. Ltd.
Pigott Construction Co. Ltd.
Pilkington Brothers Can. Ltd.
Pineridge Cable TV Ltd.
Pioneer Electric Ont. Ltd.
Plax Canada Ltd.
Polymer Corporation Ltd.
Polysar Plastics Ltd.
H.K. Porter Co. (Can.) Ltd.
Potter & Brumfield, Div. of
AMF Can. Ltd.
R. M. Pow Ltd.
Pre Con Co.
The Prestolite Co.
Preston Metal & Roofing Products Ltd.
Prince George Pulp & Paper Ltd.
Procor Ltd.
The Procter and Gamble Co. of Can. Ltd.
The Procter and Redfern Group
Proto Tools of Can. Ltd.
Pumps and Softeners Ltd.
Purolator Products Can. Ltd.
Racey MacCallum Bluteau Ltd.
Ramsden Manufacturing Ltd.
Ramsey Engineering Co.
Rapistan Can. Ltd.
Rayshield Ltd.
Raytheon Can. Ltd.
Red D Mix Concrete Co.
Reg. Municipality of Niagara
Reg. Municipality of Waterloo
Reichhold Chemical Can. Ltd.
J. D. Reid and Associates Ltd.
Reuter Stokes, Can. Ltd.
J. L. Richards and Assoc. Ltd.
Rio Algom Mines Ltd.
Robbins and Meyers Co. of Can. Ltd.
Robert McAlpine Ltd.
Robinson Perrin & Assoc. Ltd.
Robson-Lang Leathers Ltd.
Rogol Electric Co. Ltd.
B. M. Ross & Assoc. Ltd.
Roxton Furniture Ltd.
Royal Military College of Can.
Rybka Smith & Ginsler Ltd.
Ryerson Polytechnical Institute
Sabre Saw Chain (1963) Ltd.
Sandrin Bros. (1968) Ltd.
Sandwell & Co. Ltd.
Sarco Canada Ltd.
Savage Shoes Ltd.
Scarborough Board of Educ.
Scarborough Steel Works Ltd.
Schering Corp. Ltd.
J. M. Schneider Ltd.
Schutte-Koerting Co. (Can.) Ltd.
Schwenger Construction Ltd.
E. & E. Seegmiller Ltd.
Seneca Manufacturing Ltd.
Sewell & Sewell
Shaw Pipe Industries Ltd.
Sheldon-Bowman Enterprises
Sicil Canada Ltd.
Sheridan College of Applied Arts & Technology
Shiels & Associates Ltd.
Silverwood Dairies Ltd.
Simeco County
A. G. Simpson Co. Ltd.
Simpson Sears Ltd.
Simtec Ltd.
Slater Steel Industries Ltd.
Smith & Stone Ltd.
Smith Kline French Can. Ltd.
Sonoco Prod. Co. of Can. Ltd.
South Bay Mining
Southam Printing Co. Ltd.
Spantec Ltd.
Spar Aerospace Products Ltd.
Sprague Electric of Can. Ltd.
Spruce Falls Power & Paper Co.
St. Clair College of Applied Arts & Technology
St. Joseph's Hospital
St. Lawrence Cement Co. Ltd.
Standard Brands Ltd.
Stanton Pipes (Can.) Ltd.
Star Steel Limited
Starr and Tarasick
State Electric Co.
Steele & Evans Ltd. Blacktop Div.
The Steel Co. of Can. Ltd.
Steeles Wire Springs Ltd.
Steep Rock Iron Mines Ltd.
Steffler Metal Products Ltd.
Stephens-Adamison, Div. of
Borg-Warner Can. Ltd.
Stewart Warner Corp. of Can. Ltd.
Department of Co-ordination,  
and Career Planning and Placement

<table>
<thead>
<tr>
<th>Organizations Employing Co-operative Mathematics Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres Consulting Services Ltd.</td>
</tr>
<tr>
<td>AGT Data Systems Ltd.</td>
</tr>
<tr>
<td>Air Canada</td>
</tr>
<tr>
<td>Aluminum Co. of Can. Ltd.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organizations Employing Co-operative Mathematics Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Standard Products Can. Ltd.</td>
</tr>
<tr>
<td>Atmospheric Environment Serv.</td>
</tr>
<tr>
<td>Atomic Energy of Can. Ltd.</td>
</tr>
<tr>
<td>Automatic Electronic Sys. Inc.</td>
</tr>
</tbody>
</table>

J. W. Storey  
Sun Oil Co. Ltd.  
Sunbeam Corp. Can. Ltd.  
Sunnybrook Hospital  
Superior Continental Ltd.  
Taylor Instrument Companies of Can. Ltd.  
Teklogix Ltd.  
Telesat Can.  
Tempo Audio Industries Ltd.  
Temptrite Industries Ltd.  
Terry Industries  
Texaco Can. Ltd.  
Texas Instruments Inc.  
Thermal Degradation Systems  
Thomas Built Buses of Can. Ltd.  
J. E. Thomas Specialties Ltd.  
Tilco Plastics Ltd.  
Toronto Board of Education  
Toronto Coppersmithing Co. Ltd.  
Toronto Foundry Ltd.  
Toronto Transit Commission  
Toronto-Hydro Electric System  
Totten Sims Hubicki & Assoc.  
Town of Brampton  
Town of Burlington  
Town of Markham  
Town of Mississauga  
Town of Oakville  
Town of Wallaceburg  
Township of Chinguacousy  
Township of Elliot Lake  
Tracon Engineering Ltd.  
Trans-Canada Pipe Lines Ltd.  
Trecan Ltd.  
Tremco Manufacturing  
Trent Rubber Services Ltd.  
Tridon Manufacturing Ltd.  
Tripp Construction Ltd.  
Triton Engineering Serv. Ltd.  
Underwood McLellan & Assoc. Ltd.  
Union Carbide Can. Ltd.  
Union Drawn Steel Co. Ltd.  
Union Gas Co. of Can. Ltd.  
Uniroyal Chemical, Div. of Uniroyal Ltd.  
Uniroyal Ltd.  
Unit Rig and Equipment Co. (Can.) Ltd.  
United Co-operatives of Ont.  
United-Carr Can. Ltd.  
Unitel Ltd.  
Unitrон Industries Ltd.  
University of Guelph  
University of Toronto  
Val-Mar Pools Ltd.  
Van Luven Consultant Ltd.  
Varian Associates of Can. Ltd.  
Victaulic Co. of Can. Ltd.  
Victory Soya Mills Ltd.  
VME Associates  
Wabco Equipment Can. Ltd.  
Wabush Mines  
Wainbee Ltd.  
Walber Machine Products Ltd.  
P. J. Wallbank Mfg. Co. Ltd.  
Walter Fedy McCargar  
Hachborn Consult. Engineers  
L. W. Ward & Associates  
W. L. Wardrop & Associates  
Waterloo Hydro  
Wayne Sweeper Mfg. Ltd.  
Westinghouse Can. Ltd.  
Westroc Industries Ltd.  
William Neilson Ltd.  
William Trow & Associates  
R. E. Winter & Associates Ltd.  
Wm. Roberts Electrical and Mechanical Ltd.  
The W. C. Wood Co. Ltd.  
Woodstock Eng. Consult. Ltd.  
Worthington (Can.) Ltd.  
P. M. Wright Elect. Co. Ltd.  
X-Ray Assay Laboratories Ltd.  
Yarway Can. Ltd.  
York County Board of Educ.  
3M Canada Ltd.  

Department of Co-ordination,
and Career Planning and Placement

Bank of Canada
Bank of Montreal
The Bank of Nova Scotia
Bata Ltd.
The Becker Milk Co. Ltd.
Bell Canada
Bell-Northern Research
Albert College
Ashbury College
Brant County Board of Educ.
Carleton Board of Educ.
Etvobicke Board of Educ.
Leeds-Grenville County Board of Educ.
The Lincoln County Board of Educ.
Ottawa Board of Educ.
Peel County Board of Educ.
Renfrew County Board of Educ.
Sudbury Board of Educ.
Timmins Board of Educ.
Waterloo County Board of Educ.
Wellington County Board of Educ.
York Borough Board of Educ.
Wellington County Board of Educ.
York Borough Board of Educ.
York County Board of Educ.
Bouris Wilson Scott & Proctor
Budd Automotive Co. (Can.) Ltd.
Burroughs Business Machines Ltd.
Canada Permanent Trust Co.
Canada Systems Group (EST) Ltd.
Canadian General Electric Co. Ltd.
Canadian General-Tower Ltd.
Canadian Imperial Bank of Commerce
Canadian Industries Ltd.
Canadian Motor Industries Holdings Ltd.
Canadian National Telecommunications
Canadian Pacific
Campbell Keenan & Co.
Campbell, Sharp, Nash & Field
Canadian Tire Acceptance
Canavest House Ltd.
Canfarm Data Systems
Clarkson, Gordon & Co.

Cern European Organization for Nuclear Research
Combined Insurance Co. of America
Confederation Life Insurance Co.
Consumers’ Gas Company Ltd.
Control Data Can. Ltd.
Coopers & Lybrand - Chartered Accountants
Cossar Hector Payne & Co.
Cox, Hyatt & Co.
The Crown Life Insurance Co.
Data Crown Ltd.
The De Havilland Aircraft of Can. Ltd.
Deloitte, Haskins & Sells
Digital Methods Ltd.
Dominion Foundries & Steel Ltd.
The Dominion Life Assurance Co.
Dreaper Dobie & Co. Ltd.
Drewry & Co.
E. B. Eddy Co.
Wm. Eisenberg & Co.
Electrohome Ltd.
Fallis-Don Ltd.
The Excelsior Life Insurance Co.
Falconbridge Nickel Mines Ltd.
Financial Post
Ford, Keast, Giles & Smith
Ford Motor Co. of Can. Ltd.
Fuller, Jenks, Landau & Co.
Gardner, McDonald & Co.
The General Accident Assurance Co. of Can.
General Foods Ltd.
General Motors of Canada Ltd.
Gerling Global Life Insurance Co.
Glendinning, Jarrett, Gould & Co.
The Globe and Mail Ltd.
B.F. Goodrich Can. Ltd.
Goodyear Tire & Rubber Co. of Can. Ltd.
Gore Mutual Insurance Co.
D. J. Graham Automotive Ltd.
Grand & Toy Ltd.
Gray, Butcher, Frost & Co.
Gray Tool Co. of Can.
Guaranty Trust Co.
Gulf Oil Can. Ltd.
Dept. of Environment
National Research Council of Can.
Public Service Commission of Can.
Honeywell Ltd.
Hopkins, Burrows, Selby & Beadie
D. H. Howden Ltd.
IBM Can. Ltd.
Imperial Oil Ltd.
Imperial Tobacco Products Ltd.
John Inglis Co. Ltd.
International Harvester Co. of Can. Ltd.
The International Nickel Co. of Can. Ltd.
Johnson, Stewart, Bourne, Brown & Co.
Joselyn, Laughlin, Harper, Tory & Associates
Kearney-National (Can.) Ltd.
Charles A. Kench & Assoc. Ltd.
Kimberly-Clark of Can. Ltd.
L & W Data Systems Ltd.
John Labatt Ltd.
Laventhal, Krekstein, Horwath & Horwath
M. Loeb Ltd.
London Life Insurance Co.
MacGillivray & Co.
A. F. MacLaren & Co.
Mansfield-Denman General Ltd.
The Manufacturers Life Insurance Co.
Maritime Life Assurance Co.
McColl, Turner & Co.
McKerlie Automotive Co. Ltd.
The Mercantile & General Reinsurance Co. Ltd.
William M. Mercer Ltd.
Millard, Rouse & Rosebrugh
3M Can. Ltd.
Molson Industries Ltd.
Monteith, Monteith & Co.
Moore & Co.
Morris, Burk, Friedman & Luborsky
Murphy, Murphy & Wells
The Mutual Life Assurance Co. of Can.
National Data Centre
The National Life Assurance Co. of Can.
New Brunswick Telephone Co.
Noranda Mines Ltd.
North American Life Assurance Co.
Office of the Auditor General
Ont. Assoc. for the Mentally Retarded
Ont. Hydro
The Ont. Institute for Studies in Educ.
Ont. Research Foundation
Osborne & Osborne
Outboard Marine Corp. of Can. Ltd.
Ont. Ministry of Edu.
Ont. Ministry of Consumer & Commercial Relations
Ontario Ministry of Health
Ont. Ministry of Government Services
Ont. Ministry of Revenue
Ont. Ministry of Transportation & Communication
Ont. Ministry of Treasury, Economics & Intergov. Affairs
Peat, Marwick, Mitchell & Co.
Perlmutter Orenstein Giddens Newman & Co.
Philips Electronics Industries Ltd.
R. L. Polk Co. of Can. Ltd.
Price-Waterhouse & Co.
Procter & Gamble Co. of Can. Ltd.
Richardson, Bond & Wright Ltd.
Riddell, Stead & Co.
Robertshaw Controls (Can.) Ltd.
The Royal Bank of Can.
Royal Insurance Group
Royal Military College of Can.
Ryerson Polytechnical Institute
Saddington Greenfield & Co.
Scholar's Choice Ltd.
S.D.I. Associates Ltd.
Shell Can. Ltd.
Simpson-Scarfs Ltd.
Smith Nixon & Co.
Smith Klymas Selk & Co.
Software Brokers Ltd.
Software House Ltd.
The Sovereign Life Assurance Co. of Can.
St. Clair College of Applied Arts & Technology
The Steel Co. of Can. Ltd.
City of Sudbury
Systems Dimensions Ltd.
Department of Co-ordination,
and Career Planning and Placement

Telesat Can.
Tessier Smith & Partners
Texaco Canada Ltd.
Texaco Can. Ltd.
Thorne Gunn & Co.
Touche, Ross & Co.
Towers Department Stores Ltd.
Towers, Perrin, Forster &
Crusby (Can.) Ltd.
Trans-Canada Pipe Lines Ltd.
Travelers Life Insurance Co.
of Canada
City of Toronto
The Toronto-Dominion Bank
Municipality of Metro Toronto
The Toronto Mutual Life
Insurance Co.
Toronto Transit Commission
Union Gas Co. of Can. Ltd.
Union Mutual Life Assurance
Co. of Canada

United Co-operatives of Ont.
United Investment Services Ltd.
University of British Columbia
Carleton University
University of Ottawa
University of Toronto
University of Waterloo
York University
Victoria & Grey Trust
G. H. Ward & Partners
George A. Welch & Co.
Winspear Higgins Stevenson
& Co.
Woods, Gordon & Co.
Workmen's Compensation Brd.
Xerox of Can. Ltd.
Zehrs Markets Ltd.
Zurich Life Insurance Co.
of Can.

Organizations Employing Co-Operative
Architecture Students

Acres Consulting Services Ltd.
Adamson Associates
Air Canada
Akitt & Swanson Architects
Architects for Metro Centre
Arcop Associates
Arthur Erickson - Architect
Bazemore Architecture & Plan's
Bell Canada
Boigon & Armstrong Architects
Ray & Elizabeth Bradbury
Bregman & Hamann, Architects
Brook, Carruthers, Grierson &
Shaw Architects
R.V.B. Burgoyne, Architect
Central Mortgage & Housing
Corp.
Clifford & Lawrie Architects
Crang & Boake, Architects
Dept. of Nat. Health & Welfare
Dale & Scott, Architects
deBelle & Koffman, Architects
Design Research Consultants
Diamond & Myers Architects
Dickson/Ventin Architects
D. Dimakopoulos, Architect
Dunlop Farrow Aitken
E.L.B. Associates Inc.
Federal Dept. of Public Works
Henry Fliess, Architect

Giffels Associates Ltd.
Gore & Storrie - Engineers
Govan Kaminker Langley
Keenleyside Melick
Hallford & Wilson Architects
Halton Region Consv. Auth.
Hamilton Consv. Auth.
Don Hancock Landscape
Architect
Imperial Oil Ltd.
Inducon Construction of Can.
Ltd.
Innovation Four Design
Jackson Ypes & Associates
Thomas P. Kalman, Architect
William C. Karleff, Architect
William E. Keenan, Architect
Keith Little Associates Ltd.
Kettle Creek Consv. Auth.
James W. Keywan, Architect
Erdmann W. Knaack, Architect
Kyles, Kyles & Garratt
Architects
Lebensold, Affleck, Nichol, Hughes
Lipson & Dashkin, Architects
London Board of Educ.
Long Point Consv. Auth.
Ludlow & Fleury Architect
Raymond Mandel Architect
### Department of Co-ordination, and Career Planning and Placement

Jerome Markson Architect  
V.K. Mason Construction Ltd.  
McGrath Engineering Ltd.  
C. Blakeway Millar Architect  
Min. of Educ. (Barbados)  
Min. of Transport  
Town of Mississauga  
Moffet & Duncan, Architects  
National Capital Commission  
National Research Council of Canada  
W.H. Nesbitt, Architect  
Nicol Schoales Ream McBain Architects  
Nightingale & Quigley Architects  
Northern College of Applied Arts  
Ogus & Fisher Architects  
Ont. Min. of Colleges & Universities  
Ont. Min. of Community & Social Services  
Ont. Min. of Correctional Services  
Ont. Min. of Gov. Services  
Ont. Min. of Natural Resources  
Owen Luder Partnership  
Page & Steele Architects  
Searle Wilbee Rowland Architects  
Sifton Properties  
R. Stewart Smith, Architect  
Stevens & Skinner Architects  
Snider Huget & March Architects  
Joseph W. Storey, Architect  
Swain & Rupnow Consulting Engineers  
Sydenham Valley Cons. Auth.  
S D I Systems Research Group  
The R. J. Thom Partnership  
Toronto Transit Commission  
University of Waterloo  
Wing's Success Ltd.  
Y & R Properties  
Parkin-Architects  
Polymer Corp. Ltd.  
Prack & Prack Architects  
Quadric Ltd.  
Renton Howard Wood Assoc.  
E.I. Richmond, Architect  
Robinson & Heinrichs  
Sheldon D. Rosen, Architect  
Ryan & Lee  
Salter & Allison Architects  
Sankey Associates  
Scherrer & Hicks

### Organizations Employing Co-Operative Kinesiology and Recreation Students

<table>
<thead>
<tr>
<th>Organization</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult Occupational Centre, Edgar</td>
<td></td>
</tr>
<tr>
<td>Alcoholism &amp; Drug Addiction Research Foundation</td>
<td></td>
</tr>
<tr>
<td>Arrowhead Ranch</td>
<td></td>
</tr>
<tr>
<td>Ashbury College</td>
<td></td>
</tr>
<tr>
<td>Athletic Equip. Testing Co.</td>
<td></td>
</tr>
<tr>
<td>Ont. Hospital - Aurora</td>
<td></td>
</tr>
<tr>
<td>City of Barrie</td>
<td></td>
</tr>
<tr>
<td>Boys' Club of Greater Niagara</td>
<td></td>
</tr>
<tr>
<td>Brant County Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>The Briars Inn and Country Club</td>
<td></td>
</tr>
<tr>
<td>Brock University</td>
<td></td>
</tr>
<tr>
<td>Brockville Psychiatric Hospital</td>
<td></td>
</tr>
<tr>
<td>Brown's High Hope Outdoor Educ. Center</td>
<td></td>
</tr>
<tr>
<td>Town of Burlington</td>
<td></td>
</tr>
<tr>
<td>Camp Tawingo</td>
<td></td>
</tr>
<tr>
<td>Cambrian College of Applied Arts &amp; Technology</td>
<td></td>
</tr>
<tr>
<td>The Can. National Institute for the Blind</td>
<td></td>
</tr>
<tr>
<td>Ont. Hospital School - Cedar Springs</td>
<td></td>
</tr>
<tr>
<td>Children's Psychiatric Research Institute</td>
<td></td>
</tr>
<tr>
<td>Township of Chinguacousy</td>
<td></td>
</tr>
<tr>
<td>Conestoga College of Applied Arts &amp; Technology</td>
<td></td>
</tr>
<tr>
<td>Dr. MacKinnon Phillips Hosp.</td>
<td></td>
</tr>
<tr>
<td>Espanola Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>Borough of Etobicoke</td>
<td></td>
</tr>
<tr>
<td>Fern Resort</td>
<td></td>
</tr>
<tr>
<td>The Fitness Institute</td>
<td></td>
</tr>
<tr>
<td>Y.M.C.A. Galt</td>
<td></td>
</tr>
<tr>
<td>George Brown College of Applied Arts &amp; Technology</td>
<td></td>
</tr>
<tr>
<td>Goderich Psychiatric Hospital</td>
<td></td>
</tr>
<tr>
<td>Gov. of Northwest Territories</td>
<td></td>
</tr>
<tr>
<td>Ont. Hosp. School, Muskoka Unit</td>
<td></td>
</tr>
<tr>
<td>Hamilton Psychiatric Hosp.</td>
<td></td>
</tr>
<tr>
<td>Department of Co-ordination, and Career Planning and Placement</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>C.M. Hincks Treatment Centre</td>
<td></td>
</tr>
<tr>
<td>Kingston Psychiatric Hosp.</td>
<td></td>
</tr>
<tr>
<td>City of Kitchener, Parks &amp; Recreation Dept.</td>
<td></td>
</tr>
<tr>
<td>Lakehead Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>Lakehead Psychiatric Hosp.</td>
<td></td>
</tr>
<tr>
<td>Town of Lindsay - Recreation Commission</td>
<td></td>
</tr>
<tr>
<td>London Public Utilities Commission - Recreation Dept.</td>
<td></td>
</tr>
<tr>
<td>Lutherwood</td>
<td></td>
</tr>
<tr>
<td>Mental Health Centre - Penetanguishene</td>
<td></td>
</tr>
<tr>
<td>Merrymount Childrens' Home</td>
<td></td>
</tr>
<tr>
<td>Metropolitan Separate School Board</td>
<td></td>
</tr>
<tr>
<td>Midwestern Regional Children's Centre</td>
<td></td>
</tr>
<tr>
<td>Montreal Assoc. for the Blind</td>
<td></td>
</tr>
<tr>
<td>National &amp; Historic Parks Br'ch</td>
<td></td>
</tr>
<tr>
<td>Town of Oakville</td>
<td></td>
</tr>
<tr>
<td>Ont. Housing Corp.</td>
<td></td>
</tr>
<tr>
<td>Ont. Min. of Community &amp; Social Services</td>
<td></td>
</tr>
<tr>
<td>Ont. Min. of Correctional Serv.</td>
<td></td>
</tr>
<tr>
<td>City of Orillia</td>
<td></td>
</tr>
<tr>
<td>The Ont. Hospital School</td>
<td></td>
</tr>
<tr>
<td>The Orthopaedic &amp; Arthritic Hospital</td>
<td></td>
</tr>
<tr>
<td>City of Oshawa Recreation Dept.</td>
<td></td>
</tr>
<tr>
<td>Ottawa Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>Y.M.-Y.W.C.A. - Ottawa</td>
<td></td>
</tr>
<tr>
<td>City of Owen Sound - Rec. Dept.</td>
<td></td>
</tr>
<tr>
<td>Oxford Mental Health Centre - Mental Retardition Div.</td>
<td></td>
</tr>
<tr>
<td>Oxford Mental Health Centre - Recreational/Vocational Serv.</td>
<td></td>
</tr>
<tr>
<td>Participation House</td>
<td></td>
</tr>
<tr>
<td>Peel County Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>Prince Edward Heights Hosp.</td>
<td></td>
</tr>
<tr>
<td>Queen Street Mental Health Centre</td>
<td></td>
</tr>
<tr>
<td>Regina Mundi College</td>
<td></td>
</tr>
<tr>
<td>Regional Municipality of Niagara</td>
<td></td>
</tr>
<tr>
<td>Renfrew County Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>Rideau Regional Hosp. School</td>
<td></td>
</tr>
<tr>
<td>Riordan Sporting Goods</td>
<td></td>
</tr>
<tr>
<td>City of St. Catharines - Parks &amp; Rec. Comm.</td>
<td></td>
</tr>
<tr>
<td>St. Thomas Psychiatric Hosp.</td>
<td></td>
</tr>
<tr>
<td>Y.W.C.A. - St. Thomas</td>
<td></td>
</tr>
<tr>
<td>Township of Saltfleet</td>
<td></td>
</tr>
<tr>
<td>Township of Sarnia</td>
<td></td>
</tr>
<tr>
<td>Sault College of Applied Arts &amp; Technology</td>
<td></td>
</tr>
<tr>
<td>Borough of Scarborough - Rec. &amp; Pks. Dept.</td>
<td></td>
</tr>
<tr>
<td>Seneca College of Applied Arts &amp; Technology</td>
<td></td>
</tr>
<tr>
<td>Y.M.C.A. Storer Camps</td>
<td></td>
</tr>
<tr>
<td>Sunnybrook Hospital</td>
<td></td>
</tr>
<tr>
<td>City of Thunder Bay - Pks. &amp; Rec. Dept.</td>
<td></td>
</tr>
<tr>
<td>Timmins Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>Toledo Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>Y.M.C.A. - Metro Toronto</td>
<td></td>
</tr>
<tr>
<td>Trent University</td>
<td></td>
</tr>
<tr>
<td>Valleyview Home for the Aged</td>
<td></td>
</tr>
<tr>
<td>Waterloo County Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>Waterloo County Separate School Board</td>
<td></td>
</tr>
<tr>
<td>Waterloo Tennis Club</td>
<td></td>
</tr>
<tr>
<td>University of Waterloo</td>
<td></td>
</tr>
<tr>
<td>Wellington County Board of Educ.</td>
<td></td>
</tr>
<tr>
<td>WestScarborough Boys' Club</td>
<td></td>
</tr>
<tr>
<td>Whitby Psychiatric Hosp.</td>
<td></td>
</tr>
<tr>
<td>Women's Welfare League</td>
<td></td>
</tr>
<tr>
<td>City of Woodstock - Rec. Serv. Dept.</td>
<td></td>
</tr>
<tr>
<td>Woolwich Recreation Dept.</td>
<td></td>
</tr>
<tr>
<td>Borough of York - Pks. &amp; Rec. Dept.</td>
<td></td>
</tr>
<tr>
<td>York County Board of Educ.</td>
<td></td>
</tr>
</tbody>
</table>
Students at all academic levels are assisted by this Department in determining careers paths and in obtaining employment on graduation. Types of employment and the organizations and agencies compatible with the individual student's needs and abilities are discussed during personal interviews with Career Counsellors.

Group sessions in resume writing and interviewing techniques are held for graduating students, to help bridge the gap between the academic environment and the search for employment.

Through the Department students have access to a wide range of career information. This includes general employment trends, starting salary levels, opportunities in various fields, and with specific employers. Literature is available covering the characteristics of all classifications of employment and describing the operations and normal requirements for university graduates of individual employers.

Each year, several hundred employers are invited to conduct on-campus interviews for all graduating students. Employers, interested in hiring co-operative graduates, interview students during a three week period in January. Students in regular programmes, and post-graduate students, participate in a three week interview period in November-December and also in the January interviews.

The Department strives to give the best possible service by opening as many communication channels as possible among students, employers, faculty and staff, relative to career planning and placement.

The Career Planning and Placement Offices are located on the first floor of the Ira G. Needles Hall.
7

The University Libraries
The University Libraries

University Librarian
M.C. Shepherd, B.Ed. (Saskatchewan), M.A., (L.S.)
(Denver)

Assistant Librarians
Support Services
C.D. Emery, B.A. (Durham), A.L.A.

Reader Services, Arts
H. McKinnon, B.A. (Saskatchewan); B.L.S. (Toronto), M.L.S. (McGill)

Reader Services, E.M.S.
A. Berti, B.A. (Windsor), B.L.S. (Toronto)

Planning
C. Pugsley, B.A. (Toronto), M.L.S. (McGill)

Collections Development
D.E. Lewis, B.A., B.L.S. (Toronto), LL.D. (Trent)

Library Personnel
A. Dunnet, B.B.A. (U.N.B.)

Adminstrator

Support Services

Assistant Librarian
C.D. Emery, B.A. (Durham), A.L.A.

Acquisitions Department
Head
E. Waterman, B.A. (McMaster), B.L.S. (Toronto)

Bibliographic Searching
Department
Head
R. Kamra, B.A. (Panjab), M.I.S. (Western)

Cataloguing Department
Head
J. Scanlon, B.A., M.A., B.L.S. (Toronto)
Assistant Head
Y. Gordon, B.A. (Manitoba), B.L.S. (Toronto)
Assistant Head
T. Canini, B.A., M.A. (Helsinki), M.L.S. (Western)
Assistant Head
A. Chan, B.A. (Hong Kong), M.L.S. (Western)
Assistant Head
C. Halperin, B.A., M.L.S. (Toronto)
Assistant Head
G. Louden, B.A. (Temple), M.L.S. (Toronto)
Assistant Head
G. Raaphorst, B.A. (Ottawa), M.L.S. (McGill)
Assistant Head
P. Stoksik, B.A., B.L.S. (Toronto)
Assistant Head
M. Wan, B.S.Sc. (Hong Kong), M.A., M.L.S. (Western)

Government Publications
Department
Head
C. Presser, A.B. (Hunter), M.L.S. (Pratt)
Librarian
J. Boettger, B.A. (Waterloo), B.L.S. (British Columbia)

Serials Department
Head
B. Bruder, B.A. (Waterloo Lutheran)
Assistant Head
L. Anquili, B.A., M.L.S. (Rutgers)
The University Libraries

Reader Services

Arts Library

Assistant Librarian
H. McKinnon, B.A. (Saskatchewan), B.L.S. (Toronto), M.L.S. (McGill)

Circulation Department
Head
E. Reaman, B.A. (McMaster), B.L.S. (Toronto)

Reference Department
Head
M. Grant, B.A., B.L.S. (Toronto)

Reference Librarians
L. Black, B.A. (Waterloo College), B.L.S., M.L.S. (Toronto)
M. Blok, B.A. (Waterloo), M.L.S. (Western)
R. Crusz, B.A. (Ceylon), M.A. (Waterloo), B.L.S. (Toronto)
K. Dorschner, B.A., M.A. (Waterloo), M.L.S. (Western)
A. Slade, B.A. (Victoria), B.L.S. (British Columbia)
D. Wilkins, B.A. (Waterloo), M.L.S. (McGill)

Engineering, Mathematics and Science Divisional Library

Assistant Librarian
A. Berti, B.A. (Windsor), B.L.S. (Toronto)

Circulation Department
Head
V. Mixer, A.B. (Hanover)

Reference Department
Head
S. Beuttenmiller, B.Sc. (Waterloo), B.L.S. (Toronto)

Reference Librarians
G. Birks, B.Sc. (Manitoba), B.L.S. (Alberta)
W. Macpherson, B.Sc., M.L.S. (Dalhousie)
H. Mayoh, B.A. (British Columbia), M.A. (Toronto), B.L.S. (Alberta)
J. Parrott, B.Sc. (Queen’s), M.Sc., B.L.S. (Toronto)
B. Pogue, B.A. (St. Andrew’s), M.A. (Calgary), B.L.S. (Alberta)
B. Toth, B.A. (Queen’s), M.L.S. (McGill)

Environmental Studies Library
Head
C. Harvey, B.Sc., B.L.S. (Alberta)

Planning

Assistant Librarian
C. Pugsley, B.A. (Toronto), M.L.S. (McGill)

Systems Development Librarian
R.G. Bean, B.A. (Western), B.L.S., M.L.S. (Toronto)

Assistant for Budgets and Analysis
J. Jorgensen, B.A. (Toronto)

The University Libraries are central to the academic programmes going on throughout the University. Their function is to provide books, journals, and other library materials to support those programmes. The library staff, aided by the university community in many important ways, works to make the library system an excellent base for teaching, study and research.
The Dana Porter Arts Library, situated in the centre of the campus and rising to a height of ten storeys, is the focal point of the University. The lower floors house the main public service departments and the behind-the-scenes technical services. From just inside the main entrance on the second floor the public catalogue, the circulation counter and the reference desk are all immediately visible and close at hand. The periodical and journal collections, microforms, and sound recordings are located on the third floor. The reserve book area, including both the reserve collection and a reading room, is on the fourth floor. Government publications are located on the fifth floor. The upper floors house the main circulating collections and seats for readers. In all there are more than nineteen hundred places for readers.

The Arts Library collections number 450,000 volumes of books and periodicals in the Humanities and Social Sciences, plus pamphlets, theses, microforms, documents, reports, sound recordings, and other materials. The library grows by 4,000 volumes each month. An important element is the collection of journals and periodicals, back files and current issues. The library has 3,200 subscriptions to current titles.

The Engineering, Mathematics and Science Library occupies the fourth floor of the Mathematics and Computer Science Building. Again, the three principal public services – the catalogue, the circulation counter, and the reference desk – are just inside the entrance to the library. Space is provided for 740 readers.

The E.M.S. Library collections number 185,000 volumes of books and journals, plus many kinds of special materials, including technical reports, microforms, documents and maps. The library has 2,500 subscriptions to current periodicals; 18,000 volumes of books and periodicals are added per month.

The Environmental Studies Library is housed on the main floor of the Social Sciences Building. The core of the library collection consists of 35,000 maps, supported by 3,300 books and reports, together with atlases, periodicals, aerial photographs and films. Like the Arts and E.M.S. libraries, its resources are available to all members of the University.

The staff of the library system, 200 persons, both professional and supporting, is engaged in obtaining material, in processing it for the collections, and in bringing it to the attention of users. During the day and evening hours reference and circulation staff are on duty to assist in making use of the collections and facilities. Week nights the Arts and E.M.S. libraries are open for use, under the custodianship of library attendants.

Handbooks are available to explain the use of the libraries: the classification system, the card catalogues, the serial lists, and in general the rules and procedures. Also available are other publications, such as bibliographies and lists of reference materials.

Towards the end of the 1973-74 academic year, the conversion of the library catalogues to machine-readable form should be completed. The machine readable records will serve as the basis for a variety of projects, all of them aimed at offering better library services. In the summer of 1971 the library introduced an automated circulation system, designed to facilitate the borrowing of materials.

For a more detailed and up-to-date description of the University Libraries, see the current Library Handbook.
Undergraduate Programmes

8 Faculty of Arts
9 Faculty of Engineering
10 Faculty of Environmental Studies
11 Faculty of Human Kinetics and Leisure Studies
12 Integrated Studies
13 Inter-Faculty Studies
14 Faculty of Mathematics
15 Faculty of Science
Faculty of Arts
The Faculty of Arts

Perhaps the most important way of approaching university education is to think about individual human beings seeking to realize their full potential. For some people, at an early stage in their career, the obvious goal is to become professionally skilled, as soon as possible. They can see their fulfillment in the professional career of their choice. For others, however, the proper beginning is to associate in their mind with the best of man’s thinking about man, and to learn by practice to think clearly, critically and creatively. Self understanding and realization become more possible.

The traditional disciplines in the Faculty of Arts concentrate upon the study of man: man and his history and his art, literature, languages; man and his political and social institutions; man and his philosophical and theological and ethical systems; man and his cities, nations, wars; man as a consumer, buyer, seller, trader; man as a thinker, a creator, a destroyer; man as a hermit, man as a social creature; man and his behaviour. As the student works and exchanges with fellow students another dimension of experience is opened: an inner private dimension. It is a learning experience about the business of living, and an awareness of inner resources, of creativity, self-discipline and a more mature understanding usually follow.

The modern Faculty of Arts keeps up with the times, both in its methods of teaching and investigation and in its subject matter. At the University of Waterloo the Faculty of Arts meets the challenge of presenting and urging human values and human concerns in the exciting world of later Twentieth Century.

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

Pass Programme The General Programme in Arts (page 118).

Honours Programmes The Faculty of Arts offers Honours degrees in the following major disciplines: Anthropology, Classical Studies, Economics, English, Drama and Theatre Arts, Fine Arts (Art), French, Geography, German, History, Latin, Medieval Studies, Philosophy, Political Science, Psychology, Religious Studies, Russian, Sociology, Spanish. An Honours Programme in Social Science (Applied) is proposed at present, and if approved, could be offered in September 1974. Joint honours programmes combining any two of the above noted Arts disciplines or combining an Arts discipline with a programme in another faculty are available. Students should cater to their individual interests in selecting a particular programme. Descriptions of the single honours programmes and each discipline’s requirements in joint honours programmes are outlined on pages 119 through 142. Students interested in programmes and courses emphasizing Canadian material should examine the Canadian Studies programme on page 120 and the Canadian Studies section of the Calendar, in Chapter 16.
Admission to the Type A Certification programme at the Ontario Colleges of Education requires the completion of a programme of at least twenty full-year University courses, including one or two specialist fields in which the student has obtained at least second class (honours) or equivalent standing. A programme of twenty courses and one specialist field must include at least nine full courses in the field. A programme of twenty courses and two specialist fields must include fourteen full-year courses in the two combined fields, with at least six in each field. The Ontario Ministry of Education approved specialist fields are as follows: Agriculture, Anglais, Art, Biology, Chemistry, Computer Science, Drama or Theatre Arts, Economics, English, Francais, French, Geography, Geology, German, Greek, History, Home Economics, Italian, Latin, Mathematics, Music, Physical and Health Education, Physics, Political Science, Psychology, Russian, Sociology, Spanish.

Admission

The admission requirements and procedures for all programmes are outlined in Chapter 2 of this Calendar.

Registration

September 3, 4, 5, 6, 1974.

Fees

Refer to Section 3 page 45.

Examinations and Standings

The following regulations govern final examinations and standings in the Faculty of Arts. These regulations also apply to part-time students and special programmes.

Students should note that the Faculty of Arts operates under a course system in which student progress is measured by courses successfully completed rather than by years. Students who have passed fewer than five courses will be considered Year 1 students; those who have passed at least five courses but fewer than ten will be considered Year 2 students; those with at least ten but fewer than fifteen, Year 3, and those with 15 or more, Year 4.

1 Final Examinations

a) The Faculty constitutes the examining body for all examinations. When a final written examination is required it is normally held at the end of the course. Oral examinations may be required at the discretion of individual departments. The normal time for written examinations is three hours.

b) In all courses each student is required to submit, in such form and at such time as may be determined by the instructor, evidence of satisfactory participation in term work. The marks obtained for work during term may be used, in part or in whole, in determining grades. At the discretion of the chairman of the department concerned and of 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 may be considered a failure to pass. A student who defaults a final examination, except for a properly certified reason, shall have no make-up examination privileges. If a student failed to write for medical reasons, a Doctor's certificate, covering the precise period of absence, must be filed in the Registrar's office within a reasonable period of time after the examination should have been written.

d) No instructor shall be permitted to administer - and no student shall be required to sit - final examinations in the formal lecture period.

2 Grading System

a) Normally all courses should be completed within the term in which they are offered. Letter grades are used to signify evaluations in individual courses.

b) For the purpose of striking averages, the following weights will be assigned to grades received in individual courses:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>95</td>
</tr>
<tr>
<td>A</td>
<td>89</td>
</tr>
<tr>
<td>A-</td>
<td>83</td>
</tr>
<tr>
<td>B+</td>
<td>78</td>
</tr>
<tr>
<td>B</td>
<td>75</td>
</tr>
<tr>
<td>B-</td>
<td>72</td>
</tr>
<tr>
<td>C+</td>
<td>68</td>
</tr>
<tr>
<td>C</td>
<td>65</td>
</tr>
<tr>
<td>C-</td>
<td>62</td>
</tr>
<tr>
<td>D+</td>
<td>58</td>
</tr>
<tr>
<td>D</td>
<td>55</td>
</tr>
<tr>
<td>D-</td>
<td>52</td>
</tr>
<tr>
<td>F+</td>
<td>46</td>
</tr>
<tr>
<td>F</td>
<td>38</td>
</tr>
<tr>
<td>F-</td>
<td>32</td>
</tr>
</tbody>
</table>

If an examination is not written, a grade of Fail (F) will be awarded.

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

c) Overall standing is determined by the cumulative average of grades assigned for all courses taken at the University (at any time, whether passed or failed) while registered in the Faculty of Arts.

d) Credit grades are used in a few courses in the Faculty of Arts. Students enrolling in such courses will receive either a credit "Cr" grade or a failing grade as appropriate. In satisfaction of the minimum degree requirements students in general programmes are permitted to present up to three full course equivalents with the grade of Credit outside their major requirements, and students in honours programmes are permitted to present up to four full course equivalents outside their major requirements. Students should, in all cases, clear requests to enrol in Credit graded courses with their Departmental advisor. Students contemplating teaching careers should especially note that the Department of Education will not accept courses with credit grades as satisfying the minimum requirements in defined Type A Specialist fields.

An incomplete "INC" may be assigned by an instructor in exceptional circumstances, with the consent of his Department. This extension of completion date is granted to students as a privilege for a limited and specified time and in normal circumstances shall be no longer than three months for a half-course and seven months for a full course.
Examinations and Standings

Note Students should make themselves familiar with the internal procedures established by their major Department in handling incomplete courses. This is particularly important in that a student with outstanding Incompletes on his record will be given Conditional Standing and will not be able to graduate until the "INC" has been replaced by a letter grade.

3 Course Load

a) A regular (full-time) student in the General Arts Programme usually, in each academic year, enrolls in five courses. A regular student in the Honours Arts Programme enrolls in at least five or six courses (see departmental Honours programmes for specifications and exceptions). Students in Honours programmes may not enrol in more than one course in excess of the number specified for their programme.

b) Students may be enrolled for reduced programmes and may take fewer than five courses. Such programmes must be elected at pre-registration or during the official drop-add periods and must be consistent with the drop-add regulations outlined on Page 98. After these times reduced programmes require the approval of the appropriate Undergraduate Officer and of the Examinations and Standings Committee and must be consistent with the drop-add regulations. Students should note, however, no Honours Degree shall be granted to a student who has not completed at least one year (other than year one) of his academic work as a full-time student in the Honours Arts programme at the University of Waterloo.

c) Students may pursue degree studies on a part-time basis by enrolling in regularly scheduled day courses as well as evening or Saturday courses. In addition, courses may be taken in the six week summer programme or by correspondence. There is no distinction between part-time and full-time students as to admission requirements, grading practices, or promotion policies.

4) Standing

a) To be considered in good standing in the General programme, a student must maintain a cumulative overall average of at least 60 as well as an average of at least 65 in his field of specialization. If at any time a student's overall average falls between 50 and 60 or his average in his field of specialization below 65, he will be granted conditional status for one year, during which period he must make reasonable progress toward obtaining good standing or he will be asked to withdraw.

b) To be considered in good standing in the Honours programme, a student must maintain a cumulative overall average of at least 60% as well as an average of at least 75% in his field of specialization (unless otherwise specified in a departmental Honours programme). If an Honours degree candidate's major average falls below the prescribed minimum, he will be considered for the General degree and the regulations in (a) above will apply. If, subsequently, he raises his average to the required level, he may, through his Department Chairman, petition the Examinations and Standings Committee to review his case. (See Note below.)
Academic Programmes

Note  The requirements specified in (a) and (b) are minimum academic requirements and do not guarantee admission to all programmes. Individual departments may specify requirements beyond those listed here.

c) Even while otherwise in good standing, a student who fails two or more full courses in any academic year may be required to withdraw if the Faculty Council considers that he will not profit by further study.

d) A student who has been required to withdraw for academic reasons is eligible to apply for re-admission after one year's absence. If re-admitted, such a student will retain credit for previous passed courses, and will have a cleared average.

5 Appeals  Appeals against faculty decisions (whether dealing with grades or with the application of any Faculty rules) made under these regulations may be made in writing to the Examinations and Standings Committee of the Arts Faculty Council.

Academic Programmes

Group A and Group B Requirements  In order to earn a B.A., a student must complete, with the necessary cumulative averages, the necessary number of prescribed and elective courses for either the General or the Honours Programme. All Arts students in all Arts Major and Honours Programmes must also meet the Faculty of Arts Group A and B requirements. Group A comprises courses in the humanities, and Group B comprises courses in the social sciences:

| Group A (i) | English, History, Philosophy |
| Group A (ii) | French, German, Greek, Italian, Latin, Russian, Spanish, Ukrainian (see Note) |
| Group A (iii) | Drama, Fine Arts, Religious Studies |
| Group B | Anthropology, Economics, Geography, Political Science, Psychology, Sociology |

Before being admitted to the degree an Arts student must complete with passing marks a minimum of three full course equivalents from Group A and a minimum of two full course equivalents, not both in the same subject in Group B. The student should note that Group A is further sub-divided into Group A (i), Group A (ii) and Group A (iii). Of the three full course equivalents required of each student in Group A, a student must complete with passing marks:

- a minimum of one full course equivalent from Group A (i)
- a minimum of one full course equivalent from Group A (ii)
Note 1 Other foreign languages may be used to meet the Group A (ii) requirement. This includes such courses as Religious Studies 105J Elementary Hebrew, Religious Studies 106P New Testament Greek, Arts 190*/191* Introductory Chinese, Arts 290*/291* Intermediate Chinese 1 and 2, and Arts 192*/193* Introductory Japanese.

Note 2 Arts students should note that they may elect to meet the Group A (ii) requirement in their second or subsequent year by completing with passing marks one of the following courses: French 291*/292*; German 271*/272*; Russian 271*/272*; Spanish 210; Classical Civilization 201*/202* or Italian 230J. These courses are not open to first year Arts students. These courses are the only approved alternatives to the A (ii) requirements.

Selection of Year 1 Programmes All Year 1 students are officially classified as being in the General Arts Programme. Students are not identified with a specific major or honours programme until their second year. The great majority of students are relieved to discover that they do not have to choose a General or Honours Programme for the first year. The first year is a broad exploratory year, and the student should select a programme of courses that keeps as many options as possible open to him for advanced work.

Students thinking of the Honours Programme should generally follow the recommended first year programmes outlined in the Calendar beginning on page 119. These are recommendations only (which general students may also follow if they wish), but various substitutions and adjustments may be made to suit a student’s special needs or interests.

A full time student will normally sign up for five courses. He should be careful to select introductory courses in subjects in which he thinks he might major or do an honours programme. A student is free to choose any course in the university for which he has the prerequisites. Students may choose courses from Group A and B, courses in Mathematics, in Science, in Human Kinetics and Leisure Studies or in Environmental Studies.

Usually, a first year student is encouraged to take five courses in different fields so that he has a broad exploratory base from which to mount his second year programme. There is ample opportunity for specialization in subsequent years. Usually, if his marks meet the necessary minima, an Arts student can move into almost any second year programme in the Arts Faculty. Often he is able to transfer to second year programmes in other faculties. The Faculty of Arts has no required course in any particular subject in the first year.

A student who has not determined the field or subject in which 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 office of the Dean of Arts by letter or in person for additional clarification and information.
Course and Programme Changes

a) Changes in courses or programmes must be submitted for approval to the appropriate Undergraduate Officer.

b) Courses may be added or dropped during the first three weeks of the term in which they begin only with the signature of the instructor of the course and the Undergraduate Officer of the student's major department.

c) After these times, courses may be added or dropped only with the permission of the Examinations and Standings Committee acting on the recommendation of the instructor of the course and the Undergraduate Officer of the student's major department, and only if the student can support his case with reasons showing that such a change in his programme will serve his academic interests.

d) Courses offered during the Summer Session may be added or dropped during the first week in which the course begins only with the signature of the instructor of the course and the Undergraduate Officer of the student's major department, and thereafter only with the permission of the Examinations and Standings Committee.

e) Students in the Arts Faculty at the University of Waterloo may enrol in reduced programmes and may take less than five courses. Such programmes must be elected at pre-registration or during the official drop-add periods and must be consistent with the drop-add regulations outlined in (b) and (c) above. After these times reduced programmes require the approval of the Dean of Arts or of the Chairman of one of the departments (depending upon the status of the student), and of the Examinations and Standings Committee and must be consistent with the drop-add regulations.

f) A course that has not been dropped officially (i.e. recorded in the Registrar's Office) will receive a grade and be counted in the student's average.
The General Programme

Year 1  Each student in Year 1 chooses at least five courses, usually two from Group A and two from Group B, with one or two more as electives. At the end of Year 1, each student in the General major Programme must choose one of the following subjects as his major field of study:

- Anthropology
- Classical
- Civilization
- Drama
- Economics
- English
- Fine Arts (Art)
- Fine Arts (Music)
- French
- Geography
- German
- Greek
- History
- Human Relations
- Latin
- Medieval Studies
- Philosophy
- Political Science
- Psychology
- Religious Studies
- Russian
- Social Science
- (Applied)
- Sociology
- Spanish

There are no double majors or minors in the General Programme.

Year 2  Each student in Year 2 of the General Programme chooses at least five courses in consultation with his departmental adviser:

a) a minimum of two further courses in his major subject (See notes);

b) three other courses (see notes).

Year 3  Each student in Year 3 must choose five courses in consultation with his departmental adviser:

a) a minimum of two further courses in his major subject;

b) three other courses.

Note 1  The Programme of every student in the General Programme must include either

a) a minimum of eight courses beyond the 100 level, or

b) courses from no more than seven subject fields.

Note 2  Before graduation each student in the General Programme must have completed a minimum of fifteen courses with passing mark in each and an overall cumulative average of at least 60%, and a cumulative average in his major of 65%.

Non-Major General Arts Programme

a) A student in the Arts Faculty may graduate with a general Arts degree (non-major) upon completion of 15 courses with a passing mark in each, including:

a minimum of 7.5 courses, above the first year level;

a minimum of 7.5 courses in the Faculty of Arts;

a minimum of two courses, not both in the same subject from among English, History, Philosophy, Fine Arts, Religious Studies, and languages other than English;

a minimum of two courses, not both in the same subject, from among Anthropology, Economics, Geography, Political Science, Psychology and Sociology.

b) A cumulative average of 65% is required for graduation.
Note: Any normal first year Arts programme will satisfy the needs for a student contemplating a General Arts (non-major) programme. The programmes of Non-Major General Arts students must be arranged through the office of the Associate Dean (Undergraduate Affairs).

Minor Programmes
Students in other faculties may elect a minor in an Arts discipline. Minor requirements are specified in the respective Departmental listings beginning with Chapter 16.

Honours Programmes
In Year 1 a student must normally complete the introductory course in the subject in which he will major in later years. Before graduation each student must have completed twenty to twenty-four courses, (as specified in a Departmental Honours Programme) with a passing mark in each.

Students are requested to refer to the detailed programmes following this page for the other departmental requirements. Joint Honours Programmes not found in this section may be arranged by consultation between the student and the departments concerned.

Honours Anthropology

Year 1 Recommended Programme
Anthropology 101*/102*
Four electives

Year 2 Three full courses (or half course equivalents) in Anthropology.
Two electives

Year 3 Three full courses (or half course equivalents) in Anthropology.
Two electives

Year 4 A theory-oriented full course (or two half courses) in Anthropology at the 400 level
Two additional full courses (or half course equivalents) in Anthropology
Two electives.

Anthropology Joint Honours Programmes

The recommended Anthropology programme for joint honours is generally as follows:

Year 1 Anthropology 101*/102*
Year 2 Two full courses (or half course equivalents) in Anthropology
Year 3 Two full courses (or half course equivalents) in Anthropology
Year 4 Two full courses (or half course equivalents) in Anthropology, one of which must be a theory-oriented course at the 400 level

Consult the recommended programmes of other departments to determine their requirements.

Joint Honours Programmes have been approved with Anthropology and English, French, Geography, German, History, Man-Environment Studies, Political Science, and Sociology.
**Joint Honours students with Anthropology and Geography or Anthropology and Man-Environment Studies must fulfill the requirements of the Faculty of Arts for the B.A. degree or of the Faculty of Environmental Studies for the B.E.S. Geography Requirements will be found under Geography Joint Honours Programmes.**

**Students intending to qualify for the Type A Certificate for teaching high school must elect a minimum of nine courses in Geography.**

**Students are advised to consult the undergraduate officers of both Departments before formulating their programme of study.**

### Honours Programmes in Canadian Studies

#### Recommended Programme

<table>
<thead>
<tr>
<th>Year</th>
<th>Courses</th>
</tr>
</thead>
</table>
| Year 1 | French 190 or French 101*/102* if students have not passed the equivalent of grade 13 French  
The specified introductory course in the student's proposed major subject (see note 1)  
The equivalent of three other full courses chosen from among those specifically recommended for freshmen planning a Canadian Studies programme (see note 2) |
| Year 2 | Canadian Studies 201*/202*  
The equivalent of three full courses in the student's major subject, one of which should specifically deal with Canada (see note 3)  
The equivalent of two other full courses chosen from among those specifically recommended for students concentrating their programme in Canadian studies (see note 4) |
| Year 3 | Canadian Studies 300  
The equivalent of three full courses in the student's major subject, one of which should specifically deal with Canada (see note 3)  
The equivalent of two other full courses chosen from among those specifically recommended for students concentrating their programme in Canadian Studies (see note 4) |
| Year 4 | Canadian Studies 400  
The equivalent of three full courses in the student's major subject, one of which should specifically deal with Canada (see note 3)  
The equivalent of one other full course chosen from among those specifically recommended for students concentrating their programme in Canadian Studies (see note 4) |

**Note 1** Students who wish to follow a programme in Canadian Studies do so by selecting a major department in the usual fashion and fitting the above recommendations to its requirements. Students proposing a double honours programme with a concentration in Canadian Studies should complete both the required introductory courses for their programme. (See page 111 for a further discussion of joint honours programmes).

**Note 2** For descriptions of freshmen courses specifically recommended for students planning a programme in Canadian Studies see Chapter 16 of the Calendar.
Note 3 Students following a double honours programme will normally take the equivalent of two full courses in each of their major departments, one of which in each case should be the principal Canadian course at the 200, 300, or 400 level.

Note 4 Each of the participating departments has designated its principal Canadian course at the 200, 300 and 400 levels but students may choose from among any of the Canadian content courses listed in Chapter 16 of the Calendar. Many 300 and 400 level courses have specific prerequisites and it is often desirable to use the electives to pursue work in a particular discipline. Students following double honours programmes should reduce the number of electives at each level by one.

Honours Classical Studies
Recommended Programme

Year 1 Greek 100 or Latin 190
C. Civ. 201*/202*
Three other courses.

Year 2 Greek 200 or Latin 265*/266*
C. Civ. 251*/252*
C. Civ. 265*/266*
Two other courses.

Year 3 Greek 265*/266* or Senior Latin Course
C. Civ. 270
C. Civ. 351*/352*
Two other courses.

Year 4 C. Civ. 371*/372*
One other C. Civ. course
Three other courses.

Note 1 In the single honours programme in Classical Studies, two courses out of ten must be from either Greek or Latin at the 200 level or better.

Joint Honours Programme
in Classical Studies
Recommended Programme

Year 1 Greek 100 or Latin 190
C. Civ. 201*/202*
Three other courses.

Year 2 Greek 200 or Latin 265*/266*
C. Civ. 251*/252*
C. Civ. 265*/266*
Three other courses.

Year 3 C. Civ. 270
C. Civ. 351*/352*
Three other courses.

Year 4 One C. Civ. course
Five other courses.
Honours Programmes

Note 1 In the joint honours programme in Classical Studies, one course out of eight must be from either Greek or Latin at the 200 level or better.

Honours Drama and Theatre Arts

A total of twenty full courses including Faculty of Arts Group A and B requirements with an overall cumulative average of at least C and cumulative major average of B.

1) Ten of the student's courses must be in Drama and Theatre Arts.

2) Drama 101* and 102* are the required pre-requisites for most Drama and Theatre Arts courses.

3) Each student must satisfy the following requirements:
   A) Drama 329 (History of the Theatre)
   B) Drama 429* and 430* (Dramatic Criticism and Theatre Criticism)
   C) Drama 499 (Senior Seminars) See Note 3 below
   D) One full course from each of the following categories:
      1) Performance: Drama 225, 226*, 227*, 325
      2) Production: Drama 228*, 229*, 242, 326*, 327*, 330, 426*, 427*, 442
      E) Two full courses in Dramatic Literature to be chosen from:
         Drama 201*, 202*, English 361*, 362*, 363*, 364*, or other approved courses in dramatic literature
      F) Two other courses to be chosen from Drama and Theatre Arts courses including Drama 301*, 302*, 316*, 421, 422, 425, 490*A-E, 491*A-E, or other approved courses in Fine Arts, Dance, Classics, English, or other related departments.

Note 1 The Honours B.A. programme in Drama and Theatre Arts will meet the requirements for an Ontario College of Education Type A Certificate, provided the student acquires at least two courses in another teaching subject (see current calendar requirements).

Note 2 See Faculty of Arts Requirements for other required courses.

Note 3 Each student in the honours programme must complete a comprehensive presentation in his major area of concentration during his senior year. This presentation may take the form of an exhibit, a production thesis, or a recital. In some cases the student may elect to do a research thesis and a comprehensive examination. Arrangements must be made with the faculty at the beginning of the year so that showing dates and space may be scheduled. All graduands will meet with the faculty for an intensive discussion of the presentations.
Joint Honours Programmes, Drama and Theatre Arts

1) Eight of the student’s courses must be in Drama and Theatre Arts.
2) Drama 101* and 102* are the required prerequisites for most Drama and Theatre Arts courses.
3) Each student must satisfy the following requirements:
   A) Drama 329 (History of the Theatre)
   B) Drama 429* and 430* (History of Dramatic Criticism and Theatre Criticism)
   C) Drama 499 (Senior Seminar) See Note 3 below
   D) One full course from each of the following categories:
      1) Performance: Drama 225, 226*, 227*, 325
      2) Production: Drama 228*, 229*, 242, 326*, 327*, 330, 426*, 427*, 442
      3) Dramatic Literature: Drama 201*, 202*, English 361*, 362*, 363*, 364*, or other approved course in dramatic literature
   E) Plus one other course to be chosen from Drama and Theatre Arts course including Drama 301*, 302*, 316*, 421, 422, 425, 490*A-E, 491*A-E, or other approved courses in Fine Arts, Dance, Classics, English, or other related departments.

Note 1 The Combined Honours Programme in Drama and Theatre Arts will meet the requirements for an Ontario College of Education Combined Type A Certificate.

Note 2 See Faculty of Arts Requirements for other required courses.

Note 3 Each student in the honours programme must complete a comprehensive presentation in his major area of concentration during his senior year. This presentation may take the form of an exhibit, a production thesis, or a recital. In some cases the student may elect to do a research thesis and a comprehensive examination. Arrangements must be made with the faculty at the beginning of the year so that showing dates and space may be scheduled. All graduands will meet with the faculty for an intensive discussion of the presentations.

Joint Honours programmes other than those already approved may be arranged by consultation with the Drama and Theatre Arts group and the Department concerned.

Honours Economics

Prerequisite

It is desirable, but not mandatory, that students planning to enter Honours Economics should offer a minimum of one Ontario Grade 13 credit in Mathematics or the equivalent.

It is also recommended that all students in the Honours Economics programme, once they are on campus, take Mathematics 130 and one of English 109*, 140*, 209*, or 210*.

Recommended Programme:

Year 1 Economics 101*/102*
Four electives
Honours Programmes

**Year 2**
- Economics 201*, 202*
- Economics 211* or Math 130
- Economics 221*
- Economics 231*
- One of Economics 233*, 241*, 261*, 263* or 191*
- Two electives (one and one half if Math 130 is taken in place of Economics 211*)

**Year 3**
- Economics 301*, 302*
- Four half courses in Economics at 300 level or above
- Two electives

**Year 4**
- Economics 401*, 402*
- Four electives

**Honours Economics with Chartered Accountancy Option**

At the end of this programme the student will have completed all of the formal university training required by the Canadian Institute of Chartered Accountants. The other principal requirements for the C.A. certificate are a minimum of two years of work for a public accounting firm and successful completion of the Provincial Institute's examinations. 22 courses are required in order to receive the degree of Honours Economics with the C.A. option.

**Year 1**
- Economics 101*, 102*
- Economics 191*, 192*
- Economics 193*, 194*
- Math 132
- English 101*
- Elective (one full course)

**Year 2**
- Economics 201*, 202*
- Economics 211* or 221*
- Economics 231*
- Economics 291*, 292*
- Economics 293*
- Business 216 (WLU)
- One elective (two half-courses)

**Year 3**
- Economics 301*, 302*
- Economics 341*
- Economics 345*
- Economics 391*, 392*
- Two and one half electives (five half-courses)

**Year 4**
- Economics 393*, 394*
- Economics 491*, 492*
- Economics 493*
- Three and one half electives (six half-courses)
Economics Joint Honours Programmes

The core courses in economics for any joint honours programme normally are:
- Economics 101*, 102*
- Economics 201*, 202*
- Economics 211*
- Economics 221*
- Economics 231*
- Economics 301*, 302*
- Economics 401*, 402

At least one and a half other Economics course (three half courses)

In addition, students must meet the requirements of the other department, as well as the Faculty of Arts Group A and Group B requirements. Selection of courses will be made with the assistance of the appropriate undergraduate officers. For Joint Honours Programmes, 22 courses are required.

Joint Honours Programmes have been approved with Geography, Political Science and Mathematics. The following notes pertain:

Note 1 Economics and Geography
The degree requirements of the Faculty of Arts must be met for the B.A. Degree and those of the Faculty of Environmental Studies for the B.E.S. Degree. Students must take one of Economics 211* and 221* or its equivalent in Geography courses and the above core courses. Geography requirements will be found under Geography Joint Honours Programmes.

Note 2 Students are advised to consult the undergraduate officer of both Departments before formulating their programme of study.

Note 3 Economics and Political Science Economics 261*/263* must be taken and the above core courses.

Note 4 Economics and Mathematics
Economics 411*, 413* in addition to the above core courses. Students in Years 1 and 2 may take this programme in either faculty, but at the end of the second year, they will decide whether to continue toward a degree in Arts or a degree in Mathematics. The programme must then be approved by the Economics Department or by an appropriate department of the Faculty of Mathematics.

Economics Minor for Honours Students in other Faculties
Economics 101*, 102*, 201*, 202*, 231*, either 211* or 221*, plus two additional courses in Economics (four half courses).

Honours English
English Requirements
Although English 101 or 102 is recommended, first year students may take any other approved English course.

English 251
One full course equivalent in each of the following categories:
1) Language and Early Literature (305, 373, 375)
2) Historical Periods of British Literature (330, 410, 430, 451)
3) Major figures in British Literature prior to the Twentieth Century (310, 350, 362*, 363*)
Three approved English full course equivalents.
Honours Programmes

Note Students must take at least 6 full course equivalents in English courses numbered 300 or above.

Other Requirements

One full course equivalent in either a language other than English or in a foreign culture.
Two full course equivalents from Group B.
Seven other full course equivalents.

Recommended Courses

Classical Civilization 265*/266*
Courses in Philosophy, History, and Religious Studies.

Note 1 An English Honours Student will take a minimum of 20 courses before graduation, including a minimum of 10 approved English courses. These latter normally will be divided 1-3-3-3 among the four years. The student will also successfully complete the Honours Examination Essay before graduating.

Note 2 The heart of this curriculum will reside in the conferences between student and advisor. The department will expect all students to have a rational programme designed to fit their needs and plans. Students, for example, who plan to do graduate work would be wise to choose the following English courses: 101; 251; 362*/363*; 373; 305 or 310; two of 410, 430, 451, 460; one pair from among 211*/212*, 230*/231*, 232*/233*/ 290* and one of 313*/314*/315*/316*; 330 or 350. These students might also choose to take 400; or two more courses from 305, 310, 330, 350, 410, 430, 451, 460; or one of the above and two of 291*, 345*/346*/347*/. Students, on the other hand, who plan to teach high school are advised to take: 101; 251; 373 or 375; 362*/363*; one of 330, 410, 430, 451; one pair from among 211*/212*, 230*/231*, 232*/233*/ 290*/291*; two of 313*/314*/315*/ 316*; 400; one more from 305, 310, 330, 350, 373, 375, 410, 430, 451, 460.

English Joint Honours Programmes

Although either English 101 or 102 is recommended, first year students may take any other approved English course. English 251

One full course equivalent from each of three of the following categories:
1) Language and Early Literature (305, 373, 375)
2) Historical Periods of British Literature (330, 410, 430, 451)
3) Major figures in British Literature prior to the Twentieth Century (310, 350, 362*, 363*)

Three other approved English full course equivalents Twenty-two credits must be taken overall.

Note Students must take at least 4 full course equivalents in English courses numbered 300 or above.

English Minor for Honours Students in Other Faculties

101 or equivalent
Either 140*/141* or 251
One full course equivalent from 305, 310, 330, 350, 361*, 362*, 363*
Two other English full course equivalents.
Honours Fine Arts

**Recommended Programme**

**Year 1** Fine 120*/121* (see note 1)
The equivalent of eight additional half courses

**Year 2** Fine 224* and Fine 226* (see note 1)
The equivalent of four half courses in Fine Arts (see note 2)
The equivalent of four additional half courses

**Year 3** The equivalent of six half courses in Fine Arts (see note 1)
The equivalent of four additional half courses

**Year 4** Fine 490*/491* (Senior Honours Presentation) (see note 1)
The equivalent of four additional half courses in Fine Arts,
(see note 2) including two senior seminars.
The equivalent of four additional half courses

**Note 1** Of the twenty required Fine Arts courses, all Honours Fine Arts students will take the following courses:

- Fine 110*/111*
- Fine 120*/121*
- Fine 224*/226*
- Fine 490*/491*
- two senior seminars

All of these must be taken in the years indicated except for 110*/111* which must be completed before students are admitted to the 4th year.

**Note 2** Additional Fine Arts half courses will be selected to include the following:

- Group 1 two half courses in art history
- two half courses in film
- Group 2 two half courses selected from this group:

The remaining four required Fine Arts half courses may not include music or dance.

**Fine Arts Joint Honours Programmes**

Students choosing a Joint Honours programme involving Fine Arts must complete the equivalent of fourteen half courses in Fine Arts and the Senior Honours Seminar (two half courses). Unless other arrangements are approved by the Department, all students in joint honours programmes must complete, before entering the fourth year, Fine 110*/111*, 120*/121*, 224*/226* plus two from each of Group 1 and 2 (See note 2 above). Other Joint Honours programmes may be arranged upon consultation with Fine Arts.

Honours French

**Recommended Programme**

**Year 1** French 190 Group B
Four more courses

**Year 2** A minimum of three full courses or equivalent in French
Two more courses
Honours Programmes

Year 3  A minimum of three full courses or equivalent in French
Two more courses

Year 4  A minimum of three full courses or equivalent in French
Two more courses

Note 1  Before graduation, the student must complete a minimum of ten
full courses (or equivalent) in French. If he intends to enter the
teaching profession, he should complete French 250, 300 and
401W/402W.

Note 2  To establish a Minor in a sister discipline, the student must com-
plete five full courses (or equivalent) in that discipline.

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

Note 4  A total of 20 courses must be successfully completed before
graduation.

Note 5  Students in year 4 must have the permission of the Department
to enrol in French courses on the 100 or 200 level.

Note 6  The degree requirements of the Faculty of Arts (see page 115)
must be met for the B.A. degree.

French in Joint Honours Programmes

The Department of Classics and Romance Languages recognizes combined honours programmes in French and the following disciplines:

- Classical Studies
- English
- German
- Latin
- Philosophy
- Political Science
- Russian
- Sociology
- Spanish

Other combinations must be approved on an individual basis with the departments concerned.

Recommended Programme
(French)

Year 1  French 190 Group B

Year 2  Three full courses in French or equivalent. (1)

Year 3  Two full courses in French or equivalent.

Year 4  Two full courses in French or equivalent.

(1) Two full courses in French when in combination with Political Science.
Before graduation, students in combined honours programmes must complete a minimum of eight full courses (or equivalent) in French. (Seven when combined with Political Science).

Those planning to enter the teaching profession should complete French 250, 300, 401*/402*.

A total of 22 courses must be successfully completed before graduation.

Students in year 4 must have the permission of the Department to enrol in French courses on the 100 or 200 level.

The degree requirements of the Faculty of Arts (see page 111) must be met for the B.A. degree.

Honours Geography

Year 1 Geography 102* Introduction to Physical Geography

and one of but no more than three of

Geog. 101* Introduction to Human Geography
Env. St. 195* Introduction to Environmental Problems
Geog. 110* Tutorial in Human Geography
Geog. 125R* Introduction to the Developing World
Geog. 126R* The Emerging "Third World"
Geog. 127* Regional Problems of Europe

Plus additional credits chosen after consultation with the department so that the student has 6 full credits, (Note that all of these courses (except Geog. 110*) are available to any student in the University. Geography students, however, cannot take more than four first year geography half credits, and these must be taken in first year).

Year 2 Env. S. 200* Field Ecology
Geog. 201* Some Basic Topics of Climatology and Geomorphology
Geog. 202* Some Basic Topics of Economic and Urban Geography
Geog. 260* Introduction to Cartography and Map Analysis
Geog. 275* Introductory Air Photo Analysis and Remote Sensing
Geog. 271* Introduction to Quantitative Research Methods

and one of

Geog. 203* Some Basic Topics of Cultural and Regional Geography
Geog. 232* Geography of Population
Geog. 320 World Regional Geography

and additional credits so that a student should have completed by end of the second year, 11 full credits.

Year 3 Geog. 391* Field Research
Two full credits of Geography electives.
Two and one-half credits chosen after consultation with the Department.

Year 4 Geog. 481* Frontiers in Geography
Geog. 490 Seniors Honours Essay
and additional credits so that a student should have a minimum of 21 full credits.

**Geography Joint Honours Programmes**

The Department of Geography offers Joint Honours Programmes in conjunction with a number of other departments across the campus. The Bachelor of Arts degree with joint honours will be awarded to students registered in the Faculty of Arts who meet the general requirements of that faculty in addition to the specific requirements of the Joint Honours Programmes approved by the Department of Geography and the Departments of Anthropology, Economics, English, History, and Political Science. The Bachelor of Environmental Studies degree will be awarded to students registered in the Faculty of Environmental Studies who pursue a similar course of study and who meet the general requirements of that Faculty.

The Department of Geography is prepared to work out other programmes for keenly interested students who otherwise meet Honours standards.

Students enrolled in Joint Honours Programmes are required to obtain at least seven course credits in Geography: students intending to qualify for the Type A Certificate for teaching high school require a minimum of nine credits in Geography.

Course requirements for the Joint Honours Programme are identical with those of the Geography Honours programme above with the exception that where both Departments participating in the programme require courses of similar content, a student shall meet that requirement in one Department only. This might be expected to apply in the cases of technique courses, field research and the Senior Honours Essay; students should obtain clarification from the Undergraduate Officers of the respective departments before registration.

Completion of this programme will lead to the Bachelor's degree of the Faculty in which the student is registered and students should ensure that they meet all other requirements of that Faculty.

**Honours German**

**Year 1**  
German 101*/*102* or 121*/*122*  
Four additional full courses

**Year 2**  
Three full courses in German  
Two additional full courses

**Year 3**  
Three full courses in German  
Two additional full courses

**Year 4**  
Two full courses in German  
Three additional full courses

**Note 1** Before graduation students must complete the Group A (i) and B requirements listed on page 115.

**Note 2** A minimum of 20 full courses must be successfully completed before graduation.

**Note 3** With the permission of the department the student may spend one of his senior years at a university of a German-speaking country.
German Joint Honours Programmes

- English and German
- French and German
- German and History
- German and Political Science
- German and Russian
- Philosophy and Literature (German)

Other joint honours programmes may be arranged by consultation between the student and the departments concerned.

Note 1  *A student in a Joint Honours Programme will take a minimum of 22 full courses before graduation, including seven in German.*

Note 2  *Before graduation students must complete the Group A (i) and B requirements listed on page 115.*

Note 3  *With the permission of the departments concerned, the student of German may spend one of his senior years at a university of a German-speaking country.*

Honours History

**Year 1**  Any first year programme that fulfills the general Faculty of Arts requirements, normally including an introductory course in History, is acceptable. History 101, 110 and 120 are recommended.

**Year 2**  Three Honours History courses (see note 1).
Three other courses (see note 2).

**Year 3**  Two Honours History courses (see note 1).
Three other courses, preferably including History 350 (see note 2).

**Year 4**  Two Senior Seminars
One other Honours History course
One other approved course

Note 1  *In addition to an introductory History course, the Honours candidate must complete at least eight and preferably nine Honours History courses with at least a B average. The Honours History courses must be selected to ensure development and breadth. To ensure development, they must include at least four courses in the 300 and 400 ranges, two of which must be Senior Seminars. To ensure breadth, they must include at least one full course from each of the following columns:*

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>255 (or Classics)</td>
<td>261*/262*</td>
<td>265</td>
<td>277</td>
</tr>
<tr>
<td>251*/252*</td>
<td>263*/264*</td>
<td>266</td>
<td>281</td>
</tr>
<tr>
<td>259R</td>
<td>255*/256*/257*</td>
<td>267G*/268G*</td>
<td>282</td>
</tr>
<tr>
<td>after Sept. 1972) 355*/356*</td>
<td>295</td>
<td>284*/285*</td>
<td></td>
</tr>
<tr>
<td>258</td>
<td>357*/358*</td>
<td>352</td>
<td>291</td>
</tr>
<tr>
<td>260</td>
<td>359*/360*</td>
<td>380</td>
<td>370</td>
</tr>
<tr>
<td>345*/346*</td>
<td>362</td>
<td>382</td>
<td></td>
</tr>
<tr>
<td>347G*/348G*</td>
<td>383</td>
<td>372</td>
<td></td>
</tr>
<tr>
<td>353</td>
<td>364</td>
<td>386*/387*</td>
<td>374G*</td>
</tr>
<tr>
<td>361</td>
<td>366</td>
<td>388</td>
<td>375</td>
</tr>
<tr>
<td>363</td>
<td>368</td>
<td>389</td>
<td>377</td>
</tr>
<tr>
<td>397</td>
<td>392</td>
<td>390</td>
<td></td>
</tr>
<tr>
<td>Classics 365*/366*</td>
<td>393</td>
<td>394</td>
<td>396</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>398</td>
</tr>
</tbody>
</table>
Note 2 In addition to the departmental requirements for history courses, candidates must also have completed, preferably by the end of 3rd year, the Faculty of Arts A & B requirements with the following variation: one non-history course in humanities (A) must be above the 1st year level. The foreign language substitute (culture course) is considered to be at 1st year level. Also, students who plan to enter graduate school are strongly advised to develop facility in a language other than English.

Note 3 Graduation in this programme qualifies a student for admission to the Type A course in History at a College of Education in Ontario.

Note 4 It is possible for Honours students from another faculty to take a minor in History. Details should be sought from the Undergraduate Officer.

History Joint Honours Programmes

1) An Introductory History Course (preferably History 101, 110 or History 120).

2) Four Honours History courses selected from the 200 or 300 range in consultation with a department advisor. At least one of these courses must be in the 300 range (a Depth course).

3) Two Senior Seminars (History 400-455).

4) A minimum of 22 courses are required for all double honours programmes with History.

Combined programmes presently exist with Philosophy, Geography, German, Russian, English, Political Science, Sociology and Anthropology. The History Department is prepared to work out others for keenly interested students who otherwise meet Honours standards.

Students enrolled in combined or double Honours programmes do not have to fulfill the column (ARCD) requirements in History outlined in Note 1 above. They must however fulfill the A & B requirements of the Faculty of Arts.

Not all double Honours programmes fulfill the Ministry of Education's requirements for a Type A certificate. Students should consult with the departmental advisor.

Honours Latin Recommended Programme

Year 1 One Latin course
One Classical Civilization course
Three more courses

Year 2 A minimum of two full courses or equivalent in Latin
One Classical Civilization course
Two more courses

Year 3 A minimum of two full courses or equivalent in Latin
One Classical Civilization course
Two more courses

Year 4 A minimum of two full courses or equivalent in Latin
Three more courses
Note 1  Before graduation, it is recommended that students complete Latin 251*/352*.

Note 2  Students intending to obtain a Type A certificate for teaching in Ontario High Schools must take a Minor in addition to their Latin programme. In Greek as a minor subject, three courses (nine hours) are required. In French or English, five courses (fifteen hours) are required. The electives each year provide room for these requirements.

Note 3  A total of 20 courses must be successfully completed before graduation.

Note 4  The degree requirements of the Faculty of Arts must be met for the B.A. degree.

Note 5  Before graduation students must complete a minimum of ten courses in Latin, or equivalent. Not more than three Classical Civilization courses should normally be taken as part of these ten courses.

Latin Joint Honours Programmes

The Department of Classics and Romance Languages recognizes combined honours programmes in Latin and the following disciplines:

English
French
Spanish

Other combinations must be approved on an individual basis with the departments concerned.

Recommended Programme (Latin)

Year 1  One Latin course

Year 2  Three full courses in Latin or equivalent

Year 3  Two full courses in Latin or equivalent

Year 4  Two full courses in Latin or equivalent

Note 1  Before graduation, the student must complete a minimum of eight full courses (or equivalent) in Latin.

Note 2  Latin 251*/352* are recommended before graduation.

Note 3  A total of 22 courses must be successfully completed before graduation.

Note 4  The degree requirements of the Faculty of Arts (see page 111) must be met for the B.A. degree.

Honours Philosophy

Twenty full course equivalents
Ten in Philosophy, including 221*/222*, 240, 280*/281*, 282*/283*, 499 (tutorial)
Ten others, including Group A and B requirements (see page 115).
St. Jerome's students (See page 115 for further information).
Honours Philosophy and Economics

**Overall Requirements**

- Seven full-course equivalents in Economics (taken in consultation with the Economics Department)
- Seven electives
- Seven Philosophy courses
- One senior Honours tutorial in Philosophy or Economics

**Philosophy Requirements**

- Seven full-course equivalents in Philosophy, including 140* (or 240)
- One full-course equivalent from 280*/281*, 282*/283*
- One half-course in Social and Political Philosophy (e.g. 125*, 225*, or 325*)
- One half-course in Ethics (e.g. 221* or 222*)
- Philosophy 341* and 362*

**Honours Philosophy and English**

**Philosophy Requirements**

- Philosophy 221*/222*, 240 (or alternatively 140* and another half course in Philosophy), 280*/281*, 282*/283*.
- Philosophy 331
- One other Philosophy full course equivalent.

**English Requirements** (See English Joint Honours Requirements)

**Other Requirements**

- One full course equivalent in a foreign language
- Two full course equivalents from Group B
- Four other full course equivalents

**Note**

*English 495, Senior Honours Essay, may be chosen as one of these courses.*

**Honours Philosophy and History**

**Philosophy Requirements**

- The equivalent of at least seven full courses in Philosophy which must include 140*, 221*/222*, 280*/281*, 282*/283*, 446*.

**History Requirements** (See History Joint Honours Requirements)

**Other Requirements**

- Eight full course equivalents, including A and B requirements (page 115)

**Honours Philosophy and Literature**

**Year 1**

**Recommended Programme**

- French 101*/102* (or German 121*/122*)
- English 101
- A Social Science
  - two of
  - A Natural Science
  - Mathematics
  - History
- Another language
- Another Social Science
Year 2 One of Philosophy 221* / 222* or 280* / 281*
Philosophy 282* / 283* and one other Philosophy course
French: Minimum of two full courses or equivalent (see note)
(or German 281* / 282* and one of German 241* / 242*,
251* / 252*, 271* / 272*)
One elective (Social Science, if requirement not met in first year)

Year 3 Philosophy 331, 399 (tutorial), and
One of Philosophy 221* / 222* or 280* / 281*
French: minimum of two full courses or equivalent (see note)
or German 341* / 342*, 351* / 352*, 361* / 362*, 371* / 372*
One elective

Year 4 Two full course equivalents in Philosophy
French: minimum of two full courses or equivalent (see note)
(or German 451* / 452*; 461* / 462*; 471* / 472*; 481* / 482*)
Senior Essay

In certain special cases, where the student can prove a high degree
of familiarity with English literature he may substitute French 190
or German 121* / 122*, whichever has not already been chosen.
Those taking French option should normally take Latin 190.

Note Before graduation students must complete a minimum of eight
courses (or equivalent) in French. Students intending to teach
French should complete French 250, 300, 401* / 402*.

Joint Philosophy – Mathematics Programme
Choice of Degree
Students in Years 1 and 2 may take this programme in either
faculty, but at the end of the second year, they will decide whether
to continue toward a degree in Arts or a degree in Mathematics.
The programme must then be approved by the Philosophy Depart-
ment or by an appropriate department of the Faculty of Mathe-
metics respectively.
Requirements for all students
(Other requirements will depend on which degree is taken: the
student will have to add to these to meet the requirements of
his faculty)

Philosophy 340, 258* / 359*, 280* / 281*, 282* / 283*
Three others, one of which is in a value area
Mathematics 129, 130, 229, or
237 and one of 228, 233, 234, 239, 240
Two others

Further requirements for the degree B.Math.
(Mathematics and Philosophy) see Chapter 14
Further requirements for the degree B.A.
(Philosophy and Mathematics)
Six more courses, including A and B requirements for an
Arts Degree
Honours Philosophy and 
Political Science

*Philosophy Requirements*

The equivalent of at least seven full courses in Philosophy which must include 221°/222°, 240 (or 140°), 280°/281°, 282°/283°, 327*, 362*

*Political Science Requirements* (See Political Science Joint Honours Requirements)

*Other Requirements*

Either Philosophy 325°/326° or Political Science 221°/222 or 225°/226°

The equivalent of seven full courses, one of which must satisfy the Faculty's foreign language requirement and one of which should be in a social science other than Political Science

---

Honours Philosophy and 
Psychology

*Philosophy Requirements*

Philosophy 221°/222°, 280°/281°, 282°/283°, 240 or 340 Philosophy 362*

One and one half other full course equivalents in Philosophy

*Psychology Requirements* (See Psychology Joint Honours Requirements)

*Other Requirements*

Either Philosophy or Psychology 499

Seven full course equivalents, including A and B requirements (see page 115)

---

Honours Philosophy and 
Religious Studies

*Philosophy Requirements*

Philosophy 140° (or 240), 221°/222°, two half courses in the history of Philosophy, 335°, three (or 2½) other full course equivalents in Philosophy.

*Religious Studies Requirements* (See Religious Studies Joint Honours Requirements)

*Other Requirements*

8 full course equivalents to make a total of 22 full course equivalents including A and B requirements (see page 115)

---

Honours Philosophy and 
Sociology

*Philosophy Requirements*

Philosophy 221°/222°, 240 (or alternatively 140° and another half course in Philosophy), 280°/281°, 282°/283° Philosophy 362*

One and one half other full course equivalents in Philosophy

*Sociology Requirements* (See Sociology Joint Honours Requirements)

*Other Requirements*

Either Philosophy or Sociology 499

Seven full course equivalents, including A and B requirements (see page 115)

---

**Note** The following courses are recommended as electives for students with special interests: Sociology 603*, 631*, and 632*
Honours Programmes

Honours Political Science

**Year 1**  
*Recommended Programme*  
Political Science 115*/116*  
The equivalent of four other full courses

**Year 2**  
The equivalent of three full courses in Political Science (*see note*)  
The equivalent of two other full courses

**Year 3**  
The equivalent of three full courses in Political Science (*see note*)  
The equivalent of two other full courses

**Year 4**  
The equivalent of three full courses in Political Science at least two of which must be at the 400 level (*see note*)  
The equivalent of two other full courses

*Note*  
Four of the nine Political Science courses above the 100 level must be selected from four different fields of the discipline. For further information on this please consult the Department.

Political Science Joint Honours Programme

**Year 1**  
Political Science 115*/116*  
Introductory course in the other discipline  
The equivalent of three other full courses

**Year 2**  
The equivalent of two full courses in Political Science (*see note*)  
The equivalent of two full courses in the other discipline  
The equivalent of two other full courses

**Year 3**  
The equivalent of two full courses in Political Science (*see note*)  
The equivalent of two full courses in the other discipline  
The equivalent of two other full courses

**Year 4**  
The equivalent of two full courses in Political Science, at least one of which must be at the 400 level (*see note*)  
The equivalent of two full courses in the other discipline  
The equivalent of one other full course

*Note*  
Three of the six Political Science courses above the 100 level must be selected from three different fields of the discipline. For further information on this please consult the Department.

Honours Psychology  

**Recommended Programme**

**Year 1**  
Psychology 101*/102*  
The equivalent of four additional full courses

**Year 2**  
Psychology 283*/284*  
The equivalent of one full course in Psychology (*see Note 1*)  
The equivalent of three additional full courses

**Year 3**  
Psychology 285*/331*  
The equivalent of two additional full courses in Psychology (*see Note 1*)  
The equivalent of two additional full courses
Year 4  Psychology 499
   The equivalent of two additional full courses in Psychology
   (see Note 2)
   The equivalent of two additional full courses

Note 1   Honours students are required to complete one research half-
course from each of the following groups before entering the
fourth year of the programme.

   Group 1: 293*, 295*, 297*
   Group 2: 393*, 395*, 397*

Note 2   Honours students should include at least two fourth-year seminars
in their programme.

Psychology Joint Honours Programmes

   Students choosing a Joint Honours programme involving Psych-
ology must complete the equivalent of seven full courses in
Psychology and an Honours thesis course. Unless other arrange-
ments are approved by the Department, all students in Joint
Honours programmes must complete, before entering the fourth
year, Psychology 283*, 284*, 285*, 331*, and one research half
course from each of the following groups:

   Group 1: 293*, 295*, 297*
   Group 2: 393*, 395*, 397*

   In the fourth year, all students must complete Psychology 499 or
the Honours Thesis course in the related discipline.
   Joint Honours programmes other than those already approved
may be arranged by consultation with the Psychology Department
and the department concerned.

Minor Programme

   The department offers a minor programme in Psychology. Any
student interested in planning a sequence of five courses to com-
plement his major field of study is encouraged to consult the
Undergraduate Officer. All minor programmes must be approved
by the Department.

Honours Religious Studies

Year 1   Any first year programme that fulfills the general requirements of
the Faculty of Arts and includes one of the following full
R.S. courses:

   103G*/104G*, 110*/111*, 130P*/131P*, or 160R*/161R*

Years 2, 3 and 4   Nine full R.S. courses (or the equivalent) and seven electives.
The R.S. courses are to include:

   a) Two courses in one religious tradition (i.e., Buddhism,
      Christianity, Hinduism, Islam, Judaism).
   b) One course in another religious tradition.
      Note: if (a) is a "Western" tradition, (b) must be an "Eastern"
      tradition, or vice versa.
   c) Two full courses at or above the 398 level.
d) Methodology course in the fourth year that will include the elements of a thesis course.

**Note 1** *Total number of courses required, twenty-one.*

**Religious Studies Joint Honours Programmes**

The Religious Studies requirements in Joint Honours Programmes are the same as the honours programme except for the overall number of R.S. courses – honours requires 10, joint honours 7.

**Honours Russian**

**Year 1**

- Russian 101*/102* or equivalent
- Four additional full courses

**Year 2**

- Two full courses in Russian
- Three additional full courses

**Year 3**

- Three full courses in Russian
- Two additional full courses

**Year 4**

- Three full courses in Russian
- Two additional full courses

**Note 1** *A minimum of 20 full courses must be successfully completed before graduation.*

**Note 2** *Before graduation students must complete the group A (i) and B requirements listed on page 115.*

**Russian Joint Honours Programmes**

- English and Russian
- French and Russian
- German and Russian
- History and Russian
- Political Science and Russian

Other Joint Honours programmes may be arranged by consultation between the student and the departments concerned.

**Note 1** *A student in a Joint Honours Programme will take a minimum of 22 full courses before graduation, including seven in Russian.*

**Note 2** *Before graduation students must complete the Group A (i) and B requirements listed on page 115.*

**Honours Social Science (Applied)**

In September 1974 Renison College hopes to initiate a four-year programme which will lead to an Honours B.A. in Social Science (Applied). If this programme is implemented, students will have two options: co-operative and regular. Specific requirements have not yet been finalized. For further information, contact the Programme Director, Renison College, Waterloo, Ontario N2L 3G4.
Honours Sociology  

**Recommended Programme**

**Year 1**  
Sociology 101*  
Four and a half elective full year courses (or equivalent half courses)

**Year 2**  
Sociology 202*  
Two and one-half courses in sociology  
Two elective full year courses (or equivalent half courses)

**Year 3**  
Sociology 321*/322*  
Two full year courses in sociology (or equivalent half courses)  
Two elective full year courses (or equivalent half courses)

**Year 4**  
Sociology 425*/426*  
Sociology 499  
One full or two half courses in Sociology  
Two elective full year courses (or equivalent half courses)

**Note 1**  
Students may elect Honours Sociology [Canadian Studies] by fulfilling the Honours requirements in Sociology and the requirements listed under Canadian Studies in this Calendar.

---

**Sociology Joint Honours Programmes**  
Sociology has joint honours programmes with the following: Anthropology, Classics and Romance Languages, English, History, Philosophy, Political Science, Psychology, and Mathematics. The usual recommended programme in Sociology for joint honours is seven and one-half full course equivalents distributed as follows: a half course in introductory sociology (101*); a half course in statistics(202*); two half courses in research methods (321*/322*); two half courses in sociological theory to be chosen from 331*, 402*, 425*; the equivalent of three and one-half full courses of electives in Sociology; and an honours thesis course (499*) or the equivalent in the related department.

**Note 1**  
For requirements in joint honours with History, Philosophy, Psychology and Mathematics see the Department Undergraduate Officer.

**Note 2**  
In the joint honours programme with French (Classics and Romance Languages) Soc. 202* may be replaced by an elective in Sociology.
Honours Spanish  Recommended Programme

Year 1  Spanish 190 (Students with no high school Spanish will take Spanish 110 in the first year and Spanish 190 and 250 in the second year)  
Four more courses  

Year 2  A minimum of three full courses or equivalent in Spanish  
Two more courses  

Year 3  A minimum of three full courses or equivalent in Spanish  
Two more courses  

Year 4  A minimum of three full courses or equivalent in Spanish  
Two more courses  

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

Note 2  To establish a Minor in a sister discipline, the student must complete five courses (fifteen hours) in that discipline. Students registering in Honours Spanish are strongly advised to minor in French.  

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

Note 4  A total of 20 courses must be successfully completed before graduation.  

Note 5  The degree requirements of the Faculty of Arts (see page 111) must be met for the B.A. degree  

Note 6  Students in honours Spanish may receive only half credit for Spanish 210.
Spanish Joint Honours

The Department of Classics and Romance Languages recognizes combined honours programmes in Spanish and the following disciplines:

- Classical Studies
- English
- French
- History
- Latin

Other combinations must be approved on an individual basis with the departments concerned.

Recommended Programme (Spanish)

Year 1  Spanish 190 (Students with no high school Spanish will take Spanish 110 in the first year and Spanish 190 and 250 in the second year).

Year 2  Three full courses in Spanish or equivalent.

Year 3  Two full courses in Spanish or equivalent.

Year 4  Two full courses in Spanish or equivalent.

Note 1  Before graduation, students in combined honours programmes must complete a minimum of eight full courses (or equivalent) in Spanish.

Note 2  Those planning to enter the teaching profession are expected to complete Spanish 190, 250, 350 and 450.

Note 3  A total of 22 courses must be successfully completed before graduation.

Note 4  The degree requirements of the Faculty of Arts (see page 111) must be met for the B.A. degree.

Note 5  Students in honours Spanish may receive only half credit for Spanish 210.
9

Faculty of Engineering
The Co-operative Engineering Programme

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 Programme at the University of Waterloo provides a completely integrated pattern of academic study and industrial experience in various phases of engineering with ultimate graduation requiring satisfactory performance in both areas. The degree programme 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 supervised training in the practical experiences fundamental to the development of the graduate engineer. The total time spent in study is the same as that encountered in the usual course of four "academic years."

While Co-operative programmes have been offered in many other countries, and the inherent advantages are well recognized, the Co-operative Engineering 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 programme is common for all programmes except Chemical Engineering and Systems Design. A substantial part of the work of the first and second years is common to all programmes. Starting with the second year (first year for Chemical Engineering and Systems Design) students elect one of the five principal divisions of engineering. The curriculum for each of the five 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 programme brings a student into direct contact with industry and the engineering profession and exposes him to problems typical of those encountered in practice. Students are introduced to full-scale engineering projects and operations, far beyond the scope of any university laboratory. Employment on the work terms generally is secured by students through on-campus interviews with Co-operative employers. Such arrangements and other features of the work terms are the responsibility of the Department of Co-ordination and Placement of the University which produces the necessary liaison between the University and the employers. It should be understood that there can be no guarantee of work term employment, although the Department of Co-ordination will make every effort to provide as many opportunities as possible. Through personal 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
The Co-operative Engineering Programme

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 the technical ability, are prepared for individual responsibility and clearly understand the relationship of their profession to industry and society. A more detailed explanation of the Co-operative programme is given in Chapter 6.

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

Chemical Engineering
Civil Engineering
Electrical Engineering
Mechanical Engineering
Systems Design 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 five main programmes. All programmes entail five years of undergraduate study on the co-operative system.

The Degree of Master of Applied Science (M.A.Sc.) and Doctor of Philosophy (Ph.D.) are also awarded in Engineering. For further details, consult the Graduate Studies Calendar and the list of the particular courses in graduate work in the various departments.

Co-operative Programme The eight terms of study and six terms of industrial employment provided in the programme are arranged as shown in the diagram below:

<table>
<thead>
<tr>
<th>1974</th>
<th>1975</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>First</td>
<td>Second</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1 B</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1977</th>
<th>1978</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Second</td>
<td>First</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>Work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1974</th>
<th>1975</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>First</td>
<td>Second</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>1 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1977</th>
<th>1978</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Second</td>
<td>First</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>1 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1974</th>
<th>1975</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>First</td>
<td>Second</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>1 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1977</th>
<th>1978</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Second</td>
<td>First</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>1 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1974</th>
<th>1975</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>First</td>
<td>Second</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>1 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1977</th>
<th>1978</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Second</td>
<td>First</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>1 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1974</th>
<th>1975</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>First</td>
<td>Second</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>1 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1977</th>
<th>1978</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Second</td>
<td>First</td>
<td>Work</td>
</tr>
<tr>
<td>Group</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I A</td>
<td>1</td>
<td>1 B</td>
</tr>
</tbody>
</table>
All Year 1 students enrol in September. These Year 1 students spend the Fall term together at the University, after which they are divided into two groups, and, as indicated on the diagram also complete the programme and graduate together. 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 programme and the other having a double academic term at the end of the programme. 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 each various terms are shown in the academic calendar for the year.

The programme in Systems Design is not divided into two groups. All students in this programme start with four months of school before going out on the first work term in the Winter.

Admission

The admission requirements and procedures for all programmes are outlined in Chapter 2 of this Calendar. The following emphasize some of the admission requirements which relate specifically to the Faculty of Engineering.

Applicants From Ontario

**Grade 13**

Applicants must present the following Mathematics courses—Relations and Functions, Calculus, Algebra, as well as Chemistry and Physics in their overall Grade 13 programme. Applicants who do not have these specific Grade 13 courses but who have obtained a high overall standing, including at least Relations and Functions and Calculus, are encouraged to apply for admission.

It is recommended that applicants attempt to obtain standing in Ontario Grade 13 Mathematics and Science courses or their equivalent. The university has developed special pre-university mathematics and science courses which can be taken by correspondence and which are recommended for adult students (for details, contact the Correspondence Programme Office at the University of Waterloo).

Admission As An Adult Student

Because of the co-operative nature of the Engineering programme, no student will be admitted above Year 3, term A level. Any student thus admitted will be required to register in the January term “A” stream and to complete a minimum of three satisfactory work terms. The level of advanced admission is determined by an examination of the applicant's academic and work experience.

Credit for previous work experience can be applied only to those work terms preceding the level of admission and cannot exceed three work terms.

Registration

September 3, 4, 5, 6, 1974.

Fees

Refer to Section 3 page 45.
Examinations and Promotions

The Faculty constitutes the examining body for all examinations and is responsible for all decisions on grades, promotions, failures, deferred examinations, appeals and the preparation of recommendations for the granting of degrees. Students are examined and marks are set for individual subjects on completion of the work for that subject. With few exceptions beyond first year, subjects are one term in length, and promotion decisions are made at the end of each term.

For the purposes of promotion the two terms of first year are considered as a unit and promotion decisions are made at the conclusion of the second term only. However, a first year student's progress is reviewed at the end of the first term and the Engineering Faculty Council may recommend or require a student to withdraw if, in the opinion of the Council, the student is unlikely to benefit from further study.

The procedures through which promotion decisions are made are as follows:

1) At the end of each term examining faculty members submit marks to the Engineering Examinations and Promotions Committee which prepares promotion recommendations for subsequent approval by the Engineering Faculty Council. Once approved, the decisions are reported to the students through the Registrar's Office. All recommendations to award degrees must be approved by Senate.

2) Promotion decisions are made at the end of each term except the first term. The decision for each student is based on a weighted average computed from his marks in individual subjects following the weighting scheme for his department. For promotion, a student must achieve an average of 60% or higher, except in special cases where, at the discretion of the Faculty, promotion may be granted with an average below 60%.

There is no "passing" or "failing" of individual subjects. Promotion is based on the weighted overall average and a minimum grade is not normally required in any one subject, although individual departments may designate minimum grade requirements in certain courses. There are no supplemental examinations except in the last term of the programme.

3) All promoted students will be shown as having obtained First, Second or Third Class Honours according to the following table:

<table>
<thead>
<tr>
<th>Average</th>
<th>Honours</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.0 to 100%</td>
<td>First Class</td>
</tr>
<tr>
<td>70.0 to 79.9%</td>
<td>Second Class</td>
</tr>
<tr>
<td>60.0 to 69.9%</td>
<td>Third Class</td>
</tr>
</tbody>
</table>

The exception to this will be those special cases where a student has less than 60% but who has been given a "Promotion Granted" decision.
It should be specially noted in such "Promotion Granted" cases from 1B that emphasis is placed on Math 12 and 21, Physics 11 and GE 122.

Students will be ranked in order of overall averages. A student's class standing will be shown on his report. Failing students will be given their failing average.

4) Students who are not promoted at the end of the First Year will be required to repeat at least the second term, except that re-admission will be denied if, in the opinion of the faculty, a student is deemed unlikely to profit from further study.

5) Students who are not promoted at the end of the third or subsequent terms will be required to repeat all or part of the work of the term failed.

Where timetables permit, repeating students may be excused from repeating individual courses in which good marks have been obtained, and permitted to register in other appropriate courses, at the discretion of the student's department.

Previous marks in exempted courses will not be included in the average of the repeated term.

6) A student may not repeat a given term more than once. The Examinations and Promotions Committee decisions "Failed, May Repeat" and "Promotion Granted" are to be considered equivalent in that the maximum number of such decisions a student may accumulate is two.

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

8) A student who withdraws from the programme less than four weeks before the commencement of the final examinations period in the programme, shall normally be deemed to have failed the year or term in which he was enrolled at the time of withdrawal. This does not apply to the 1A term.

9) Courses taken by students that are in addition to the degree requirements will not be included in a student's average. Marks obtained in extra courses will be reported on a student's transcript.

10) Courses taken by students during work terms will not be included in a student's average for any term. The marks of courses taken at the University of Waterloo, however, will be reported on a student's transcript. Normally students will be expected to register for the minimum number of courses specified by the calendar for the appropriate term.

11) In special cases other symbols may be substituted for marks and the following list summarizes these symbols and their meanings:

AEG – Student was ill as per medical evidence.
Undergraduate Co-operative Work Term Reports

Work reports are recognized formally as part of the requirements for the Bachelor's degree. The regulations related to work term reports are:

1) Each Engineering student is required to submit a minimum of four satisfactory work reports prior to graduation. For those students admitted to advanced standing into 3A 'A' stream, only 3 satisfactory work reports would be required.
2) All work reports shall be submitted to the Co-ordination Department on the first day of lectures for the academic term following the work term and subsequently distributed to departments within 1 week. Failure to comply with the deadline will result in no work term credit for that term.

3) Work reports shall be compulsory for all students in their first work term and these reports shall be assessed by the Co-ordination Department. The reports and evaluation forms shall be returned to the students and copies of the evaluation forms shall be placed in the students' files in the Co-ordination Department.

4) Three additional work reports shall be submitted for the remaining five work terms. Students are encouraged to reserve a report for their final work term. If a student wishes, he may submit the additional reports and the evaluations of these reports will be added to his work term record. Students may be required to submit work reports to employers.

5) Work reports, other than those completed by first year students, shall be evaluated by the Engineering Faculty following the same procedure suggested in Item 3. This shall include reports marked by employers.

6) Work reports rated as unsatisfactory may be re-written and re-submitted during the academic term. Students with unsatisfactory work reports may be required to take formal instruction in technical report writing.

7) Continued registration in later academic terms may depend on satisfactory work-terms performance and/or reports.

Academic Programmes

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

Rigorous work in mathematics and the sciences is emphasized throughout the programme, 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 programme 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 five 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.

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 is strongly 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 five 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 five 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 1 Engineering Students** All students enrolling in Year 1 are required to choose and register in one of the following three programmes:

a) General
b) Chemical Engineering
c) Systems Design

Students enrolling in General and Chemical Engineering must register in the courses indicated in the following table:

**Term 1A**
Mathematics 12
Mathematics 21
Chemistry 11
Physics 11
GE 111 Graphics or ChE 100 Introductory Engineering Concepts 1
GE 113 Measurement
One of GE 101, 102, or 103 or Phil 150K

**Term 1B**
Mathematics 12
Mathematics 21
GE 111 Graphics of ChE 101 Introductory Engineering Concepts 2
GE 120 Synthesis
GE 121 Digital Computation
GE 122 Electricity & Magnetism
One of GE 101, 102, or 103
Students in Systems Design have an entirely separate programme as described on page 170 under the Department of Systems Design. They must register for the courses as described in Year 1 Systems Design.

At the completion of the First Year, students in the General and Chemical Engineering programme are required to select one of the following major divisions of engineering for the second year of study:

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

Students intending to go into Chemical Engineering are encouraged to take ChE 100 and 101 in place of GE 111, 113, 120. Other students may easily transfer into second-year Chemical Engineering by completing aspects of ChE 100 and 101 which are not covered in that section of the General Engineering programme; this may be carried out by reading assignments during the 1B off term.

Students interested in pursuing an Engineering Physics option may do so by taking suitable advanced Science and Mathematics courses in the electives scheme described later, for each of the four basic engineering programmes.

Note  *Detailed course descriptions commence in Chapter 16.*

Chemical Engineering

There are many possible answers to most problems. Society expects engineers to choose the best answers to practical problems. The modern engineer is involved not only with his traditional goals of satisfying material needs but also with the overall quality of life which is affected by his processes and products.

Chemical engineers in particular apply the natural and social sciences to solve problems where physico-chemical transformation of matter plays a significant role. Examples of the broad fields of application are: design construction, operation, quality control, sales, management, research, education and government.

In contrast to chemists or other kinds of engineers, chemical engineers are generally involved with large-scale operations based on the chemical sciences.

Chemically-based technologies produce metals, drugs, food, alcohol, soap, fertilizers, gasoline, plastics, rubbers, paper, paint, textile fibres and many other products. Some of these technologies can also generate pollution problems which must be solved by chemical engineers in their overall process operations and designs.

Most chemical engineers are employed in the general areas of production, sales, management and research. A substantial number go into government and teaching. An increasing number are entering interdisciplinary areas such as food engineering, biomedical engineering and environmental engineering. The solution to crucial problems of health, nutrition, ecology, and pollution require chemical engineering expertise.
More women enter chemical engineering than any other branch of engineering and this trend is increasing, as women become more aware of the career possibilities in this profession.

The basic objective of the undergraduate programme is to provide the student with an education appropriate for a career in one of the above fields, or for further studies in Science or Engineering, or in other professions such as Medicine, Law, Business, etc. To be most effective in a rapidly changing technological age, the programme deals primarily with scientific and engineering principles. In the early years chemistry, physics and mathematics form the foundations. In the senior years, subjects such as economic analysis and pollution control enable the student to reach a more relevant understanding of his earlier studies. Specialization is available through six options oriented towards Biochemical and Food Engineering, Extractive and Process Metallurgy, Mathematical Analysis and Control, Pollution Control Engineering, Polymer Science and Engineering, and Transport Processes.

**Biochemical & Food Engineering Option**
The Biochemical and Food Engineering option is concerned with the economic processing of materials of biological character or origin. It is primarily involved with waste treatment, food processing and the manufacture of microbial products such as alcoholic beverages, yeasts, antibiotics, vitamins, enzymes, etc. The usefulness of these studies is obvious in an underfed, unhealthy and over-populated world with pollution problems, and for the Canadian economy in which agricultural products play a significant role.

**Extractive & Process Metallurgy Option**
Extractive and Process Metallurgy as presently practiced in industry requires further understanding of the principles of chemical engineering applied to metallurgical processes in order to improve many of the present pyrometallurgical, electrolytic and hydrometallurgical processes used in Canada. The Waterloo programme inter-relates chemical engineering and chemical metallurgy in order to achieve this goal.

**Mathematical Analysis & Control Option**
Mathematical Analysis and Control also forms a core area involving studies in optimal control, economic or process optimization, and simulation. At Waterloo, this is probably the most developed area of its type at a Canadian university.

The department's vigorous postgraduate research activities provide necessary vitality and up-dating of the undergraduate programme in all the above-mentioned fields.

**Pollution Control Engineering Option**
This option presents aspects of waste-treatment and pollution-abatement techniques which are becoming increasingly important for the proper function of technology in a quality-conscious society.

**Polymer Science & Engineering Option**
The Polymer Science and Engineering option covers a wide scope but special emphasis is placed on the physics and physical chemistry of polymers, and on the modification of polymer structure by physical or chemical means. At present, a significant percentage of the Canadian chemical industry is directed towards products classed as polymers (plastics, elastomers, synthetic fibers) and most of their production is in Ontario.
Transport Processes Option

Transport Processes form a core area of chemical engineering and in this option aspects of fluid flow, heat transfer and mass transfer and reaction rates which are important in all chemical and allied industries are developed further in the senior years.

The Curriculum

The curriculum is constantly under revision to meet changing needs. At present about one-quarter of the curriculum consists of elective courses. Almost half of these electives may be chosen from non-technical courses in the humanities or social sciences; the remaining electives are technical courses, of which three are normally selected from one of the technical option groups. The other technical electives may be chosen from any other approved science or engineering courses according to individual student interest and career objectives.

The Waterloo programme is the most comprehensive and flexible of its kind in Canada. It is also unique in Ontario in that the co-operative system of education provides an integrated pattern of academic study and practical experience which allows the prospective engineer an opportunity to secure financial assistance and to make an early start on a vocation.

Guide to Undergraduate Chemical Engineering Course Numbers

Beginning in the academic year 1972-73 a new revised curriculum was developed and a new three digit number was assigned to each course offered by the Chemical Engineering Department. These course numbers are prefixed by the abbreviation ChE; courses offered by other departments are also identified, e.g. Math., Chem.

It is to be noted that transition to the revised curriculum will not be completed until 1974-75. The code for the new numbers is consistent with the graduate course numbers and is as follows:

First digit (1-5) year
1-4: Year of study, core courses
5: Fourth year, elective courses

Second digit (0-8): subject matter
0: General engineering
1: Transport Processes
2: Mathematics, Control, Economics
3: Chemistry, Kinetics, Catalysis
4: Polymer Science and Engineering
5: Extractive and Process Metallurgy
6: Biochemical and Food Engineering
7: Ecology, Environmental Engineering
8: Projects, seminars, etc.

Third digit (0-9): term
Even numbers: first term
Uneven numbers: second term
Core Courses (Beyond Year 1)

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Problems</th>
<th>Tutorials</th>
</tr>
</thead>
<tbody>
<tr>
<td>ChE 220</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ChE 230</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ChE 232</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chem 26</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Math 22</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 211</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ChE 231</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 233</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chem 36</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 31</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 312</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ChE 320</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 330</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 332</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 334</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 313</td>
<td>3</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>ChE 315</td>
<td>3</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>ChE 331</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 420</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 422</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 482</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thermodynamics

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Problems</th>
<th>Tutorials</th>
</tr>
</thead>
<tbody>
<tr>
<td>ChE 280</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 281</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R) Elective Courses

A minimum of 13 elective courses must be taken in addition to the core courses listed above. Four to six of these courses may be chosen from non-technical electives in the humanities or social sciences (one required in each of the terms 2A, 2B, 3A, and 3B, and one open elective in each of the terms 4A and 4B). Four non-technical elective courses must be successfully completed beyond year 1B. Marks for these courses are not included in the term averages from 2A to 3B inclusive.

The remaining seven to nine courses must be technical electives, of which at least three are to be selected from one of the first seven option groups listed below. An elective course is normally based on three lecture hours per week for one term unless otherwise specified in the detailed course description. The other technical electives may be chosen from other Chemical Engineering courses or from other science or engineering courses according to interest, but the choice must be approved by the Associate Chairman (Undergraduate Studies).

The three technical electives for each of the seven Chemical Engineering option groups are identified below. Within each option group, the first course is normally taken in the 4A term and the other two courses in the 4B term.
1) Transport Processes
ChE 511 Selected Topics in Process Applications
or
ChE 570 Air Pollution
ChE 510 Physico-chemical Properties of Gases and Liquids
ChE 513 Non-Newtonian Flow and Heat Transfer

2) Mathematical Analysis and Control
ChE 520 Chemical Engineering Analysis
ChE 521 Process Dynamics and Control 2
ChE 523 Process Control Laboratory

3) Polymer Science and Engineering
ChE 540 Introduction to Polymer Science
ChE 541 Physical Chemistry of Polymers
ChE 543 Polymer Laboratory

4) Extractive and Process Metallurgy
ChE 550 Introduction to Extractive Metallurgy
ChE 551 Metallurgical Chemistry
ChE 553 Principles of High Temperature Extractive Metallurgy

5) Biochemical and Food Engineering
ChE 560 Introduction to Biochemical Engineering
ChE 561 Fermentation Operations
ChE 563 Food Processing

6) Pollution Control Engineering
ChE 511 Selected Topics in Process Applications
or
ChE 570 Air Pollution
ChE 560 Introduction to Biochemical Engineering
ChE 571 Water Pollution

7) Research/Design Option
ChE 580 Research-Design Project 1
ChE 581 Research-Design Project 2 (worth 2 courses)

8) Other Research and/or Design Projects
ChE 583 Process Systems Design
ChE 585 Technical Elective Project

Academic Programme for Each Term (1974-75)
This represents the transitional period between the old and the new revised curriculum described above.

Year 2A, Fall 1974
Math 22, Chem 36, ChE 220, ChE 230, ChE 232, Non-technical elective

Year 2B, Fall 1974
Math 31, Chem 36, ChE 211, ChE 231, ChE 233, Non-technical elective

Year 3B, Fall 1974
ChE 313, ChE 315, ChE 331, Technical elective, Non-technical elective
Civil Engineering

Year 4A, Fall 1974
ChE 420, ChE 422, ChE 482, 2 Technical electives, Technical or Non-technical elective

Year 2A, Winter 1975
Math 22, Chem 26, ChE 220, ChE 230, ChE 232, Non-technical elective

Year 3A, Winter 1975
ChE 312, ChE 320, ChE 330, ChE 332, ChE 334, Non-technical elective

Year 4B, Winter 1975
One of ChE 581, ChE 583 or ChE 585, 3 Technical electives. Technical or Non-technical elective. Students taking ChE 581 (the equivalent of two courses) would be required to complete 2 Non-technical electives rather than 3 in this term.

Year 2B, Spring 1975
Math 31, Chem 36, ChE 211, ChE 231, ChE 233, Non-technical elective

Year 3A, Spring 1975
ChE 312, ChE 320, ChE 330, ChE 332, ChE 334, Non-technical elective

Detailed course descriptions are given in Chapter 16 under the appropriate Departmental sections of this calendar.

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 spend well over a tenth of our total national income — more money than is 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 engineering as it relates to society, socio-economic aspects of civil engineering are also included.

Whereas complete professional specialization can be achieved only in postgraduate study and in engineering practice, the student 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, traffic operation and evaluation of streets, highways, airports, and transit. Emphasis is placed on planning, design, operation and evaluation, particularly as related to 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 resources management.

g) Experimental Mechanics – for students with an interest in the experimental investigations of static and dynamic response of structures and machines, in theory and technique of experimental methods and in the rheology of materials used in experimental mechanics.

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

A) Core Programme

Civil Engineering Core Courses

CE 200 Civil Engineering Project 1
CE 203 Statics
CE 204 Dynamics
CE 205 Mechanics of Deformable Solids 1
CE 206 Mechanics of Deformable Solids 2
CE 221 Calculus
CE 222 Differential Equations
CE 224 Probability and Statistics
CE 265 Materials
CE 280 Fluid Mechanics
CE 291 Survey Camp
CE 292 Socio-Economic Aspects of Civil Engineering
CE 298 Seminar
CE 299 Seminar
CE 300 Civil Engineering Project 2
CE 303 Structural Analysis 1
CE 304 Structural Analysis 2
CE 315 Structural Design 1
CE 342 Urban Transport Planning 1
Civil Engineering

CE 353 Geology and Soil Mechanics
CE 354 Soil Mechanics and Foundations
CE 375 Sanitary Engineering
CE 381 Hydraulics
CE 393 Environmental Engineering
CE 398 Seminar
CE 399 Seminar
CE 400 Civil Engineering Project 3
CE 498 Seminar
CE 499 Seminar

B) Elective Courses  The electives may be selected from the list below in consultation with a Civil Engineering faculty advisor:
CE 343 Urban Transport Planning 2
CE 413 Structural Steel Design
CE 414 Structural Concrete Design
CE 415 Structural Design 2
CE 441 Transportation Economics
CE 454 Foundation Engineering
CE 481 Engineering Law
CE 493 Engineering in the Canadian North
CE 500 Special Project
CE 501 Approximate Analysis of Structures
CE 504 Structural Analysis 3
CE 506 Project Management
CE 508 Structural Dynamics and Stability
CE 518 Plates and Shells
CE 520 Advanced Computer Programming for Engineers
CE 522 Engineering Analysis
CE 524 Probability, Statistics and Decision Theory
CE 526 Continuum Mechanics
CE 534 Model Analysis of Engineering Structures
CE 536 Model-Aided Design of Engineering Structures
CE 540 Highway Design
CE 541 Traffic
CE 542 Pavement Structural Design
CE 543 Land Use Models
CE 544 Systems Analysis
CE 545 Transportation Planning Practice
CE 551 Engineering Terrain Analysis
CE 558 Soil Engineering (Case Histories)
CE 560 Mechanical Behaviour of Materials
CE 572 Topics in Wastewater Treatment
CE 573 Pollution in the Aquatic Environment
CE 580 Elements of Water Resources Management
CE 583 Water Distribution and Collection Systems
CE 586 Hydrology
CE 589 Open Channel Flow

Appropriate courses offered in other Departments are also available as electives upon the consent of the instructor.
### Academic Programmes for Each Term (1974-75)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures hrs./week</th>
<th>Labs or Tutorials hrs./week</th>
</tr>
</thead>
</table>

**Year 2A**

- CE 203 Statics                     1  
- CE 204 Dynamics                   2  
- CE 205 Mechanics of Deformable Solids 1  2  
- CE 221 Calculus                   3  
- CE 265 Materials                  3  
- CE 291 Survey Camp†               3  
- CE 292 Socio-Economic Aspects of Civil Engineering  2  
- CE 298 Seminar                    1  

**Year 2B**

- CE 200 Civil Engineering Project 1  2  
- CE 206 Mechanics of Deformable Solids 2  3  
- CE 222 Differential Equations      3  
- CE 224 Probability and Statistics  3  
- CE 280 Fluid Mechanics             3  
- CE 291 Survey Camp†               3  
- CE 299 Seminar                    1  

**Year 3A**

- CE 303 Structural Analysis 1       2  
- CE 342 Transportation Engineering 3  
- CE 353 Geology and Soil Mechanics  3  
- CE 381 Hydraulics                  3  
- CE 393 Environmental Engineering  3  
- CE 398 Seminar                    1  

**Year 3B**

- CE 300 Civil Engineering Project 2 13  
- CE 304 Structural Analysis 2       2  
- CE 315 Structural Design 1         2  
- CE 354 Soil Mechanics and Foundations 3  
- CE 375 Sanitary Engineering        3  
- CE 399 Seminar                    1  
- Elective                          3  

**Year 4A**

- CE 498 Seminar                    1  
- Five Electives                    1  

**Year 4B**

- CE 400 Civil Engineering Project 3  
- CE 499 Seminar                    1  
- Four Electives                    1  

† CE 291 Survey Camp is taken at the commencement of the Fall Term preceding either year 2A or 2B.
Electrical Engineering

The curriculum in Electrical Engineering is designed to teach those fundamental physical and engineering sciences which form the basis of the work of electrical engineers. After the common first year programme in Engineering, the programme in Electrical Engineering consists of nineteen core courses and a minimum of nine technical electives (taken during the last two terms): these technical electives include the possibility of working on a design type of project. In addition, students are required to take one non-technical elective course in each of the 2B, 3A and 3B terms and a general elective course in each of the last two terms. A general elective may be either technical or non-technical. During each term they also attend one general seminar course. The department uses a broad interpretation of what constitutes a "non-technical elective".

The normal recommended programme shown below involves a course load (excluding seminar) of five or six courses per term; however, students are allowed to depart from this normal load within the framework of the following rules and within the constraints of the timetable.

The technical programme will consist of a minimum of all nineteen core courses and nine technical electives, normally chosen from the listing below (including the possibility of one or two final year project electives). Laboratory exercises are compulsory where they form part of the course.

The non-technical programme consists of one general seminar course (non-credit) covering topics of general interest. Three non-technical electives must be successfully completed; however the mark is not included in the term average. General electives in the last two terms are included in the term average.

A student must carry at least four courses per term (excluding the seminar course), but may carry more at the discretion of the department.

The maximum number of terms of resident study to be as stipulated in the Calendar (viz. ten terms, see page 146).

The normal rules of the co-operative programme will apply. By special permission the number of co-operative work terms may be reduced, but a student must complete at least four work terms (including that done in his first year) – unless he is a student admitted to advanced standing, as defined in the Calendar (see page 147).

The student must register his course load at the start of each term. Departmental permission at the time of registration will be required for departing from the normal load in any one term.

Permission to carry more than the normal load in any one term will normally be given only if the student holds an A average in the previous term.

The promotion criteria will be as laid down in the Faculty rules, (see page 148) and the student will be examined on the basis of the courses for which he is registered at the time of examination.
Programme

(a) Core (Years 2 and 3)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</th>
<th>Tut.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 203</td>
<td>Concepts of Electrical Engineering</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EE 205 (Math 25)</td>
<td>Advanced Calculus for Electrical Engineers 1</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 206 (Math 35)</td>
<td>Advanced Calculus for Electrical Engineers 2</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 221</td>
<td>Principles of Digital Logic Circuits</td>
<td>3</td>
<td>2*</td>
<td>1</td>
</tr>
<tr>
<td>EE 233</td>
<td>Physical Electronics</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 241</td>
<td>Electric Networks 1</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 261</td>
<td>Energy Processing and Conversion</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>EE 271</td>
<td>Electric &amp; Magnetic Fields</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 293</td>
<td>Instrumentation and Measurement 1</td>
<td>1</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>EE 294</td>
<td>Instrumentation and Measurement 2</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 316</td>
<td>Probability &amp; Statistics</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 324</td>
<td>Principles of Digital Computers</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>EE 342</td>
<td>Electric Networks 2</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 351</td>
<td>Electronics 1</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 352</td>
<td>Electronics 2</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 362</td>
<td>Dynamic Energy Conversion</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 372</td>
<td>Electromagnetic Theory &amp; Applications</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>EE 380</td>
<td>Introduction to Systems &amp; Control</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>ME 50</td>
<td>Thermodynamics</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

(b) Technical Electives (Year 4)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</th>
<th>Tut.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 425</td>
<td>System Simulation</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 426</td>
<td>Software Engineering</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 427</td>
<td>Design of Discrete Signal Systems</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 428</td>
<td>Signal Analysis and Frequency Domain Methods</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 429</td>
<td>Communication Systems</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 434</td>
<td>Magnetic Materials and Quantum Electronics</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 435</td>
<td>Semiconductor Devices 1</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 436</td>
<td>Semiconductor Devices 2</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 443</td>
<td>Electric Networks 3</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 446</td>
<td>Algebra of Linear Systems</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 453</td>
<td>General Electronic Circuits</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 454</td>
<td>Pulse and Switching Circuits</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 459</td>
<td>Sound, Noise and Electroacoustics</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 463</td>
<td>Energy Conversion &amp; Power Applications</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 464</td>
<td>High Voltage &amp; Insulation Engineering</td>
<td>3</td>
<td>3*</td>
<td>0</td>
</tr>
<tr>
<td>EE 465</td>
<td>Power Systems</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 473</td>
<td>Microwave Engineering</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 474</td>
<td>Antenna &amp; Propagation Engineering</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 481</td>
<td>Control Systems 1</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>EE 482</td>
<td>Control Systems 2</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 499A</td>
<td>Project</td>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>EE 499B</td>
<td>Project</td>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Math 24</td>
<td>Complex Variables</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*With the approval of the Department, students may take technical courses offered by other departments.*
### Academic Programmes for Each Term (1974-75)

#### Electrical Engineering

**Note** Students may depart from this programme within the framework of the rules given above, and within the constraints of the timetable.

<table>
<thead>
<tr>
<th>Term</th>
<th>Lect.</th>
<th>Lab.</th>
<th>Tut.</th>
<th>Course Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2A Term: Fall and Winter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 201 Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>EE 203 Concepts of Electrical Engineering</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>EE 205 Advanced Calculus for Electrical Engineers 1</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>EE 221 Principles of Digital Logic Circuits</td>
<td>3</td>
<td>2*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EE 241 Electric Networks 1</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>EE 271 Electric and Magnetic Fields</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EE 293 Instrumentation and Measurement 1</td>
<td>1</td>
<td>9</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>2B Term: Fall and Spring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 202 Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>EE 206 Advanced Calculus for Electrical Engineers 2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>EE 233 Physical Electronics</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EE 261 Energy Processing and Conversion</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EE 294 Instrumentation and Measurement 2</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>MF 50 Thermodynamics</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Non-Technical Elective</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>3A Term: Winter and Spring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 301 Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>EE 316 Probability and Statistics</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>EE 342 Electrical Networks 2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>EE 351 Electronics 1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EE 362 Dynamic Energy Conversion</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Non-Technical Elective</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>3B Term: Fall and Winter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 302 Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>EE 324 Principles of Digital Computers</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EE 352 Electronics 2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EE 372 Electromagnetic Theory &amp; Applications</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>EE 380 Introduction to Systems &amp; Controls</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Non-Technical Elective</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
**4A Term: Fall and Spring**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lect.</th>
<th>Lab.</th>
<th>Tut.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 401 Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>† 1 General Elective</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Five Technical Electives from:††</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 425 System Simulation</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 426 Software Engineering</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 428 Signal Analysis and Frequency Domain Methods</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 435 Semiconductor Devices 1</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 446 Algebra of Linear Systems</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 454 Pulse &amp; Switching Circuits Applications</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 463 Energy Conversion &amp; Power</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 473 Microwave Engineering</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 481 Control Systems</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>EE 499A Project</td>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Math 44 Complex Variables</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**4B Term: Winter**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lect.</th>
<th>Lab.</th>
<th>Tut.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 402 Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>† 1 General Elective</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Four Technical Electives from:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 427 Design of Discrete Signal Systems</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 429 Communication Systems</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>EE 434 Magnetic Materials &amp; Quantum Electronics</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 436 Semiconductor Devices 2</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 443 Electrical Networks 3</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 453 General Electronic Circuits</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 459 Sound, Noise and Electroacoustics</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 464 High Voltage &amp; Insulation Engineering</td>
<td>3</td>
<td>3*</td>
<td>1</td>
</tr>
<tr>
<td>EE 466 Power Systems</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 474 Antenna &amp; Propagation Engineering</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>EE 482 Control Systems 2</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>FF 499R Project</td>
<td>0</td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>

**Service Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Electrons</th>
<th>Electronic Instrumentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mech Eng 2A EE 14 Electromagnetics</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>Mech Eng 3A EE 32 Electronic Instrumentation</td>
<td>3</td>
<td>3*</td>
</tr>
</tbody>
</table>

† General Elective is any course that is not a repeat of course material already taken.

The undergraduate course descriptions will be found in Chapter 16.

**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 environmental research equipment, safety equipment, 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 the 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 permits registration as a Professional Engineer in the Association of Professional Engineers of the Province of Ontario upon satisfaction of the work experience requirement and carries exemption from parts 1 and 2 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 Civil and Electrical Engineering. The second year provides elementary courses in Mechanical Engineering and certain subjects in 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) The Thermodynamics-Fluid Mechanics Option: The courses in this option deal with a broad range of applications of the principles of thermodynamics and fluid mechanics, with emphasis on topics of industrial significance.

b) Solid Body Mechanics and Mechanical Design Option: The courses offered in this option range from those which provide the mathematical and physical basis of the subject matter through to those which are largely applied. Subjects treated are: mechanics (including vibrations); theories of elasticity, plasticity and fracture; choice of working stress, mechanical design and design optimization. Students taking this option will be prepared for careers in design and development.

c) Production/Industrial Option: is designed to provide the student with an understanding of industry from the viewpoint of its organization, its processes, economics and the application of mathematics to its operation. It is suggested for those students primarily interested in the industrial aspects of mechanical engineering.
d) **Engineering Materials Option:** Comprehensive series of courses in Physical Metallurgy, Ceramics, Industrial Polymers and Composite Materials offers the necessary versatility for work in Industry and Research.

e) **Geophysical (Environmental) Fluid Dynamics Option:** For students interested in the control of air and water pollution and noise abatement, or who wish to embark later on a research career in meteorology, oceanography, ocean engineering, weather modification, pollution problems or related fields.

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

### A) Core Programme

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Lect.</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 14</td>
<td>Electromagnetics</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>EE 32</td>
<td>Electronics</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>ME 1</td>
<td>Advanced Calculus</td>
<td>2</td>
<td>2*</td>
</tr>
<tr>
<td>MS 21</td>
<td>Mathematical Probability and Statistics</td>
<td>3</td>
<td>2*</td>
</tr>
<tr>
<td>ME 3</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
<td>2*</td>
</tr>
<tr>
<td>ME 4</td>
<td>Numerical Analysis</td>
<td>2</td>
<td>2*</td>
</tr>
<tr>
<td>ME 5</td>
<td>Partial Differential Equations</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ME 12</td>
<td>Dynamics</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ME 15</td>
<td>Structure and Properties of Matter</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>ME 19</td>
<td>Mechanics of Deformable Solids 1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ME 20</td>
<td>Mechanics of Deformable Solids 2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ME 21</td>
<td>Kinematics and Dynamics of Machines</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ME 30</td>
<td>Structure and Properties of Matter 2</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>ME 40</td>
<td>Manufacturing Processes</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ME 44</td>
<td>Production Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ME 51</td>
<td>Fluid Mechanics 1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>ME 33</td>
<td>Heat Transfer 1</td>
<td>3</td>
<td>3*</td>
</tr>
<tr>
<td>ME 60</td>
<td>Introduction to Control Systems</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ME 62</td>
<td>Fluid Mechanics 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 82</td>
<td>Mechanical Engineering Projects</td>
<td>0</td>
<td>4½</td>
</tr>
<tr>
<td>ME 560</td>
<td>Instrumentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS 21</td>
<td>Applied Probability &amp; Statistics</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>MS 23</td>
<td>Engineering and Managerial Economics</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ME 200</td>
<td>Introduction to Mechanical Engineering 1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME 300</td>
<td>Introduction to Mechanical Engineering 2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ME 400</td>
<td>Introduction to Mechanical Engineering 3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

### B) Elective Course

a) **Non-technical electives:** Students entering the programme will take four non-technical electives.

b) **Technical Electives:** Eight elective courses are required in addition to the core courses listed above to fulfill the requirements of the Mechanical Engineering programme. Also each student will complete a two-term Mechanical Engineering Project (ME 82). Electives should be chosen largely from a single option and the choice must be approved by a designated faculty member.
a) Thermodynamics – Fluid Mechanics Option
ME 52 Air Conditioning
ME 54 Thermodynamics 2
ME 55 Refrigeration Engineering
ME 56 Heat Transfer 2
ME 58 Internal Combustion Engines
ME 59 Energy Conversion
ME 62 Fluid Mechanics 2
ME 64 Industrial Aerodynamics
ME 555 Thermodynamics 3
ME 557 Combustion 1
ME 561 Fluid Control Systems
MF 562 Control Theory 2
ME 563 Turbomachinery
ME 565 Gas Dynamics 1
ME 566 Turbulent Flow 1
ME 567 Aerodynamics of Flight
MF 568 Noise Analysis and Control
ME 576 Control System Design

b) Solid Body Mechanics and Mechanical Design Option
ME 22 Mechanical Design 1
ME 523 Mechanical Design 2
ME 525 Mechanical Vibrations
ME 527 Mechanics of Deformable Solids 3
ME 528 Experimental Mechanics
ME 626 Creep, Fatigue and Brittle Fracture
SD 543 Human Factors Engineering
SD 544 Ergonomics

c) Production/Industrial Option
ME 41 Manufacturing Science 1
ME 42 Principles of Machining
ME 43 Manufacturing Science 4
ME 45 Manufacturing Science 6
ME 46 Manufacturing Science 7
ME 47 Analysis and Design of Manufacturing Systems
ME 544 Manufacturing Science 5
MF 548 Numerical Control of Machine Tools 1
MS 31 Industrial Statistics and Design of Experiments
MS 43 Economics of Enterprise and Benefit/Cost Analysis
MS 44 Industrial Psychology
MS 46 Stochastic Models of Industrial Operations
MS 47 Optimization Models for Policy Analysis
ME 22 Mechanical Design 1
ME 35 Industrial Metallurgy
ME 534 Properties of Polymers
SD543 Human Factors Engineering
SD544 Ergonomics
d) Engineering Materials Option
ME 32 Physical Metallurgy 2
ME 33 Materials Science Laboratories
ME 35 Industrial Metallurgy
ME 531 Physical Metallurgy 1
ME 534 Properties of Polymers
ME 537 Ceramics

Suggested electives from other options and departments
ME 22 Mechanical Design 1
ME 41 Manufacturing Science 1 (Plasticity)
ME 43 Manufacturing Science 4 (Casting)
ME 527 Mechanics of Deformable Solids 3
ME 544 Manufacturing Science 5 (Welding)
CE 560 Mechanical Behaviour of Materials

e) Geophysical (Environmental) Fluid Dynamics Options
ME 69 Introduction to the Environment Sciences
ME 566 Turbulent Flow 1
ME 568 Acoustics
ME 570 Geophysical Fluid Dynamics 1
ME 571 Air Pollution 1
ME 572 Ocean Engineering
Graduate courses in this field may also be available to selected undergraduate students.

f) General Mechanical Engineering Option Programme should include all of the following courses:
ME 22 Mechanical Design 1
ME 32 Physical Metallurgy
ME 41 Manufacturing Science 1
ME 56 Heat Transfer 2
ME 528 Experimental Mechanics
ME 563 Turbomachines

Academic Programmes for Each Term(1974-75)

Year 2A Fall 1974 and Winter 1975
ME 1
MS 21
ME 15
ME 19
ME 12
ME 200
EE 14

Year 2B Spring 1974 and Fall 1974
ME 3
ME 4
MS 23
ME 20
ME 30
ME 50

Year 3A Spring 1975 and Winter 1975
ME 5
ME 21
ME 40
ME 51
ME 60
ME 300

1 non-technical elective
Year 3B Fall 1974 and Winter 1975
ME 53
ME 62
EE 32

Year 4A Spring 1974 and Fall 1974
ME 82
ME 400
ME 560

Year 4B Winter 1975
ME 44
ME 82
3 technical electives
1 non-technical elective

Systems Design

The Department of Systems Design (formerly the Department of Design) was formed at Waterloo in 1965. Since that time it has received international recognition for its graduate programmes, research activities and design projects.

Within the last decade it has become increasingly apparent that effective solutions to problems involving both society and technology must be based on a broad systems point of view. Not only must the overall technical factors of these problems be carefully considered, but the economic, social, human and political parameters must be given equally careful attention. When large scale problems are under study, few people can be knowledgeable in the complete span of factors and parameters which must be considered. For these cases, solutions must be arrived at by interdisciplinary teams where each member contributes his own special expertise. In order to work effectively on this team, each member needs to be aware of the fundamental systems and design aspects of the problem.

The undergraduate programme in Systems Design Engineering at Waterloo is a study of those basic skills required for system analysis, simulation, optimization and design. Numerous examples may be cited where these systems design fundamentals may be applied: transportation, engineering design, computer applications, production, planning and scheduling, environmental pollution, education, etc. Of course the importance of specialized expertise in these areas should not be minimized, but these skills usually work most effectively toward problem solutions when operating within an overall systems context.

Type of Student
The Systems Design Engineering programme is specifically oriented towards developing graduates who can solve problems lying at the interface of technology and the human environment. It is therefore attractive to those students who are technically oriented and also have a strong parallel interest in social and human problems.
The tools for systems problem solving are becoming more powerful and sophisticated; thus larger and more complex systems may be successfully investigated. Recent developments include an increasing awareness of the theories of communication, progress in the areas of Systems Theory, Human Systems Engineering and Socio-Economic Systems, developments in the theories of Design and Planning and, of course, the tremendous impact of electronic computing systems.

The Systems Design Engineering Programme

The undergraduate programme in Systems Design Engineering encompasses a study of the basic skills required for systems analysis, simulation, optimization and design. In particular the first three years of the programme are intended to provide each student with a broad background and capability in the areas of:

- Applied mathematics
- Engineering systems and systems theory
- Socio-economic systems
- Human systems engineering and
- Computer systems and applications

Throughout these three years the student’s ability to grasp real engineering problems is enhanced by an early course in Engineering Design and an intensive experience in the Systems-Design Workshop. It is here that a focus is given to the whole curriculum and the student learns to apply his lecture material, to develop his skills in solving problems that cut across the traditional disciplines, and to develop his design, planning and organizational abilities.

The beginning three years of the programme are followed by one year in which the problem-solving capabilities of the student may be applied with emphasis in one particular area of technology, as chosen by the student. This prepares him for a further year of advanced study to the M.A.Sc. degree if he so wishes, or for a meaningful career in industry or government with his Bachelor’s degree.

The general core curriculum of the first three years is given flexibility through two means. Firstly, in each term of the 2nd and 3rd years the student may elect one course freely from any of the offerings of the University, provided only that these courses do not duplicate the core programme. Secondly, in the third year, the student is provided with two additional technical elective courses which serve as precursors to the technical option areas selected for study in the fourth year.

General Description of the Technical Options

The Systems Design Department is offering three well-defined technical options to its students. The technical disciplines encompassed by these options are in areas in which individual faculty members of the department are involved but a procedure for devising special options outside of these areas is outlined below. There is considerable overlap among the disciplines encountered in the various options; indeed, this overlap extends to the objectives of the options in terms of engineering problem solving and design.

In general, it is possible to define technical options for engineering students either through the specific engineering disciplines to which they are oriented or through the special problem-solving skills to which they are directed. The Systems Design options are
characterized by an amalgamation of these two points of view. This is emphasized by the continuation of the Systems Design Workshop through the fourth year. At this time each individual student will be required to attack a major problem taken from his technical option area, but with strong involvement in other disciplines. In addition, each student is encouraged to structure his technical elective courses so that his studies include not only the major technical option area but also a "minor" study from a second technological discipline.

Nonetheless, the technical options are named in terms of the major engineering disciplines that they encompass. This has the advantage of identifying the general problem areas which are to be studied in the options, and gives a specific professional identity to the students who choose them.

If he wishes to select an area not included in the general Systems Design programme, the student may structure a special option with the advice and approval of his supervisor. A special option will include a core of four Systems Design courses taken from within any Systems Design option series with an additional four courses which may be taken from well structured options offered outside of the Systems Design department, e.g. water resources, transportation, etc.

Structure of the Options

Each technical option is characterized by a series of option core subjects, and an additional set of technical elective courses. When a student has chosen a particular option he must take all of the associated option core courses. His remaining courses are chosen with the advice of his faculty advisor, in such a way as to strengthen his knowledge of particular facets of the option discipline and to provide for an integrated minor study of a second area. The third and fourth year curriculum is structured as follows:

3A 4 courses Systems Design general core programme
Systems Design Workshop
1 free elective course
1 technical option course, from the option core

3B 4 courses Systems Design general core programme
Systems Design Workshop
1 free elective course
1 technical option course, from the option core

4A 2 Systems Design mandatory courses
Systems Design Workshop
1 free elective course
3 elective courses, at least two from the option core

4B Systems Design Workshop
1 free elective course
4 technical option courses, at least two from the option core

Design and Human Systems Option

The Design and Human Systems option embraces in whole or in part a wide spectrum of "professional" areas known as human factors engineering, human engineering, ergonomics, engineering ecology, biomedical engineering, and elements of various technical and non-technical disciplines such as aesthetics, perceptual
psychology, marketing, mechanics, materials, etc.

However, the concentration within the Systems Design programme is on the human problem to be solved rather than on one of these professional or discipline areas. Thus, courses will be selected, under supervision, to provide the knowledge and expertise required to define and solve problems arising at the interface between man and machine (artifact), or man and environment.

Problem areas chosen might include:
- design for extreme human environments
- design where anthropometric aspects are dominant
- design of instrumentation for human operators
- design problems associated with safety in industry, transportation, etc.

medical design problems involving engineering technology
- design involving human engineering
- design of consumer products used in recreation and normal living
- human aspects of engineering ecology
- design of human “micro-environments”
- problems of ergonomics and industrial hygiene

**Option Core Courses**

3A SD341 Problems of Man in the Operational Environment
3B SD366 Aesthetic and Perceptual Aspects of Design
4A SD443 Human Engineering and Rational Design
   SD463 Structures and Design
4B *Two courses from:*
   - SD542 Human Engineering and Systems Development
   - SD564 Methodological Processes in Design
   - SD472 Man-Machine Communications
   - SD522 Computer-Aided Design 2
   - SD464 Theory and Applications of Photographic Methods to Measurement and Design

**Socio-Economic Systems Option**

Many large scale design projects have important socio-economic consequences. Also social and political forces may affect the design process. Under this option a student can study the various interactions between a project and its social environment; in particular the aim of this option is to equip the student to attack problems associated with the design of large-scale non-corporate systems.

In the option core, techniques are taught for analyzing this interaction by the use of statistics, operations research, game theory and the social sciences. Through his electives a student may pursue further various topics in the social sciences and operations research.

**Option Core Courses**

3A: SD 333 Experimental Design
3B: SD 332 Mathematical Programming
4A: SD 411 Systems Operations 2
   SD 433 Conflict Analysis
4B: SD 412 Topics in Operations Research
   SD 432 Analysis of Large Systems
In this option the student is given the opportunity either to study in some depth Physical Systems Theory as it has evolved as a discipline over the last decade or to gain additional background and expertise in the application of electronic computers to the analysis, simulation and design systems.

Those students who study Systems Theory are expected to be able to apply this theory to problems involving electrical, mechanical and hydraulic systems and their combinations. They may also apply the concepts of Systems Theory to wide varieties of other systems, involving both engineering and non-engineering disciplines.

For those students concerned with the applications of electronic computers the option provides access to information concerned with computer hardware (the physical structures of digital, analog and hybrid computers), computer software (procedural, simulation and problem-oriented languages), and application techniques (particularly in computer-aided design).

**Option Core Courses**

3A SD 353 Time Domain Models for Physical Systems
3B either SD 324 Principles of Digital Computers or SD 352 Algorithms for Computer-Aided Systems Analysis
4A SD 521 Analog and Hybrid Computing Systems
   SD 451 Multi-Terminal Representations and Piecewise Analysis of Physical Systems

4B Two courses from:
   SD 522 Computer-Aided Design 2
   SD 452 Introduction to Linear Control Systems
   SD 454 Hydraulic Systems
   SD 456 Power Systems

**Free Electives and Technical Electives**

In each term of the second, third and fourth years the Department of Systems Design requires each student to study one course outside of the core programme. These free elective courses give the student the opportunity to devise a coherent, “minor” study in an area of his own choice or to provide a sample of courses from a number of differing fields. The intent of this free elective programme is to allow the student to broaden his own education in the manner most suitable to his own needs; there is no restriction regarding the departments from which free elective courses may be chosen.

In the third and fourth years a student in Systems Design has, in addition, a total of eight technical elective courses. Most of these form the core of his chosen option area while the remainder are chosen by the student to provide insight into particular applications of his option discipline.

In all cases elective course selections are subject to approval by the department.
1A (Fall Term)
SD 111 Calculus 1
SD 113 Linear Algebra
SD 121 Digital Computation
SD 131 Engineering Economics
SD 161 Systems Behaviour
SD 181 Statics
SD 183 Graphics and Design

1B (Spring Term)
SD 112 Calculus 2
SD 114 Theory and Applications of Probability
SD 142 Introduction to Ergonomics
SD 162 Systems Design Methodology
SD 182 Dynamics
SD 184 Electricity and Magnetism
SD 192 Systems Design Laboratory 1

2A (Winter Term)
SD 211 Applicable Mathematics for Systems Design 1
SD 213 Theory and Applications of Statistics
SD 221 Numerical Analysis and Computation
SD 261 Systems Design Workshop 1
SD 281 Mechanics of Deformable Solids
SD 291 Systems Design Laboratory 2
1 free elective

2B (Fall Term)
SD 212 Applicable Mathematics for Systems Design 2
SD 252 Physical Systems 1
SD 262 Systems Design Workshop 2
SD 264 Form and Function in Design

2 courses chosen from:
SD 282 Thermodynamics
SD 284 Fluid Mechanics
SD 286 Introduction to Biochemical and Polymer Systems
1 free elective

3A (Spring Term)
SD 311 Systems Operations 1
SD 351 Physical Systems 2
SD 361 Systems Design Workshop 3
SD 381 Materials Engineering
SD 391 Systems Design Laboratory 3
1 technical elective
1 free elective

3B (Winter Term)
SD 322 Computer Simulation of Systems
SD 362 Systems Design Workshop 4
SD 364 Manufacturing Science
SD 382 Applied Electronics
SD 392 Systems Design Laboratory 4
1 technical elective
1 free elective
Systems Design

4A (Fall Term)
SD 421 Computer-Aided Design 1
SD 431 Economics of Engineering Design
SD 461 Systems Design Workshop 5
3 technical electives or 2 technical electives
and 1 free elective

4B (Winter Term)
SD 462 Systems Design Workshop 6
4 technical electives
1 free elective

Option Core Courses
Design and Human Systems Option:
3A SD 341 Ergonomics of Special Environments

Socio-Economic Systems Option:
SD 333 Experimental Design

Systems Theory and Computer Option
SD 353 Time Domain Models for Physical Systems

3B Design and Human Systems Option:
SD 366 Aesthetic and Perceptual Aspects of Design

Socio-Economic Systems Option:
SD 332 Mathematical Programming

Systems Theory and Computer Option:
either SD 324 Principles of Digital Computers
or SD 352 Algorithms for Computer-Aided Systems Analysis

4A Design and Human Systems Option:
SD 443 Human Engineering and Rational Design
SD 463 Structures and Design

Socio-Economic Systems Option:
SD 411 Systems Operations 2
SD 433 Conflict Analysis

Systems Theory and Computer Option:
SD 521 Analog and Hybrid Computing Systems
SD 451 Multi-Terminal Representations and Piecewise Analysis
of Physical Systems

4B Design and Human Systems Option: Two courses from:
SD 542 Human Engineering and Systems Development
SD 564 Methodological Processes in Design
SD 472 Man-Machine Communications
SD 522 Computer-Aided Design 2
SD 464 Theory and Applications of Photographic Methods to
Measurement and Design

Socio-Economic Systems Option:
SD 412 Topics in Operations Research
SD 432 Analysis of Large Systems
Systems Design

Systems Theory and Computer Option: Two courses from:
SD 522 Computer-Aided Design 2
SD 452 Introduction to Linear Control Systems
SD 454 Hydraulic Systems
SD 456 Power Systems

Notes The numbering of Systems Design courses is as follows:

a) If the course is given in the "A" term, the number in the units place is odd. Otherwise, it is even.

b) The number in the 10's place refers to the field of the subject matter of the course, according to the following codes:

1 topics in mathematics required for Systems Design
2 computer systems
3 socio-economic systems
4 human systems
5 physical systems
6 the design of engineering systems
7 human communication systems
8 engineering sciences
9 laboratories

c) The number in the 100's place refers to the year in the programme in which the student will encounter the course. The only exception is that courses in the 500 series are available to fourth year students.

The majority of Systems Design courses are given on the basis of three formal lectures and one tutorial hour each week. The department endeavours to ensure that the formal course schedule remains below 25 hours per week in each term. Beyond this, other, less formally scheduled meetings between students and faculty are required. It is expected that the average student will spend, in total, between 55 and 65 hours per week on his studies.
10

Faculty of Environmental Studies
Faculty of Environmental Studies

Introduction

The Faculty of Environmental Studies is equivalent in organization to any regular Faculty, such as Arts, Science, and Engineering but is unique in its outlook. It concentrates on using diverse sources of knowledge from different disciplines needed to understand one particular problem area: man and his environment. Since many of the issues are contemporary, the Faculty has attempted to utilise the best of traditional teaching approaches combined with newer and innovative techniques derived from a broad range of disciplines.

The Faculty of Environment Studies has within it two types of academic groups – the professional Schools, and the academic Departments.

Schools and Departments

School of Architecture
Department of Geography
Department of Man-Environment Studies
School of Urban and Regional Planning

The professional Schools are specialized, vocation oriented but they are not narrow. Through the Faculty of Environmental Studies, they are integrated into the mainstream of the University's concern with man and his environment, through the two main thrusts of research and practical applications.

The academic Departments represent a grouping of studies which have the interaction of man with his environment as their core. Both the Man-Environment and Geography Departments are inter-disciplinary in nature and interact with many fields of study and research from the Arts, Science, Social Sciences, Mathematics, and Engineering.

One of the innovative aspects of the Faculty of Environmental Studies is the high degree of interaction among its four units. Faculty members in each School or Department participate in the programmes of the other units, and it is an objective of the Faculty to make all its members available to students in any of its four units. Interaction with other parts of the University is also fostered, and joint appointments of faculty members with other Faculties and Schools have been made. Students are not only free to, but are encouraged to choose courses from across the whole university.

Academic Programmes

The calendar is designed to enable students to make a wise choice of their programmes and courses while at the University of Waterloo. However, it is a complex document often difficult to understand and in all cases of confusion students are encouraged to consult the undergraduate officer of the appropriate School or Department. The Secondary School Liaison Officer and the Assistant Registrar for Environmental Studies will also respond to written or personal inquiries.

The following statement outlines the objectives and nature of the four programmes in the Faculty of Environmental Studies.
Some courses are offered in the Faculty of Environmental Studies under an Environmental Studies heading. These courses are integrative in nature and extend across the academic interests of the four units. They are ES 195* - Environmental Problems; ES 200* - Field Ecology; ES 252* - Media Tools and Environmental Studies; ES 358* - Environmental Pollution; ES 380*/381* - Environmental Studies Workshop; ES 400 - Environmental Law.

Full course descriptions are given in Chapter 16 of the Calendar under the heading Environmental Studies.

Architecture, traditionally, is the art, science and technique of modifying the physical environment to satisfy the needs and aspirations of man. The School, therefore, endeavours to engender in the student of architecture an awareness of the need to understand the diverse, dynamic and, often, contradictory demands of a society and its individuals.

Equally stressed, is the need to comprehend the implications of those demands in relation to the existing environment. That is, the School also endeavours to foster in the student of architecture an acceptance of responsibility for the influence of his action upon the environment he modifies and the realization that, in so doing, he requires consultation and collaboration with others of a variety of disciplines involved in the study of human ecology.

The intention of the programme of study is to impart to the student of architecture an understanding of a process of responsible environmental modification for man's use and to enable him, as an architect, to contribute to that process. This requires a broad base for architectural studies and promotes an interdisciplinary approach to studies in the University and especially, within the Faculty of Environmental Studies. The full, five-year programme in Architecture is intended to prepare the student to become an architect capable of practice within contemporary professional constraints and capable, too, of adaptation to a changing profession and society it serves.

The School of Architecture offers two undergraduate programmes: a pre-professional, three-year Bachelor of Environmental Studies programme and a two-year, professional programme of study for the Bachelor of Architecture degree. Both programmes are on the co-operative system which consists of alternating periods of academic study and practical work experience.

The pre-professional architecture programme comprises six academic terms of study and three, four-month co-operative work terms* leading to the degree, Bachelor of Environmental Studies (B.E.S.). This degree indicates appropriate preparation for four subsequent academic terms of study and two co-operative work terms*, one of four months and one of eight months, leading to the degree, Bachelor of Architecture (B.Arch.).

* See section in this chapter on Co-operative Programme.
Non-Architecture Students

Students not enrolled in the curriculum of Architecture may take any architectural course listed in the recommended core programme with the exception of courses in the theme area of Design. Prerequisites indicated in the course descriptions are primarily for Architectural students. For Non-Architectural students, prerequisite evaluation must be carried out by the respective teaching staff.

Bachelor of Environmental Studies
(Pre-Professional Programme)

The purpose of the pre-professional B.E.S. Programme is to educate future architects to an understanding of the beliefs and needs of the individual and of society, and to a willingness to take an active role in creating and improving the environment; to a clarification of the interaction of seemingly unrelated disciplines, and to know the principles and values that surround the creation of any artifact; to a comprehension of the many forms of creative expression; and to an understanding of the present as part of a historical process. The programme helps the student to predict the effect of science, technology and man's creations on the environment, and to understand that continuing studies will help the future architect to become sensitive to the needs of mankind in a never-ending cycle of change. The programme is founded on four broad study themes.
1) the design studio, theories and methods, and a workshop for application and experimentation of theories.
2) Studies of systems and measures including computer, physical and material sciences.
3) cultural history in the human environment.
4) environmental studies, including natural and human ecology.
See Chapter 16 of the Academic Calendar for course descriptions and arrangement.

Bachelor of Architecture Programme

The purpose of the Bachelor of Architecture programme is to permit a student who has successfully completed the Environmental Studies (Pre-professional Architecture) course or its equal to pursue, in parallel with a prescribed design studio programme, courses of study selected by the student and appropriate to his/her capabilities and interests. The final two terms of the programme are normally devoted to the undertaking of a thesis or final design problem selected and programmed by the student.

Note Students are expected to defray costs of materials in connection with studio projects.

See Chapter 16 of the Academic Calendar for course descriptions and arrangement.

Co-operative Programmes

The Bachelor of Environmental Studies programme includes six terms of study, three four-month co-operative work terms and one "off-term". The subsequent Bachelor of Architecture programme consists of four terms of academic study and two co-operative work terms, one four months and one eight months.
Note The "off-term" in the Bachelor of Environmental Studies program follows the first two terms of study (from September to April) in Year 1. A student may use the "off-term" as a vacation period or he may seek temporary employment. Any employment arrangements made for the "off-term" are the student's own responsibility.

The terms are arranged as indicated on the following chart.

Objectives of the Work Term
The Co-operative Work Terms are designed to provide the student with knowledge of present day practice in architecture and to develop within the student practical skills essential for the practising architect to-day.

Work opportunities are developed in private architectural practices, corporate and government architectural departments, and construction and development companies. Drafting abilities, methods of construction, division of sub trades, construction supervision, real problem solving, and the disciplines of time and money will be learned during the work terms.

At the completion of the Work Terms the student who has taken full advantage of the opportunities offered will have a thorough understanding of the current methods and procedures used in the design and construction of buildings, sufficient ability and adequate mature judgement to assume responsibility for any medium-sized building project.

Co-operative Work Term Schedule
Bachelor of Environmental Studies

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Term 1</td>
<td>Term 2</td>
<td>&quot;off term&quot;</td>
<td>Term 3</td>
</tr>
</tbody>
</table>

Bachelor of Architecture

<table>
<thead>
<tr>
<th>1978</th>
<th>1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter Co-op</td>
<td>Spring Fall</td>
</tr>
<tr>
<td>Work Term 4</td>
<td>Work Term 5</td>
</tr>
<tr>
<td>Term 7</td>
<td>Term 8</td>
</tr>
</tbody>
</table>
Department of Geography

Nature of the Programme

Geography is concerned with both the natural and man-made environment, studying how man has shaped it to his needs, how patterns of human activities are structured over space, and how these are influenced by environmental factors. Geography is considered both a natural and social science and flourishes in an academic organization where the multidisciplinary approach is emphasized. The Bachelor of Environmental Studies (B.E.S.) programme in Honours Geography provides students with almost unlimited freedom to choose supporting electives from across the whole University. Thus, in consultation with professors, every student will be able to have a tailor-made programme to suit his particular needs, whether he is primarily interested in physical or human geography, regional or systematic topics, or a combination of these. The Department has Joint Honours programmes with a number of other departments on campus.

The Honours Geography programme provides a sound, well-rounded foundation in the discipline, and prepares the student for specialization at the graduate level in almost any aspect of Geography. The programme includes a group of mandatory core courses that provides a balance of content and technique. The content courses include a series of integrated courses in both physical and human geography, using a systems approach. The technique courses include field methods, remote sensing, cartography, statistical analysis, and computer use. The fourth year includes a seminar on the philosophy and research frontiers of Geography and a research project known as the Senior Honours Essay.

In the programme there is emphasis on both the development of theory and methodology and on practical application of geographical concepts to the economic, social and political problems of Canada and other parts of the world. The “applied geography” aspects of the programme are enhanced by the availability in the Faculty of elective courses in Planning and Man-Environment Studies given by faculty with academic and practical experience in urban and regional planning, resource management, conservation, sociology of rural development, environmental design, and engineering systems analysis.

Many graduates of the geography programme proceed to further graduate work or jobs in education, in government, industry and planning agencies.

Although the programme is broad in scope, it permits a student to specialize in one of three major aspects of the discipline: applied physical, economic-urban, or cultural-regional geography. Advanced elective courses are available in each of these three streams, and further concentration is possible by careful selection of courses from related fields in other parts of the University.

The programme is liberal in that the only requirement other than the core of Geography courses is that five of the elective courses be taken outside the Faculty of Environmental Studies. These may be taken all in one discipline or in a variety of disciplines.
Department of Geography

Students should note that geography courses are open to any student in the University. Students taking the geography programme in the Faculty of Arts will receive a B.A. (Bachelor of Arts) degree and those in the Faculty of Environmental Studies will receive a B.E.S. (Bachelor of Environmental Studies) degree.

The Department of Geography has both Master's and Ph.D. graduate programmes. At the graduate level the course work and research is concentrated on some specific subfield of Geography. The Department's areas of research specialization include applied geomorphology, air photo interpretation and remote sensing, urban and economic geography, agricultural geography and rural development, regional planning and development, resources management and Europe.

Bachelor of Environmental Studies
(Honours Geography Programme)

Undergraduate Geography Courses

Note 1 All courses are open to any student from any Faculty or School of this University whenever prerequisites are met.

Note 2 The Department of Geography offers General and Honours programmes both in the Faculty of Arts (B.A.) and the Faculty of Environmental Studies (B.E.S.). Joint honours programmes with any other subject in the University may be arranged subject to approval. Some examples of such programmes may be seen under the Faculty of Arts programme section earlier in the calendar.

Note 3 The letter R designates courses given through Renison College.

Note 4 Geog. 101* and Geog. 102* are given both fall and winter terms. It is immaterial which of these courses is taken first as neither is sequential to the other.

Note 5 A full credit can be either a course of two terms duration or two separate courses each of one term duration.

Honours Geography

Year 1 Geography 102* Introduction to Physical Geography

and one but no more than three of:

Geography 101* Introduction to Human Geography
Environmental Studies 195* Introduction to Environmental Problems
Geography 110* Tutorial in Geography
Geography 125R* Introduction to the Developing World
Geography 126R* The Emerging "Third World"
Geography 127* Regional Problems of Europe

Plus additional credits chosen after consultation with the department so that the student has 6 full credits. Note that all of these courses (except Geography 110*) are available to any student in the University.
Year 2
Environmental Studies 200* Field Ecology
Geography 201* Some Basic Topics of Climatology and Geomorphology
Geography 202* Some Basic Topics of Economics and Urban Geography
Geography 260* Introduction to Cartography and Map Analysis
Geography 275* Introductory Air Photo Analysis and Remote Sensing
Geography 271* Introduction to Quantitative Research Methods

and one of:

Geography 203* Some Basic Topics of Cultural and Regional Geography
Geography 232* Geography of Population
Geography 320 World Regional Geography
and additional credits so that a student should have completed by the end of second year, 11 full credits.

Year 3
Geography 391* Field Research
Two and one half credits of geography electives
Two credits chosen after consultation with the Department

Year 4
Geography 481* Frontiers in Geography
Geography 490 Senior Honours Research Essay
and additional credits so that a student should have a minimum of 21 full credits

* An asterisk indicates a half-credit course

Note 1 While twenty-one full credits is the minimum required for the degree of Bachelor of Environmental Studies (Honours Geography) students may take an enriched programme of up to twenty-four credits maximum.

Note 2 The minimum and maximum number of full credits in geography courses in the programme are nine and thirteen unless a student takes an enriched programme in which case the additional electives may all be in Geography.

Note 3 Students must take a minimum of five full credits in Faculties other than the Faculty of Environmental Studies.

Note 4 To enter Year 2 of the Honours Geography programme, a student must achieve in Year 1 a minimum overall average of B— (70.0) and an average of B (73.0) in his Geography and Environmental Studies courses. In subsequent years, a student must continue to achieve an overall average of B— (70.0) and an average of B (73.0) in his Geography and Environmental Studies courses.

Note 5 It is recommended that all honours students specialize at third and fourth year levels. The department offers specialized streams in (a) Applied Physical Geography (b) Economic Geography (industrial resources, rural, and urban aspects) (c) Regional/Cultural Geography. Additional courses in areas of specialization can be obtained from other disciplines in University.

Note 6 Since many departments doing graduate work in Geography demand proficiency in a foreign language, students intent on graduate work should consider taking a foreign language in their first year.
Note 7  Students intending to teach in Secondary Schools are advised to take at least two full credits (or equivalent) of Regional Geography courses.

Note 8  This programme prepares students for graduate study in Geography or in Planning, for entry to Secondary School teaching, or for research positions in industry and government.

Note 9  All Geography students are encouraged to take summer employment which will provide experience useful to a geographer. Where possible, the Department will provide information and assistance in securing such summer employment.

Note 10  For some courses, participating students may be expected to make a small financial contribution to defray heavy equipment/travel costs, e.g. Geog. 391* (Field Camp), which is mandatory for all third year honours students and make-up students.

Joint Honours  Joint Honours programmes have been arranged between Geography and several other disciplines in the University. Detailed programmes have been worked out with Anthropology, Canadian Studies, Earth Sciences, Economics, English, History, Man-Environment Studies, Mathematics, and Political Science. These programmes lead to the degrees of the Faculty in which the student is registered, providing always that in addition to the requirements of the specific programme the general requirements of that faculty have been met. For the programmes already approved, depending on the student's registration, the following degrees may be awarded.

B.E.S. or B.A.  Joint Geography with:
Anthropology,
Canadian Studies
Economics, English,
History, Political Science,
Man-Environment Studies

B.E.S. or B.A.  Mathematics
or B.Math.

B.E.S. or B.Sc.  Earth Sciences

The Department of Geography is prepared to work out other programmes for keenly interested students who meet Honours standards.

Students enrolled in these programmes are required to obtain at least seven course credits in Geography with the exception that five are required in the joint programme with Earth Sciences; those intending to qualify for the Type "A" certificate for teaching high school require a minimum of nine credits in Geography.

Geography course requirements in joint programmes are identical with those of the Geography Honours Programme above, with the exception that where both Departments participating in the programme require courses of similar content, a student shall meet that requirement in one Department only. This might be expected to apply in the cases of technique courses, field research and the Senior Honours Essay; students should obtain clarification from the Undergraduate Officers of the respective departments before registration.
Department of Geography

Geography Minor for Honours Students in Other Faculties

The requirements are the same as those noted for the General Geography Programme.

General Geography Programme

Year 1

Geography 102* Introduction to Physical Geography

and one of, but not more than three of:

Geography 101* Introduction to Human Geography
Environmental Studies 195* Geography and Environmental Problems
Geography 110* Tutorial in Geography
Geography 125R* Introduction to the Developing World
Geography 126R* The Emerging “Third World”
Geography 127* Regional Problems of Europe

Four credits selected in consultation with the Department. (Note that all of these courses (except Geog. 110*) are available to any student in the University.)

Year 2

Environmental Studies 200* Field Ecology
Geography 201* Some Basic Topics of Climatology and
Geography 202* Some Basic Topics of Economic and Urban Geography

one of:

Geography 203* Some Basic Topics of Cultural and Regional Geography
Geography 232* Geography of Population
Geography 320 World Regional Geography

and additional credits so that a student should have completed by the end of second year 10 full credits.

Year 3

Geography 381* the Nature of Geography
One and one-half courses of Geography electives
Three courses selected in consultation with the Department.

Note 1 Fifteen full credits is the minimum requirement for the degree of Bachelor of Environmental Studies (General Geography). However, an enriched programme of up to eighteen full credits may be arranged.

Note 2 A minimum of five full geography credits constitutes a Geography Major but up to eight full geography credits may be taken in this programme. Students taking an enriched programme may choose additional geography electives.

Note 3 Students must take a minimum of four full credits in Faculties or Schools other than the Faculty of Environmental Studies.

Note 4 Students must maintain an overall average of C — (60.0) with an average of C (63.0) in their geography courses.
Department of Man-Environment Studies

Bachelor of Environmental Studies
(Honours Man-Environment Studies Programme)

Nature of the Programme
The four-year honours degree programme in Man-Environment Studies is unique in Canada, although similar ones have been established in American and European universities since this one started at Waterloo in 1969. It uses the wide-ranging theme of man-environment interrelationships to give intellectual perspective and orientation, supported by related study in the contributory academic disciplines. Through problem and issue-oriented study of Man interacting with the natural environment he uses, the cities and towns he constructs and the society and communities he creates, ample scope is provided for a broad-based education which recognizes to a degree the need for contemporary “relevance” in the approach and content of higher education.

For many students a “theme” programme of this kind offers a more satisfying undergraduate education than some traditional alternatives. It is a programme which challenges students to acquire an intellectual acumen that is not artificially constrained by academic disciplinary boundaries, to obtain a considerable degree of understanding of complex environmental problems, and to develop some of the skills related to their solution. It is not a programme which focuses on technical matters in some particular area in order to meet a professional requirement within an undergraduate degree. Its working assumption is that education comes first and more specific training after students have a much better personal understanding of the various possibilities and can decide more knowingly on how best to proceed.

The programme does provide a good basis from which professional qualifications can be sought in a number of related areas in part through concurrent, but mainly through graduate study. It would provide for society a type of well educated person who in due course could usefully contribute to the policy-making and management function in the public service or in the private sector, or serve particularly well the role of advocate, critic or initiator in the continuous process of social change and adjustment.

The Department is unique in having a multidisciplinary faculty whose formal education and experience ranges over a number of disciplines in the natural sciences, social sciences and the fine arts. They bring to the programme qualifications in fields such as anthropology, agriculture, biology, communications science, earth sciences, economics, fine arts, geography, mathematics, planning, political science, psychology, sociology and social work, chemistry, and chemical engineering, as well as a variety of experience in such diverse areas as the planning of education systems, ecological research, geological development, economic studies and urban affairs.

For the approach used in Man-Environment studies, considerable academic innovation has been necessary. Besides lectures and labs, the programme uses modular instruction units; student-selected projects and community work; field trips to environments other than lecture halls; team teaching; a regular flow of visitors from outside the university; and workshop instruction to help develop techniques and skills relevant to environmental studies.
In addition, through its elective courses the man-environment studies programme provides some of the input into the pre-professional training of planners and architects, as well as an environment-oriented perspective for those who will ultimately enter other careers. The department is in a favourable position to keep in touch with developments in a wide range of academic subjects so that professional programme students are constantly encouraged to form their ideas, attitudes and goals in the wider context of Man and his Environment.

**Curriculum**

For the core of the Honours Programme, first year introductory courses examine major environmental themes and issues from the perspective of the natural and social sciences, and introduce ways of doing research and analyses on them. In the second year this is followed by further work in ecology, the social sciences, and on techniques relevant to environmental studies. In each of the four years there are "seminar-workshops" in which individual or small group projects selected by students are undertaken to develop skills for analysing and resolving environmental problems and issues. An increasing number of students are able to incorporate or relate project work they undertake for the "seminar-workshops" to the programme of community organizations, government agencies and other groups who have environmental interests and activities.

In addition, about half of the 22 courses required for a degree can be selected from elsewhere in the university so that each student can develop the mix of subjects and skills best suited for achieving his/her own education objectives. Faculty will advise students on this, but essentially there are three broad options. Students can combine man-environment studies with some one discipline as a joint honours degree, they can concentrate studies in some other subject to the extent it becomes recognized as a "minor" orientation in addition to man-environment studies, or they may prefer to explore a number of other subjects they find of interest. Among courses which can be chosen are others in the Faculty of Environmental Studies in areas such as environmental design, environmental management, and social and community studies. In each case, however, students should give careful consideration to their choices in terms of the careers or goals they may wish to pursue after obtaining a B.E.S. degree.

For the third and fourth year in particular, elective choices should be made in consultation with faculty advisors.

The Honours Programme requires a minimum of six full credits or the equivalent per semester for the first two years and five full credits or their equivalent per semester in the third and fourth years. Each student must have completed twenty-two full credits or the equivalent before graduation with a cumulative overall average of B— (70.0); a major average of B (73.0) must be maintained in the required courses and Environmental Studies courses.

The programme is as follows:

**Year 1**

- M.Env. 120 (Y) Environmental Issues and the Natural Sciences
- M.Env. 130 (Y) Environmental Issues and the Natural Sciences
- M.Env. 150 (Y) Environmental Issues: Research and Analysis
- M.Env. 190 (Y) Seminar-Workshops

Electives: Two full credits: Four half-year courses or equivalent
Year 2

Env.S. 200* Field Ecology
One of M.Env. 241* Social Change
or any half-year course in the social sciences
One of M.Env. 271* Introduction to Quantitative
Research Methods:
Phil. 140* Fundamentals of Logic or another suitable methods
course selected in consultation with the Undergraduate Officer
M.Env. 290 (Y) Seminar-Workshop
Electives: Three and one-half full credits:
seven half-year courses or equivalent.

Year 3

M.Env. 390 (Y) Seminar-Workshop (credit value 1 or 2 by
consent of Faculty)
Electives: Three or four full credits: six or eight half year courses
or equivalent.

Year 4

M.Env. 490 (Y) Seminar-Workshop (credit value 1, 2, 3 by
consent of Faculty)

One credit of:
M.Env. 410 Honours Seminar: Natural Resources Management
M.Env. 420 Honours Seminar: Community Environments
M.Env. 430* Honours Seminar: International Co-operation on
Environmental Problems
M.Env. 431* Honours Seminar: Comparative Approaches to
Environmental Management
M.Env. 440 Honours Seminar: Communication and Education
M.Env. 450 Honours Seminar: Environmental Design
Electives: One to three full credits: two to six half courses or
equivalent.

Note 1 Students wishing to enrol in M.Env. 390 and 490 for more than
one credit will submit a proposal to the faculty outlining the nature
and scope of the project to be undertaken.

Note 2 For some courses, participating students may be expected to make
a small financial contribution to defray travel costs, e.g. M.Env.
334* (Comparative Development of Northern Regions).

Joint Honours

The department offers Joint Honours Programmes in conjunction
with a number of other departments and faculties across the cam-
pus. Students registered in the Faculty of Environmental Studies
will be awarded the Bachelor of Environmental Studies;
they must complete the core requirement of the Man-Environment pro-
grame in addition to the programme approved by the other
department.

Students from other departments choosing a Joint Honours
programme involving Man-Environment Studies must complete
the equivalent of seven full Man-Environment courses. The pro-
grame for such students will be worked out in consultation with
the Man-Environment undergraduate officer.

Joint programmes have been approved between the Department
of Man-Environment Studies and the Departments of Anthrop-
ology, Geography, Russian, and Psychology.

A special programme, Man-Environment Studies (Biology
Option), has been arranged with Man-Environment Studies and the
Department of Biology. Man-Environment students interested in
this programme should consult with their Undergraduate Affairs
Officer.
School of Urban and Regional Planning

Bachelor of Environmental Studies (Honours Urban and Regional Planning Programme)

The emphasis of the programme is on Planning as a process, conceived in terms broad enough to include policy-making, research, and decision making. The subject focus is regional; that is, the integrated planning of regions, large and small, with both their urban and rural components, including urban-centred or core regions, in which the policy emphasis is on environmental issues and other regional contexts, typical of the Canadian scene, in which resource potentials are not yet realized, and where development issues and problems of human adjustment are in the forefront.

In order to implement this approach, the School of Planning has gathered a team of faculty with diverse academic backgrounds and various kinds of planning experience.

The broad educational aim of the School is to prepare the student for active participation in the planning process. This leads to an approach which gives equal emphasis to the 'why' and 'how' of Planning. To make this effective, and vital, has required that a style be adopted that strives for a continuum between classroom and field experience, between Planning studies and related disciplines, and between academic studies and future professional practice. Realizing this concept requires the integration within the programme of selected elements from the discipline of Geography and from other sciences, social sciences and applied sciences. For this purpose, the School of Planning has been located in a Faculty with an interdisciplinary approach to a wide range of environmental issues.

The programme gives a well-rounded preparation for a wide variety of professional or graduate work in urban planning, regional planning and resource development. Courses on the theory, methods and philosophy of Planning provide an integrating framework. The student is also given an opportunity to pursue a special interest in economic, social, and ecological issues in planning, or in planning methodology. This is done through the selection of elective courses. Students are also encouraged to select Senior Honours Essay Topics from these special fields of interest.

The integration of planning experience into the programme is considered an important part of the education process. Students are expected to gain planning experience during the summer vacation period if opportunities are available. The School endeavours to help students find suitable work, particularly between their second and third, and third and fourth years. It is hoped that through the work of the Professional Liaison Officer, the student will be brought into direct contact with the profession and will be exposed to problems typical of those encountered in practice, as well as being introduced to projects and operations far beyond the scope of any university laboratory.

Appropriate experience provides the maturing prospective planner with an opportunity for gaining a better understanding of the discipline and allows for the testing of personal learnings and aptitudes. In seeking assistance for finding meaningful planning experience, students will be asked to give permission for the release of their marks to employers.
<table>
<thead>
<tr>
<th>Year 1</th>
<th>Required Planning Courses</th>
<th>Elective Planning Courses</th>
<th>Required Other Courses</th>
<th>Other Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plan 100 - Introduction to Planning Concepts and Methods (1 credit)</td>
<td>Plan 159* - Graphics for Planning (see notation: Year 2 re: Geography 275*) (½ credit)</td>
<td>Geog. 101* - Introduction to Human Geography or Env.S. 195* - Introduction to Environmental Problems</td>
<td>1½ or 2 courses depending on whether Philosophy or Political Science is elected. Elective may be chosen from Elective Planning courses or from any available credit courses offered by the University in general. The following are suggested:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Geog. 102* - Introduction to Physical Geography Econ. 101* - Introduction to Economics Econ. 102* - Introduction to Economics. An introductory course offered by the Sociology Department. Introductory Philosophy or Political Science. (A total of 3 or 3½ credits)</td>
<td>- Math - Computer Science - Man-Environment - French or any other language - Biology - Earth Sciences - Music - Drama - Civil Engineering</td>
</tr>
<tr>
<td>Year 2</td>
<td>Env.S. 200* - Field Ecology Plan 255 - Planning Surveys and Analysis Plan 256 - Principles of Environmental Design Plan 271* - Introduction to Quantitative Research Methods (2½ credits)</td>
<td>Plan 258* - Special readings in Planning Plan 222* - Canadian Regional Issues (Geog. 322* - Regional Geography of Canada, may be substituted). Plan 272* - Computer Programming and Selected Terminal Systems Plan 307* - Social Survey Techniques</td>
<td>Geog. 270* - Introduction to Cartography and Air Photo Interpretation. (If Plan 159* was taken in Year 1, then Geog 275* Introductory Air Photo Interpretation may be taken instead of Geog. 270*) Geog. 202* - Some Basic Topics of Economic and Urban Geography A full-year course with a Sociology theme is required in Year 2 or Year 3. If taken in Year 2 this will reduce the number of other electives to 1½ courses.</td>
<td>2½ courses including any elective Planning courses. Electives may be chosen from any available courses offered by the University for which the student has the prerequisite. The following are suggested:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Geog. 270* - Introduction to Cartography and Air Photo Interpretation. (If Plan 159* was taken in Year 1, then Geog 275* Introductory Air Photo Interpretation may be taken instead of Geog. 270*) Geog. 202* - Some Basic Topics of Economic and Urban Geography A full-year course with a Sociology theme is required in Year 2 or Year 3. If taken in Year 2 this will reduce the number of other electives to 1½ courses.</td>
<td>- Economics - Anthropology - Geography - Man-Environment - Political Science</td>
</tr>
<tr>
<td>Year 3</td>
<td>Honours Urban and Regional Planning Recommended Programme</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Required Planning Courses</td>
<td>Elective Planning Courses</td>
<td>Required Other Courses</td>
<td>Other Electives</td>
</tr>
<tr>
<td></td>
<td><strong>Plan 300 - Seminar/Workshop</strong> in Urban and Regional Planning</td>
<td>Plan 301* - Planning Design Projects</td>
<td>A full credit course or two 1/2 credit with a Sociology theme are required in year 2 or 3 in addition to the Introductory courses taken in Year 1. Courses may be selected from</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 307</em> - Social Research Techniques</em>*, if not taken in Year 2.</td>
<td>Plan 314* - Urban Society</td>
<td>- Plan 314*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 391</em> - Field Research Methods and Projects</em>* — <em>(related to Plan 300).</em></td>
<td>Plan 316* - Multivariate Statistics</td>
<td>- Plan 332*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Also</em> courses chosen from the Elective Planning courses to make a total of 4 credits.</td>
<td>Plan 317* - Nonparametric Statistics</td>
<td>- Plan 333*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 301</em> - Planning Design Projects</em>*</td>
<td>Plan 318* - Spatial Analysis Techniques</td>
<td>- Plan 415*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 314</em> - Urban Society</em>*</td>
<td>Plan 319* - Regional Planning Techniques</td>
<td>or Sociology courses offered by the Department of Sociology and Anthropology.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 316</em> - Multivariate Statistics</em>*</td>
<td>Plan 332* - The Sociology of Regions</td>
<td>Two courses including any elective planning courses other than those included in the 4 required courses — <em>(see note under required Planning courses)</em>, such courses as the following:</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 317</em> - Nonparametric Statistics</em>*</td>
<td>Plan 333* - The Sociology of Regional Planning</td>
<td><strong>Economic Issues</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 318</em> - Spatial Analysis Techniques</em>*</td>
<td>Plan 344* - Principles of Recreation Planning</td>
<td>Geography 310*/311*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 319</em> - Regional Planning Techniques</em>*</td>
<td>Plan 357* - Conservation and Resource Management</td>
<td><strong>Urban Issues</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 332</em> - The Sociology of Regions</em>*</td>
<td>Plan 358* - Regional Planning and Development</td>
<td>Geography 350*/351*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 333</em> - The Sociology of Regional Planning</em>*</td>
<td>Plan 414* - Housing Policies</td>
<td><strong>Recreation Issues</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 344</em> - Principles of Recreation Planning</em>*</td>
<td>Plan 415* - The Small Group in the Planning Process</td>
<td>Geography 410*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 357</em> - Conservation and Resource Management</em>*</td>
<td>Plan 470* - History of Urban Planning</td>
<td><strong>Philosophy of the City</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 358</em> - Regional Planning and Development</em>*</td>
<td>Plan 475* - Projects, Problems and Readings in Planning</td>
<td>Philosophy 425*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 414</em> - Housing Policies</em>*</td>
<td>Plan 476* - Projects, Problems and Readings in Planning</td>
<td>or any other courses in the student's field of interest.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 415</em> - The Small Group in the Planning Process</em>*</td>
<td>As Year 3</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em><em>Plan 470</em> - History of Urban Planning</em>*</td>
<td></td>
<td>Two full-credit courses in student’s field of interest.</td>
<td></td>
</tr>
<tr>
<td>Year 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The four year Honours programme is recognized by the professional association of planners in Canada (the Town Planning Institute of Canada) and an increasing number of employers as a satisfactory preparation for a wide range of careers.

**Note 1** Courses with an asterisk (*) are half credit courses. Two half-year courses occurring in sequence and given the same timetable slot are designated as follows: e.g. Planning 332*/333*.

**Note 2** To enter Year 2 of the Honours Planning Programme, a student must obtain a minimum overall average of B— (70.0) and a B (73.0) in Planning and Environmental Studies courses and must obtain credit standing in 6 full courses. In subsequent years, a student must maintain a cumulative, overall average of B— (70.0) as well as an average of B (73.0) in Planning and Environmental Studies courses.

**Note 3** Planning 156* (Fall and Winter terms) and Planning 342* and 343* are intended for students in other disciplines and may not be taken for credit by Planning students.

**Note 4** If Planning 159* Graphics for Planning is taken as an elective in Year 1, then Geography 275* Introductory Air Photo Interpretation may be taken in place of Geography 270* Introduction to Cartography and Air Photo Interpretation in Year 2.

**Note 5** Students interested in the Political Science electives: Pol. Sci. 330 and 340 are advised to first complete an introductory course from Pol. Sci. 115*/116*, or Pol. Sci. 260.

**Note 6** A student wishing to register for a readings and research course (e.g. Planning 258*) must first make arrangements with a faculty member to provide the necessary supervision and guidance.

**Note 7** Planning 307* may be taken in Year 2 or Year 3.

**Note 8** Students selecting the Quantitative Methods elective in the Fourth Year are required to select Planning 319*; and, if they wish, any of Planning 316*, 317*, 318*.

**Note 9** Not all the courses listed below are offered each year. Students should consult the School prior to registration.

**Note 10** The number of hours of lectures shown after the course description is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

**Note 11** For some courses, participating students may be expected to make a small financial contribution to defray materials/travel costs, e.g. Plan 159* (Graphics for Planning).
Degrees

The Faculty of Environmental Studies offers two undergraduate degrees: a Bachelor of Environmental Studies (B.E.S.), and a Bachelor of Architecture (B.Arch). At the graduate level a Master of Arts (M.A.) and a Ph.D. Degree may be obtained in both Geography, and Regional Planning and Resource Development.

In addition, the Geography and Man-Environment Departments offer joint honours programmes with many other departments in the University (see programmes for other details).

Degrees may be obtained in the following programme areas:

- B.E.S. - Pre-Professional Architecture (3 years), on rotating work/study co-operative scheme.
- B.E.S. - Honours Geography (4 years)
- B.E.S. - Major in Geography (3 years)
- B.E.S. - Honours Man-Environment Studies (4 years)
- B.E.S. - Honours Urban and Regional Planning (4 years)
- B.Arch. - Professional Architecture (2 years, with co-operative work terms following completion of B.E.S. Pre-professional Architecture).
- M.A. - Geography
- M.A. - Regional Planning and Resource Development
- Ph.D. - Geography
- Ph.D. - Regional Planning and Resource Development

The student should choose the unit most suited to his interests. There is considerable freedom to transfer to other faculties after year one, depending upon the student's academic record and programme. Ease of transferring between the units of the Faculty of Environmental Studies varies. Transfer to the Department of Geography or the Department of Man-Environment Studies is relatively easy. Transfer to the School of Architecture is not normally permitted above Year 1, except where the applicant has done acceptable work at another approved School of Architecture. Transfer to the School of Urban and Regional Planning is not normally permitted above Year 2.

Admission

The admission requirements and procedures for all programmes are outlined in detail in Chapter 2 of this Calendar. The following points emphasize some of the admission requirements which relate specifically to programmes in the Faculty of Environmental Studies.

Applicants from Ontario

Because of the increasing use of statistics and quantitative methods in environmental research it is recommended, but not required, that students present at least one Grade 13 Mathematics course for admission to programmes in Environmental Studies. Grade 13 Geography is similarly recommended for those applying to the Geography Department. For applicants to the School of Architecture, Functions and Relations, Calculus, and Physics at the Grade 13 level are required. (In addition, standing in English at the Grade 13 level will be required for Fall 1975 admission to Architecture.)
Applicants – Other Than Ontario Grade 13

Applicants in this category should refer to Chapter 2 of this Calendar for general University admission requirements. Furthermore, applicants to the School of Architecture must show equivalent proficiency to Ontario Grade 13 applicants in the areas of Mathematics and Physics.

Interviews

Students being seriously considered for admission to the Schools of Architecture and Urban and Regional Planning are normally required to participate in an interview as part of the admissions process. For Architecture, a test will be conducted by the School during interviews to establish ability to comprehend the various thematic areas.

Registration

September 3, 4, 5, 6, 1974.

Fees

Refer to Chapter 3 page 45.

Examinations and Standings

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

Students should note that the Faculty of Environmental Studies operates under a “course system” in which student progress is measured by courses successfully completed rather than by years. Students who have passed fewer than five courses will be considered Year 1 students; those who have passed at least five courses but fewer than ten will be considered Year 2 students; those with at least ten but fewer than sixteen, Year 3, and those with sixteen or more, Year 4.

1) Final Examinations

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

b) Failure to write an examination is ordinarily considered a failure to pass. A student who defaults a final examination, except for a properly certified reason, shall have no make-up examination privileges and may be required to 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 of the set examination date.

c) A student will be eligible for make-up examinations only when failure to pass is attributable to extraordinary circumstances. In addition, students i) must have attended a reasonable number of lectures in the course in which they propose to write, and must have satisfied all term work requirements; ii) must have secured the permission of the professor concerned.
d) Appeals against faculty decisions made under these regulations may be made in writing to the Undergraduate Affairs Committee of the Faculty through the appropriate Undergraduate Affairs Officer. The form of examination is at the discretion of the individual faculty member. Where final written examinations are required they are held in December, April, or August. Oral examinations may be required at the discretion of individual departments. The normal duration for written examinations is three hours.

2) Standing

a) Standing in an individual subject is determined by combining the marks assigned for term work with those obtained in the final examination. For the purpose of striking averages, the following numerical weight will be assigned to grades received in individual courses:

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Average</th>
<th>Poor</th>
<th>Failing</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>95</td>
<td>B+</td>
<td>78</td>
<td>C+</td>
<td>68</td>
</tr>
<tr>
<td>A</td>
<td>89</td>
<td>B</td>
<td>75</td>
<td>C</td>
<td>65</td>
</tr>
<tr>
<td>A-</td>
<td>83</td>
<td>B-</td>
<td>72</td>
<td>C-</td>
<td>62</td>
</tr>
</tbody>
</table>

b) The range of marks assigned to letter grades is as follows:

- A+ (90-100)
- B+ (77-79)
- C+ (67-69)
- D+ (57-59)
- F+ (42-49)
- A (85-89)
- B (73-76)
- C (63-66)
- D (53-56)
- F (35-41)
- A- (80-84)
- B- (70-72)
- C- (60-62)
- D- (52-52)
- F- (0-34)

c) Overall standing is determined by the cumulative average of grades assigned for all courses taken at the University except where a course is retaken, in which case the second grade will be included in the cumulative average regardless of whether it is higher or lower than the first. The first grade will, however, remain on the student's record. Students (except those in the School of Architecture) should note that their major average is determined by the cumulative average of grades assigned for all courses taken in the student's major programme plus those courses which are given the Environmental Studies designation.

d) To be considered in good standing in the Honours programmes, a student must maintain a cumulative overall average of at least B— (70.0) as well as an average of at least B (73.0) in his field of specialization (unless otherwise specified in a departmental Honours programme). If an Honours programme candidate's average falls below the prescribed minimum, he or she can be given conditional standing if in the opinion of the School or Departmental Promotions Committee he or she can attain Honours standing before graduation. If not, he or she, upon request, will be considered a candidate for a degree in the General Geography Programme and the regulations in (e) below will apply.

e) To be considered in good standing in the General Geography programme, a student must maintain a cumulative overall average of at least C— (60.0) as well as an average of at least C (63.0) in his field of specialization. If at any time a student's average falls below C— (60.0) or his average in his field of specialization below C (63.0), he will be granted conditional status for one year, during which period he/she must make reasonable progress toward
obtaining good standing or he/she will be asked to withdraw. A student whose cumulative overall average falls below D (53.0) may continue only with the permission of the Undergraduate Affairs Committee.

f) The only general programme in the faculty is the General Geography Programme. The B.E.S. programme in the School of Architecture is a pre-professional programme. A regular (full-time) student in the General Geography Programme must in each academic year enrol in at least five courses, but in not more than six. A regular student in the Honours programmes must each year enrol in at least six courses (unless otherwise specified in a departmental Honours programme), but in not more than seven. Students may be enrolled for reduced programmes after obtaining the approval of the appropriate Undergraduate Affairs Officer.

g) Even while otherwise in good standing, a student who fails more than two full-credit courses or the equivalent over the academic year or who, in the opinion of the School or Departmental Promotions Committee, is deemed not to be profiting from University studies may be required to withdraw regardless of his/her cumulative average.

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

To pass from one term to the next in the B.E.S. and B.Arch. programmes it is necessary for the student to:

1) obtain an overall cumulative average of (60.0) (beginning with the Year 1 class entering in September 1974, promotion from Year 1 to 2A will require an overall cumulative average of 65.0. Term promotion from 2A through to 3B will require an overall cumulative average of 70.0 each term).

2) pass the studio course. If any studio course (Arch. 192, 193, 292, 293, 392, 393, 492, 493, 592, 593) is failed, the student may not proceed to the studio course of the next term, until the studio course is passed.

3) fail not more than two courses in any single term, where a course is four months in duration; a minimum passing grade in any course is D.

Normally students of the School are permitted to take only one more or one fewer half-course (academic weight 0.50) than that prescribed for the particular year and term registered in. Any further addition or reduction to the student's programme must be approved by the Undergraduate Officer of the School of Architecture.

The following procedures have been set out for those students who have not met the above conditions.
Supplemental Examinations
A student failing any Architecture course with an F+ standing has supplemental examination privileges and may take such an examination as arranged in accordance with University policy.

Incomplete Marks
Students receiving an Incomplete standing in any prerequisite Architecture core subject during any given term, must clear up this deficiency before being permitted to take the respective follow-up course. If an Incomplete standing is received in any Architecture elective subject, the student has up to 11 months to clear this deficiency. However, any Incomplete standing whether core or elective not cleared within the 11 month period, will automatically be converted to a grade of F—.

Appeals
Appeals against School decisions concerning grades and promotions made under these regulations may be submitted in writing to the Chairman of the Appeals Committee of the School. The Appeals Committee sits once each term, and the student is advised to contact the School as soon as possible to determine the next sitting of the Appeals Committee.

Academic Programmes
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 individual courses in order to have a more comprehensive idea of what the content of any programme would include. He should consult his High School Guidance Officer, Chairman or Undergraduate Officer of any University department, or the Registrar, by letter or in person for additional clarification and information.

Course and Programme Changes
a) Students may add and drop half courses during the first three weeks of the Fall, Winter and Spring Terms upon having the appropriate change form completed.
b) Students may add and drop full-year courses during the first three weeks of the Fall term upon having the appropriate change form completed.
c) After these periods, students will be allowed to add courses only with the permission of the instructor and the appropriate undergraduate officer and upon completing the appropriate change form.
d) After these periods, students enrolled in more courses than their programmes require may, upon having the appropriate change form completed, with the signature of the appropriate undergraduate officer, drop courses to reduce their programmes to the specified minimum up to but not later than four weeks prior to the end of lectures in the courses being dropped.
e) Students may reduce their programmes below the specified minimum only upon the recommendation of the undergraduate officer of the major department.
f) A course that has not been dropped officially (i.e. recorded in the Registrar’s Office) prior to the last four weeks of lectures in that course will receive a grade and be counted in the student's average.
11
Faculty of Human Kinetics and Leisure Studies
Faculty of Human Kinetics and Leisure Studies

The Faculty of Human Kinetics and Leisure Studies was officially formed in the Fall of 1972. This Faculty has gradually evolved from the School of Physical and Health Education (1966-1967) and the School of Physical Education and Recreation (1968-1972). It is composed of three departments: The Departments of Kinesiology and Recreation administer the academic and research programmes, and the Department of Athletics conducts programmes of intercollegiate and intramural athletics and a service programme in physical activity for all students, faculty and staff.

The programmes of the Faculty have developed rapidly in response to student needs and interests and to the changing needs and demands of society. Four years ago a regular stream was added to the Co-operative programme to enable students who wanted the programmes but not the co-operative aspects to attend the University of Waterloo. The Regular programme has grown to the point where it equals the Co-operative programme enrollment. At the same time elective courses were introduced into each department making it possible for students to pursue in some depth an area of Kinesiology or Recreation in which they had a special interest. 1974 will see even greater opportunities for study by the individual students.

Kinesiology The Kinesiology programmes are multi-dimensional studies of human physical movement incorporating the biological, physical, and social sciences. Extensive laboratory facilities enable the students in the programme to be among the few undergraduate students in the world to examine first hand the problems inherent within human physical activity.

A General programme was added in 1973, as were two streams for concentration: Kinesiological Sciences, and Applied Kinesiology. Freshman students need not concern themselves with these channels, as all first year students enrol in Honours Kinesiology.

Two distinct Honours Options are also available within the Department. Students may enrol directly into the Dance, or the Health Studies Options. Both programmes are outlined in the Faculty undergraduate brochure. All students within the Department are permitted to take some electives in the other areas.

The Kinesiology programmes are designed to provide graduates with maximum flexibility in choosing a career. Graduates are already found in a variety of agencies ranging from teaching (the Honours programme meets all requirements for admission to the Type "A" Certificate courses in Physical and Health Education at the Colleges of Education in Ontario), to hospitals for the aged, infirm, retarded, and psychiatric populations, fitness institutes, sports equipment manufacturing outlets, YM-YWCA's, youth centres, university teaching and/or graduate programmes, and related fields.

Recreation The academic programme in Recreation has been designed to give each graduate the body of knowledge necessary to prepare for a professional position in the field of Recreation. Students completing the Honours Degree programme can, in addition, complete course sequences resulting in a declared option in Recreation
Co-operative System

The Co-operative system gives the student an opportunity, unique in Canada, to gain experience in several of the career fields open to Kinesiology and Recreation graduates. Work opportunities are planned in educational institutions, community recreation departments and private agencies such as YM-YWCA. Arrangements for work assignments are made through the Department of Co-ordination 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. Students should refer to Chapter 6 of the calendar for further details concerning the Co-operative programmes.

Degrees

Graduates of Kinesiology programme will receive either an Honours or General Bachelor of Science degree in Kinesiology. Recreation programme graduates are awarded an Honour Bachelor of Arts degree in Recreation.

Regular Programme

The regular programme consists of eight academic terms in a period of four years. All courses are offered in the Fall and Winter terms. Students in all programmes enrol in September.

Co-operative Programme

All Year 1 students enrol in September. Precise dates for the beginning and end of each year of the other terms are shown in the academic calendar for the year. The eight terms of study and six terms of employment provided in the course are arranged as shown in the following diagram:

<table>
<thead>
<tr>
<th>1974</th>
<th>1975</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>First Term</td>
<td>Second Term</td>
<td>Work Period</td>
</tr>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>1977</td>
<td>1978</td>
<td>1979</td>
</tr>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
<tr>
<td>Fifth Term</td>
<td>Sixth Term</td>
<td>Work Term</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1974</th>
<th>1975</th>
<th>1976</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>First Term</td>
<td>Second Term</td>
<td>Work Period</td>
</tr>
<tr>
<td>Winter</td>
<td>Spring</td>
<td>Fall</td>
</tr>
</tbody>
</table>
Admission

The admission requirements and procedures for all programmes are outlined in detail in Chapter 2 of this Calendar. The following points emphasize some of the admission requirements which relate specifically to programmes in the Faculty of Human Kinetics and Leisure Studies.

Application from Ontario

Grades 13

Applicants to the Kinesiology programme are advised to select a Grade 13 programme which includes one or more of the following courses:

- Calculus
- Biology
- Chemistry
- Physics

Applicants to the Recreation programme are advised to include both Geography and Biology in their Grade 13 programme.

Advanced Standing

In unusual circumstances advance standing may be granted for entry into Year 3 or 3A. All transfer students will be required to complete at least the equivalent of two years of study (i.e. at least 10 full year courses) regardless of the number of full year courses that are presented.

Examinations and Standings

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

Students should note that the Faculty of Human Kinetics and Leisure Studies now operates under a "course system" in which student progress is measured by courses successfully completed rather than by years. Students who have passed fewer than 12 courses will be considered Year 1 students; those who have passed at least 12 courses but fewer than 22 will be considered Year 2 students; those with at least 22 but fewer than 32, Year 3; and those with 32 or more, Year 4.†

†course equals term course

1) Final Examinations

a) The faculty constitutes the examining body for all examinations. All examination results are considered by the Examinations and Standings Committee 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. Appeals against faculty decisions made under these regulations should be made in writing to the Registrar within one month of publication of the official mark reports.

b) For Students in Regular Programmes:

Final examinations in one-term courses are held in December or in April. Final examinations for all full year courses are held in April, and cover the whole work of each course.
c) For Students in Co-operative Programmes:
In Year 1, final examinations in one-term courses are held at the end of the term in which the course is taken, whereas final examinations in full-year courses are held at the end of the second term and cover the whole work of each such course. Beyond first year, final examinations are usually held at the end of each term.

d) In all courses each student is required to submit, in such form and at such time as may be determined by the instructor, evidence of satisfactory participation in term work. The marks obtained for work during the term are used, in part, in determining standing. The ratio in which marks for term work and written examinations are combined is at the discretion of the individual departments.
To pass in a course, a student must obtain a minimum of 50% in the combined term and examination marks. At the discretion of the chairman of the department concerned and of the Dean, a student may be barred from the final examination if the course requirements are not completed to the satisfaction of his instructor. Some courses and/or instructors may not require final examinations; in such cases term work only will be used in determining a final grade.

e) Failure to write an examination is considered a failure to pass. A student who defaults a final examination, except for a properly certified reason, shall have no make-up examination privileges and must repeat the work in class. If a student fails to write for medical or health-related reasons, 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.

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

2) Standing
a) Marks in individual courses will be reported in numerical grades in the scale 0 to 100. These may be interpreted as follows:

<table>
<thead>
<tr>
<th>Numerical Range</th>
<th>Grade Equivalent</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-100</td>
<td>A- to A+</td>
<td>Excellent</td>
</tr>
<tr>
<td>70-79</td>
<td>B- to B+</td>
<td>Very Good</td>
</tr>
<tr>
<td>60-69</td>
<td>C- to C+</td>
<td>Good</td>
</tr>
<tr>
<td>50-59</td>
<td>D- to D+</td>
<td>Passing</td>
</tr>
<tr>
<td>Below 50</td>
<td>F</td>
<td>Failure</td>
</tr>
</tbody>
</table>

In addition to the numerical scale above, the following designations may be used from time to time:

DNW = student did not write final exam in a course not dropped officially.

INC = student's work in course is incomplete for reasons other than that he did not write final exams.

AEG = student's work is incomplete for reasons of illness; however, student is granted standing in the course.

CR = credit granted where no specific mark is given in a course and AEG is not applicable.

AUD = a course which is audited only and neither averaged nor counted for credit.
b) Overall standing will be determined at the end of each year for Regular programmes and upon completion of the B term for Co-operative programmes, by the cumulative average of all courses taken at the University (whether passed or failed).

The following cumulative averages are required to proceed in the programmes of the Faculty:

<table>
<thead>
<tr>
<th>Programme</th>
<th>Overall</th>
<th>Major Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinesiology Honours</td>
<td>60%</td>
<td>60% *</td>
</tr>
<tr>
<td>(Dance Option)</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>(Health Studies Option)</td>
<td>60%</td>
<td>60% *</td>
</tr>
<tr>
<td>Kinesiology General</td>
<td>50%</td>
<td>60% *</td>
</tr>
<tr>
<td>Recreation Honours</td>
<td>60%</td>
<td>70%</td>
</tr>
</tbody>
</table>

* All courses designated Kinesiology, Health Studies and Dance will be included in the major field average.

If a student fails to meet either of the above required cumulative averages he may be designated as in Conditional Standing for the following year. A General student in Conditional Standing must improve his standing to at least the minimum overall level noted or else he will be required to withdraw from the Faculty.

An Honours student in Conditional Standing may elect to transfer to the General programme in good standing (if this is possible) or may endeavour to improve his Honours average to the cumulative minimum required; if such improvement is not forthcoming such a student may be transferred to the General programme.

An Honours student in Conditional Standing may be required by his major Department to repeat certain courses in which he has done poorly or he may elect to do so himself in order to improve his performance in subsequent years.

A student’s standing (overall and major field) will be recorded each year or term in co-operative programmes according to the following terms:

<table>
<thead>
<tr>
<th>Cumulative Average</th>
<th>Honours Programme</th>
<th>General Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-100</td>
<td>First Class Honours</td>
<td>A</td>
</tr>
<tr>
<td>70-79.9</td>
<td>Second Class Honours</td>
<td>B</td>
</tr>
<tr>
<td>60-69.9</td>
<td>Third Class Honours</td>
<td>C</td>
</tr>
<tr>
<td>50-59.9</td>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>

Below these levels will be Conditional Standing (first time) or Failure, required to withdraw (second time such level in the same programme is achieved). If a regular (full-time) student, even in good standing, fails more than two full-year courses or their equivalent in a given year he may be transferred to the General programme or else he may be asked to withdraw if his Department feels he is not making satisfactory progress towards a degree.

Students thus asked to withdraw may be eligible to apply for re-admission only after a one year’s absence. Students asked to withdraw after the equivalent of two “years” in Conditional or “Failed” standing (here or elsewhere) will normally not be re-admitted.
Note In cases where a course (failed or passed) is repeated, both marks will be used in calculating the student's cumulative overall average. If a passing grade is achieved more than once in the same course, it will still only count as one course passed towards the total necessary for graduation. Students in good standing will not normally repeat courses they have passed. No course may be repeated more than once.

c) Programme selection:
Full-time students: All first year students must take a minimum of 12 courses. In subsequent years, a student will normally take 10 courses, minimum, per year.

Part-time studies or reduced programmes: Except in exceptional circumstances, an Honours programme may not be taken on a completely part time or reduced programme basis; at least seven academic terms must be taken on a full-time (full programme) basis and no student may spend more than 5 years of full-time study (or its equivalent) for an Honours degree. The Faculty of Human Kinetics and Leisure Studies does not encourage part-time studies but will allow the General degree to be pursued on a part-time or reduced-programme basis subject to approval by the Associate Dean (Undergraduate Affairs) and the Department concerned. Normally, no first year programme for a full-time student may be reduced below the 12 course minimum except in very exceptional circumstances.

† course equals term course.

Make-up Examinations
The Faculty of Human Kinetics and Leisure Studies will no longer grant automatic supplemental examinations to all students in good standing. This is in line with general practice in other Faculties and Universities operating on a credit system. The Faculty realizes that course prerequisites are important to students proceeding to a degree and will endeavour to grant make-up examination privileges to deserving students in good standing but only in a limited number of cases according to the following general principles:

a) In any case where failure to pass is attributable to extraordinary circumstances, especially medical or health-related problems.

b) In failed courses for students in their graduating year where only one or two such courses remain to be completed for a degree.

c) In all other years, normally only where such failed courses could not be repeated and where a student's progress could be unduly held up by lack of one prerequisite. Non-prerequisite courses would have to be repeated, and many others could be repeated on a co-requisite basis.
In all cases regarding make-up examinations the student must have satisfied all term work requirements in the course and must have the permission of the Examinations and Standings Committee (who must be satisfied the student has a fair chance to pass the examination – the students overall University record may be used in making this assessment). Regardless of standing, no student will be allowed make-up privileges if he has failed more than two full courses or their equivalent in a given year (except on medical grounds as in ‘a’).

Except in extraordinary circumstances, (e.g. ‘a’ above), when a make-up examination is passed, the course will count as a course passed toward the degree, but the mark obtained will not be counted in determining cumulative averages (i.e. the original mark will normally be the mark which counts).

Course and Programme Changes

a) Students may add and drop half courses during the first three weeks of the Fall, Winter and Spring terms upon having the appropriate change form completed.

b) Students may add and drop full-year courses during the first three weeks of the Fall term upon having the appropriate change form completed.

c) After these periods, students will be allowed to add courses only with the permission of the instructor and the appropriate associate chairman and upon completing the appropriate change form.

d) After these periods and until the last day of lectures, students may reduce their programmes from honours to general where appropriate.

Academic Programmes

Kinesiology

Listed below are the course combinations leading to the Honours and General degrees in Kinesiology. Of the total of forty-four term courses required for graduation, twenty-four are electives. The requirements are common to both degrees except as noted in C, Kinesiology electives. Students are encouraged to make full use of the advisory system of the Department in planning their programmes.
Degree Requirements
Honours and General Programmes


B) Required courses from other departments: Physics 103*, or Physics 104* (see note), Biology 110*, 303* and 304*, Psychology 101*, Sociology 101* and one other Sociology or Psychology.

Note In the case of Physics 103*, Physics 104* and Biology 110* students may elect to take full year courses in either subject in the appropriate department. Physics 103* is for students not presenting Grade 13 Physics for admission. Physics 104* is for students who have taken Grade 13 Physics.

C) Kinesiology electives: ten (10) courses from those offered in the Department in addition to the required courses.

1) Honours Programme Each student must include in his programme at least seven (7) courses from one of the following two areas of concentration:


Note Kinesiology 346, 410, 451, 452, 453, and 455 are common to both areas.

2) General Programme The ten (10) elective courses in Kinesiology may be made up of any combination of Kinesiology, Health Studies and/or Dance courses.

D) Electives: The remaining thirteen term courses required for the degree are to be elected as follows:

1) Eight (8) term courses must be elected in departments outside the Faculty of Human Kinetics and Leisure Studies.

2) The remaining five term courses may be taken in any department of the University including Kinesiology and Recreation.
Course Sequence – Honours and General Programmes

Year 1 (Common to Regular and Co-operative Programmes)

**Fall**
- Kin 102
- Psych 101
- Soc 101
- Phys 103, or Phys 104*
- Two electives

**Winter**
- Kin 103
- One of Psych or Soc
- Biol 110
  (Kin 116 if no Grade 13 Chemistry)
- Two or three electives

Co-operative Programme

**Term 2A Fall**
- Kin 200, 222
- Biol 303
- Two electives

**2B Spring**
- Kin 321, 330, 335
- Two electives

**Term 3A Winter**
- Kin 355
- Biol 304
- Three electives

**3B Fall**
- Kin 300, 317
- Three electives

**Term 4A Spring**
- Kin 431
- Five electives

**4B Winter**
- Kin 432, 470
- Four electives

Regular Programme

**Year 2 Fall**
- Kin 200, 222
- Biol 303
- Two electives

**Winter**
- Kin 321, 335
- Biol 304
- Two electives

**Year 3 Fall**
- Kin 300, 317, 330
- Two electives

**Winter**
- Kin 355
- Four electives
Academic Programmes

**Year 4 Fall**  
Kin 431  
Five electives

**Winter**  
Kin 432, 470  
Four electives

**Honours Health Studies Option**

Students may apply for admission directly into the Honours Health Studies programme, co-op or regular.

44 term courses

**Degree Requirements**


b) Required Kinesiology courses: Kinesiology 200*, 222*, 300*, 317*, 330*

c) Required courses from other departments: Biology 131, 245*, 246*, 303*, 304*, Sociology 101*, 270*, Psychology 101*, 211*

d) Electives: Sixteen (16) term courses selected in consultation with the student's advisor.

**Health Studies Option**

*Year 1 Common*

| HS 140 | HS 141 |
| Psych 101 | Psych 211 |
| Soc 101 | Kin 116 (if necessary) |
| Biol 131 | Biol 131 |
| Two electives | Two (or Three) Electives |

**Regular Programme**

*Year 2*

| HS 240 | IIS 241 |
| Kin 200/222 | Soc 270 |
| Biol 245 | Biol 246 |
| One Elective | Two Electives |

*Year 3 Fall*

| HS 349, 410 | Winter |
| Kin 330, 317 | HS 345, 346, 348 |
| Biol 303 | Biol 304 |

*Winter*

| HS 431, 440 | Four Electives |
| Kin 300 | |
| Three Electives | |
Co-operative Programme

<table>
<thead>
<tr>
<th>Year 2</th>
<th>2A Fall</th>
<th>2B Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 240</td>
<td></td>
<td>HS 345/348</td>
</tr>
<tr>
<td>Kin 200/222</td>
<td></td>
<td>Kin 330</td>
</tr>
<tr>
<td>Biol 245</td>
<td></td>
<td>Two Electives</td>
</tr>
<tr>
<td>Biol 303</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
<th>3A Winter</th>
<th>3B Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 241</td>
<td></td>
<td>HS 410, 440</td>
</tr>
<tr>
<td>Biol 246</td>
<td></td>
<td>Kin 300, 317</td>
</tr>
<tr>
<td>Biol 304</td>
<td></td>
<td>One Elective</td>
</tr>
<tr>
<td>Soc 270</td>
<td>One Elective</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 4</th>
<th>4A Spring</th>
<th>4B Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 349, 431</td>
<td>Four Electives</td>
<td>HS 346, 432, 445</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Three Electives</td>
</tr>
</tbody>
</table>

Honours Dance Option

Students may apply for admission directly into the Honours Dance programme (regular only).

44 term courses.

Degree Requirements

a) Required Dance Courses: 162*, 163*, 262*, 264*, 362*, 460*, 461*, 462*, 463*, 464*, and two others to be developed.


c) Required Courses from Other Departments:

d) Elective Courses in Dance: sex term courses.

e) Electives: the remaining twelve term courses must include at least seven term courses taken outside the Faculty of Human Kinetics and Leisure Studies.

Note: This option programme is to be phased in over a two year period during which the additional courses required will be developed. Under consideration at this time are the following:
Dance 363*: Dance Ethnology
Dance 364*: Creativity and Movement
Dance 466*: Performance and Production (Modern Dance)
Dance 467*: Performance and Production (Ballet)

Additionally there are courses offered in other departments, notably Recreation and Psychology, as well as courses in Kinesiology, which are being considered for cross-listing as Dance courses. This would augment the elective series without additional staffing.
Recreation

Forty-four term courses are required for the Honours degree in Recreation. The student begins study in one of the four areas of concentration available to him in the second year of the programme. Double Honours programmes with other departments are being developed. For information about these programmes, please consult the Department of Recreation.

Degree Requirements

A) Recreation courses:

1) Required:


b) Each student normally must include in his programme the courses listed in one of the following areas of concentration (see note):


Recreation Administration: Recreation 211*, 320*, 334*, 434*.


Note In exceptional cases, with departmental advice and approval, other course combinations may be developed to meet specific educational goals.

2) Electives:

Each student must complete 2 to 5 additional recreation electives to meet the required total of 21.

B) Courses outside the Department of Recreation:

1) Required:

Geography 101*, or Environmental Studies 195*, Planning 156*, Psychology 101*, English 140/141, Science 351*, Sociology 101*,

Plus 8 additional term courses chosen in consultation with a faculty advisor with regard to area of concentration.

2) Electives:

Each student must select at least 8 term courses from any Department of the University.

C) Additional Requirements:
Practical Experience. To complete the requirements for a degree, all students must complete a faculty approved work term, normally of at least three months duration, or successfully petition the Department for exemption on the basis of experience.

Course Sequence
(Co-operative and Regular)

Year 1
Recreation 100*, 101*, 220*, 230*, 250*
Geography 101* or Environmental Studies 195*
Planning 156*
Psychology 101*
English 140/141
Science 351*
Sociology 101*

Year 2
Recreation 221*, 270*, 271*
2 Recreation electives
6-8 Electives

Year 3
Recreation 300*
5 Recreation electives
5 electives

Year 4
Recreation 400*, 470*, 471*
2 Recreation electives
5 electives

Students enrolled in the programme prior to September, 1972 have different course requirements from the above. Such students must complete 18 recreation courses, 8 electives, and 18 required courses outside the Department or their equivalent.

Honours Recreation and Sociology
A Joint Honours programme is available in Recreation and Sociology. Interested Recreation students should consult with their departmental faculty advisor for details.
Programme of Integrated Studies
Mid Campus Scene
Programme of Integrated Studies

Integrated Studies is a unique and exciting opportunity for students with a strong aptitude for self direction and a desire to integrate material across disciplinary lines.

Students are free to create their own programme of study in their areas of interest in a manner best suited to their needs. While they may pursue independent study, the wide resources of the University, including a full array of courses within the various faculties, are available to them. In addition, Integrated Studies has its own resource persons to assist students in their studies.

The Programme requires a review from each student at the end of each academic year in which a detailed accounting is presented of his educational development.

Interested students are urged to visit the Programme in operation in order to gain some real appreciation of it.

Degree Students desiring a Bachelor of Independent Studies (B.I.S.) degree apply to the Academic Board of Integrated Studies at least one year prior to their desired graduation. The Board evaluates each application and, if it approves, appoints a supervisory committee to meet with the candidate during two academic terms. The Board reviews the reports of the supervisors and makes its recommendations to the University Senate.

It should be noted that the pursuit of a degree in Integrated Studies is completely optional; a student may pursue a programme which is not degree oriented.

Administration An Operations Council consisting of all members of Integrated Studies, its students, resource persons and staff, is responsible for the day to day administration of the Programme, subject to the approval of the Vice-President, Academic. This includes budget development, recommendations for the hiring of personnel, admissions, and year-end evaluations.

Admission Requirements The admission requirements and procedures for all programmes are outlined in detail in Chapter 2 of this calendar.

While general University admission standards are applicable to Integrated Studies, consideration is given to those not possessing these minimum requirements. Applicants are admitted on the basis of a personal interview. Those showing the strongest aptitude for self direction and the ability to flourish in an unstructured academic setting are given first consideration. Students are normally admitted only in September.

Full admission procedure information may be obtained by writing directly to the Assistant Registrar for Integrated Studies.
13

Inter-Faculty Studies
Inter-Faculty Studies

Inter-Faculty Studies courses and programmes are offered by the Inter-Faculty Programme Board of the University of Waterloo. It was felt that the University should offer a number of broadly structured courses and programmes covering wide areas and designed not so much to prepare students for further work in a concentrated area or discipline as to contribute more generally to their educational development.

The Board, whose membership is broadly representative of Faculties and Colleges, sponsors both multi-disciplinary courses and thematic programmes available as electives to students through the University. In addition, the Board sponsors, from time to time, seminars, colloquia, and lectures on topics of broad general interest to the University at large.

Courses offered by the Inter-Faculty Programme Board are intended to enrich existing University offerings, to provide a multi-disciplinary context within which students may deal with fundamental issues and problems confronting today’s world, and to foster co-operation and awareness of others’ interests and goals among the various members (students and professors alike) of the University community.

How may the University student himself contribute to solutions to urgent social problems? What tools are available to enable one to cope with the mass of information and pseudo-information encountered in the communications media? What are the dominant issues facing man today? How does one determine values appropriate for man in today’s world? How can human conflict be resolved in a non-violent way? How is social justice to be achieved through social planning? In what ways can leisure contribute to the future of mankind? What, after all, is the nature of man?

These questions and issues provide the basis of the Inter-Faculty Studies courses. A listing and description of each course can be found in the Course Description section of this calendar. In addition, the Inter-Faculty Programme Board has initiated and sponsored a thematic programme in Communication Studies. With the co-operation of the Faculties of Arts, Engineering and Environmental Studies, the Inter-Faculty Programme Board offers the Communication Studies Programme which brings students and faculty from several disciplines together in a study of communication processes.

The study of multi-media communication, socio-cultural analysis, decision and value theory, technological communication systems, mass communication processes, inter-cultural communication, information diffusion and utilization, advocacy processes and social change are indicative of the range of interests and topics in the Communication Studies Programme. Students wishing to elect the Communication Studies Programme enroll at the University of Waterloo in the Faculty of their choice, and through the elective structure of their programme take communication courses. A list of courses and an outline of the programme requirements for the Communication Studies Programme can be found in the Course Description section of this calendar.
Inter-Faculty Studies

Programme Board

Members of the Board:
P. G. Cornell, E.D., M.A., Ph.D. (Toronto), Faculty of Arts
W. F. Forbes, D.I.C., Ph.D., D.Sc. (London), Faculty of Mathematics
G. R. Francis, B.A. (Toronto), B.A. (McGill), M.A. (British Columbia), Ph.D. (Michigan), Faculty of Environmental Studies
G. S. Kenyon, B.P.E. (British Columbia), M.S. (Indiana), Ph.D. (New York), Faculty of Human Kinetics and Leisure Studies
A. M. McLachlin, M.A. (Toronto), B.D., Th.D. (Emmanuel), St. Paul's College
D. E. Smucker, B.A. (Bluffton), M.A. (Chicago), B.D. (Princeton Theological Seminary), Ph.D. (Chicago), Conrad Grebel College
L. A. K. Watt, B.Sc. (Manitoba), M.S. (Chicago), Ph.D. (Minnesota), Faculty of Engineering

Associated Faculty
D. R. Gordon, B.A. (Queen’s), M.A. (Toronto), Associate Professor

Inquiries concerning Inter-Faculty Studies should be addressed to the Office of the Vice-President, Academic.
14
Faculty of Mathematics
Faculty of Mathematics

The Faculty of Mathematics of the University of Waterloo was inaugurated as a separate faculty in 1967. General and Honours programmes in Mathematics had been offered through the Faculties of Arts and Science for a number of years and the continued growth and development of these programmes made it natural to unite them under one faculty. At the same time, this unification has led to greater flexibility in the choice of overall programmes.

The Faculty of Mathematics is a close association of the Departments of Applied Analysis and Computer Science, Applied Mathematics, Combinatorics and Optimization, Pure Mathematics, and Statistics. Programmes in each of these areas are offered, commencing in the third year of study, to honours students of Mathematics.

The Graduate School in the Faculty is very active. A large number of graduate degrees is conferred each year and active research is carried on in many areas. For information concerning Graduate Programmes, please see the University of Waterloo Graduate Studies Calendar.

Applicants may register for the regular programme (not co-operative) through St. Jerome's College, which also offers some of the courses leading toward the B.Math. degree in conjunction with the University.

Students in the Faculty of Mathematics may take a three-year Pass Degree programme, a four-year General Degree programme, or a four-year Honours Degree programme.

The Co-operative Mathematics programmes are merely rearrangements in the scheduling of academic terms in the Honours and General programmes 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.) by the University. A student may specialize in various areas within the departments of Applied Analysis and Computer Science, Applied Mathematics, Combinatorics and Optimization, Pure Mathematics, or Statistics (see pages 245-249).

Faculty of Mathematics

The Faculty publishes two brochures one of which is specifically designed for high school students in Ontario. Copies of this booklet are available in high school guidance offices.

Admission

The admission requirements and procedures for all programmes are outlined in detail in Chapter 2 of this Calendar. The following points emphasize some of the admission requirements which relate specifically to programmes in the Faculty of Mathematics.

Applicants from Ontario

Grade 13

Applicants must include the following Mathematics courses in their overall Grade 13 programme – Relations and Functions, Calculus, and Algebra.
Admission as an Adult Student

Any student who has been away from formal education for more than two years and who does not possess the minimum requirements for admission may apply as an adult student. The applicant must, however, have obtained standing in Ontario Grade 13 level Mathematics courses. (This may be done through a local high school or through the Correspondence Branch of the Ontario Ministry of Education). Each application will be considered on its own merits by the Admissions Committee.

Advanced Standing

Students accepted by transfer from other universities will normally be given credit for a course taken if the mark obtained was at least 60% or the equivalent.

Students accepted for admission to the Faculty of Mathematics by transfer from other Faculties at the University of Waterloo will normally be given credit for courses taken if the marks obtained were (1) at least 50% for non-mathematics courses (2) at least 60% for mathematics courses. Mathematics courses with marks between 50% and 59% normally result in a student being "exempted" from re-taking the course in the Faculty of Mathematics, but no credit is given towards a Mathematics degree.

However, if the student took the mathematics course in a lecture section specifically designated for mathematics students, he will normally be given credit (rather than exemption) for the course if the mark obtained was at least 50%.

Courses taken previous to a student's admission to the Faculty of Mathematics are not counted in future cumulative average calculations, except in the case of a student in a Joint Honours Mathematics programme (e.g. Sociology and Mathematics) from another Faculty at the University of Waterloo. Cumulative averages for such a student will normally include all courses taken while registered in the Joint Honours programme which would have been acceptable for credit for a student registered in the Faculty of Mathematics.

Students being re-admitted to the Faculty of Mathematics are treated as if they had never interrupted their studies, provided they originally left the Faculty after September, 1969 under the "course credit" system. All courses taken previous to their re-admission are included in subsequent credit evaluations and average calculations. However, students being re-admitted to the Faculty who interrupted their studies prior to September, 1969 when the Faculty was operating under a "year" system do not have their marks from courses taken previously included in future cumulative averages. Credits are normally granted for all courses taken where the mark obtained was at least 50%, but new cumulative averages begin at the time of re-admission to the Faculty.

Applicants may not apply for admission to a Co-operative Programme beyond the Year 2 level. Those applying at the second year level must have credit in Math 129 (Algebra), Math 130 (Calculus) and Math 132 (Computer Science), or their equivalents, and should be aware that past experience has indicated that very few places are available in second year Co-op for applicants applying from other institutions. If applicants in this category cannot be accommodated in the Co-operative Programme, their applications will automatically be considered for the Regular Programme.
Part-Time Studies  Any student wishing to work toward a degree in Mathematics on a part-time basis must meet the regular admission requirements.

Since the Faculty of Mathematics, as a general rule, does not offer courses on campus in the evenings, part-time degree students should check to see if courses in Mathematics are available at a time convenient for them. A reasonable cross section of elective courses is available in the evenings during the fall/winter sessions.

Both Pass and General degrees in Mathematics may be obtained by part-time studies. The General degree requires at least one year’s residence. The Correspondence Programme is available to part-time students.

If the Admissions Committee feels that it cannot grant an applicant admission to a degree programme, that applicant may be admitted as a non-degree, part-time student at the discretion of the Committee. This means that the student is allowed to take up to two full courses per session to a total of six. Many adult students first enter the University this way. Once the student has completed the equivalent of two full Mathematics courses, he may apply to the Admissions Committee for degree candidacy. If regular admission is granted, any credits earned as a non-degree part-time student will count toward B.Math. degree requirements.

Correspondence Courses  The University of Waterloo offers a number of courses in Mathematics and in other areas (e.g. Physics, Chemistry, Earth Science) by correspondence. This is a unique offering in that lectures are recorded on magnetic tape, so that the student in effect receives actual lectures. In addition, the tapes are accompanied by diagrams and worked examples to explain and supplement material in the text. Each course has a number of problem assignments.

Although this programme is primarily designed to assist teachers who already have a baccalaureate degree to upgrade their teaching qualifications, these courses may be taken by part-time students for credit towards a degree (see above).

A more detailed description of this programme (including courses available in the Fall/Winter and Summer sessions, etc.) is available upon request by contacting

The Director
University of Waterloo Correspondence Programme
c/o Department of Physics
University of Waterloo
Waterloo, Ontario, N2L 3G1
Phone (519) 885-1211 (extensions 2410, 2196 or 2430)

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

Since September 1969, the Faculty has been operating under a “course credit system” in which student progress is measured by courses successfully completed rather than by years. A student who has passed fewer than five courses is considered a first-year student. A student who has passed at least five courses, but fewer than ten is considered a second-year student; at least ten but fewer
Standings and Promotions

than sixteen a third-year student; sixteen or more, a fourth-year student.

The following regulations govern the practice of the Faculty in regard to standings and promotions.

1) All examination results are considered by the Faculty Committee on Standings and Promotions and subsequently by the Faculty Council and are then issued to individual students by the Registrar.

2) At the end of each academic year a student's standing is determined by the cumulative average of all courses previously taken at the University of Waterloo while registered in the Faculty of Mathematics, whether passed or failed. To be allowed to proceed without being "On Probation" requires a minimum cumulative average of 50% overall and 55% in Mathematics. If a student fails to meet the required averages, the Committee on Standings and Promotions may allow the student to proceed "On Probation". A student "On Probation" who fails to improve his averages to the required minima during his next academic year will normally be required to withdraw from the Faculty.

3) The minimum passing mark in all courses is 50. In addition to the numerical scale 0-100, the following designations may be used from time to time.

INC (term work, lab. work, examinations, etc. are incomplete).

AEG (aegrotat - signifying the student's work or examination was incomplete for some acceptable reason (such as illness) and his instructor felt the student should receive credit for the course but a numerical mark could not be set).

CR (credit granted - rare cases not covered by AEG).

NMR (no mark reported).

DNW (did not write).

AEG or CR will count as a course passed towards the total necessary, but will not be used in cumulative average calculations.

NMR, DNW, INC will be counted as zero in cumulative average calculations.

4) For each academic year, except the graduating year, a student must register in N courses where $5 < N \leq 8$, and these must include at least two mathematics courses. In his graduating year the student must take two mathematics courses and at least as many other courses as are needed to satisfy degree requirements.
5) Cases may arise where a student passes a course but would like to repeat it in order to raise his mark. This may be done but both marks will show on his record and both marks will be counted in the cumulative average. The course will not be counted more than once toward the total number of required courses for a degree.

6) Failed non-compulsory courses need not be repeated but may be replaced by some other non-compulsory courses.

7) Students missing academic work or examinations for medical or other special reasons should so inform their instructors and provide official documentation to the Assistant Registrar, Mathematics, as soon as possible.

8) All papers that receive a failing mark are automatically re-read. Any student wishing to appeal a mark must do so by contacting the Assistant Registrar, Mathematics within one month of the official announcement of term or year marks. There will be a charge of $5.00 per course appealed, to be refunded if the mark is raised.

9) 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.

10) Permission to take courses from other universities for credit towards a B.Math. degree must be obtained from the Standings and Promotions Committee of the Faculty. Permission will normally be given only for non-mathematics courses.

11) After four years, students must have completed the requirements at least for the Pass degree. Within five academic years the student must apply for the award of a particular degree by filling out an “Intent to Graduate” form. If, at the end of five years, a student has fulfilled the requirements for two or more degrees he will be awarded the highest degree (Pass, General, Honours).

12) Continuance in the Co-operative programme is contingent upon acceptable performance on work terms. Students with an overall cumulative average of less than 55% in Years 1 or 2 may not proceed in the Co-operative programme. These students will become Regular students and they will be governed by the rules for Regular students.

13) No course may be dropped later than one month prior to the end of lectures in the term/year of the course.

14) A student may withdraw from the University up to and including the last day of lectures without being held responsible for that term's/year's courses.

15) A student judged to be unlikely to profit from further study in the Faculty of Mathematics may be required to withdraw from the Faculty.
Degrees

Mathematics Degrees

The interests of students majoring in mathematics range from those seeking a very general education with an emphasis on mathematics to those wanting a very intensive programme leading to graduate study in mathematics. In order that each student may select the degree programme suiting his own requirements, the Faculty of Mathematics offers three Bachelor of Mathematics (B.Math.) degree programmes: Pass, General, and Honours.

<table>
<thead>
<tr>
<th>Degree Programme</th>
<th>Pass</th>
<th>General</th>
<th>Honours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Total Credits</td>
<td>16</td>
<td>21</td>
<td>24</td>
</tr>
<tr>
<td>Minimum Math Credits</td>
<td>6</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Minimum Non-Math Credits</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Optional Credits (Math or other)</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Minimum Overall Average</td>
<td>50%</td>
<td>50%</td>
<td>60%</td>
</tr>
<tr>
<td>Minimum Math Average</td>
<td>55%</td>
<td>55%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Note 1  Credit refers to a normal eight-month (two term) course. A one-term (four-month) course counts as 1/2 credit.

Note 2  The averages referred to in the table include all courses taken at the university, whether passed or failed.

There are certain Faculty minimum course requirements for each B.Math. degree. Each student proceeding toward a Pass Degree must have credit in at least Math 119, 120, 122a or 132a, and 132b (or the honours course equivalents). A student proceeding to a General Degree must have, in addition to these, credit in Maths 217, 219, 312, and 319 (or the honours course equivalents).

A student proceeding to an Honours Degree must have credit in Math 129, 130, 132a,b, 229, 233, 237, 329 or 341; (332b and one of 332a, 334a, 334b) or (342/343). He must also complete certain Departmental requirements before acquiring the Honours Degree. These are discussed in the section on Programmes.

The essential differences in the three degrees lie in the number of mathematics courses taken and the number of these which are required. A student is not required to state in advance which degree he is seeking, although his selection of mathematics courses can determine his eligibility for an Honours Degree as early as his first year. In the selection of degree he wishes to pursue, a student will be guided by the amount and intensity of mathematics he wishes; he will also be guided by his intended career after graduation. For example, a person who wishes to study extensively in mathematics, specializing in one particular area such as computer science and possibly going on to post-graduate study, will certainly require an Honours Degree. A person who wishes to study less intensively, and who wishes to acquire a fairly broad understanding of a number of areas of mathematics will most likely take a General Degree. The person who desires a more limited knowledge still, and wishes to include a number of liberal arts or science courses, will probably elect a Pass Degree. It should be noted that the Pass Degree could also be elected by a person wishing to take a number of mathematics courses but who, for one reason or another, wishes to complete his degree in three years.
The normal course load in Year 1 is six courses, of which three are the first year mathematics courses; the remaining three are non-mathematics electives, such as Economics, Philosophy, etc. In other years the normal load depends on the degree sought. Students seeking a Pass Degree will usually take two mathematics courses and three electives; students seeking a General Degree will usually take three mathematics courses and two electives; and students seeking an Honours Degree will usually take four mathematics courses and two electives. This means that a Pass Degree is usually completed in three years, and a General or Honours Degree in four academic years.

All required courses are offered at the general level and the honours level. The differences between the two levels are emphasis, approach, and depth of exploration of the subject matter, with a greater emphasis on problem solving rather than on theory in the general courses. Some topics included in the honours courses may be omitted in the general courses but the descriptions of general and honours courses are the same.

Descriptions of the foregoing courses and other courses in Mathematics appear in Chapter 16.

Academic Programmes

The First Year Programme

A student in his first year must take at least five courses, and may take as many as eight. The normal choice is six, consisting of three mathematics courses and three elective courses. The mathematics courses are Calculus, Algebra and Geometry, and Computer Science.

A student entering the Faculty of Mathematics may register as an Honours, General, or Pass student in his first year but he need not be sure of which degree he will ultimately seek. In addition, a student is not associated with a department in his first two years.

The first year programme provides for transfer to other Faculties in the University, subject to the elective courses chosen. For example, a student selecting Physics and Chemistry as electives will have no difficulty in transferring to the Science Faculty in Year 2. A student who is not certain of his first choice of interest area can, by proper selection of electives, put himself in a position to pursue several different areas in Year 2.

First Year Mathematics Courses

In the Honours programme, students register in Mathematics 129, 130, and 132a,b. A student proceeding to a Pass or General degree should register in Math 119 (Algebra and Geometry), Math 120 (Calculus), and two half courses in Computer Science, Math 112a,h (Pass) or Math 122a, 132h (General). Math 129 and 130 cover approximately the same material as Math 119 and 120 but at a slightly faster pace with a greater degree of rigour.

A student who is uncertain about his choice of degree may select either set of courses. If he selects and does sufficiently well in Math 119 and 120, he may arrange to proceed in the Honours programme in second year. A student entering the Faculty with a Grade 13 average of under 75% should register in Math 119 and 120.
The Second Year Programme
Honours students normally take six courses in Year 2 (four maths and two electives). General and Pass students normally take five courses, often three maths and two electives. General students may obtain credit in Math 217 and 219 (second year calculus and algebra) and Honours students must obtain credit in the corresponding Math 237 and 229 and also in statistics (Math 233). Other second year mathematics courses available are Math 228 (Introduction to Pure Mathematics), Math 234a,b (Introduction to Applied Mathematics), Math 235 (Actuarial Mathematics), Math 236 (Elementary Differential Equations), Math 239a,b (Introduction to Combinatorics and Optimization), Math 240a,b (Applications in Computer Science).

Credits for Elective Courses
The choice of the student’s non-mathematics courses is, except in certain specialized Options, normally subject only to timetable restrictions. However some courses offered by other Faculties have considerable mathematical content and it is not possible for a student to obtain credit in such a course as well as the corresponding mathematics course. A list of these courses is available to the student at the time of pre-registration and may also be obtained from undergraduate advisors.

Mthel Courses
Courses labelled MTHEL may be taken as non-mathematics elective courses. They will not be counted as mathematics credits.

Three Year Pass Degree Programme
This degree requires a minimum of 16 courses including at least 6 mathematics courses and at least 6 non-mathematics courses.

Credit must be obtained in Math 119 or 129, Math 120 or 130, and one of
(1) Math 112a,b (2) Math 122a, 132b (3) Math 132a,b

The cumulative averages required are 50% overall and 55% in the mathematics courses. A student must complete this programme in not more than four academic years or equivalent.

Four Year General Programme
This degree requires a minimum of 21 courses including at least 12 mathematics courses and at least 6 non-mathematics courses.

The following courses, or the corresponding courses for Honours students, must be included: Math 119, 120, 122a, 132b, 217, 219, 312b, 319 and one of 312a, 334a,b.

The cumulative averages required are 50% overall and 55% in the mathematics courses. A student must complete this programme in not more than five academic years.
Students interested in one of the following areas are encouraged to incorporate any or all of the suggested courses.

**Actuarial Science** 235; 243; 335; 336.

**Computer Science** 132a; 132b; 240a; 240b; 334a; 334b; 340a; 340b; 371a; 371b; 372b; 474a; 474b; 474c; 474d.

**Combinatorics and Optimization** 239; 243; two of 351a, 351b, 351c, 351d, 352a, 352b.

**Pure Mathematics** 228, 330, 344, 351a, 351c, 425, 436, 446.

**Statistics** 223, 233 or 243; 339a or 339b; 349a; 449; 467b.

**Teaching Option** Additional requirements:
- Mathematics 300, 446.
- Psyc. 241/242, Phil. 311/312, Soc. 207G.
- Recommended courses include Math 239a, 239b, 240, 307.

Students in the co-operative teaching option must obtain two credits in Computer Science.

**Four Year Honours Programme** This degree requires a minimum of 24 courses including at least 15 mathematics courses and at least 6 non-mathematics courses.

The following courses must be included: Mathematics 129; 130; 132a,b; 229; 233; 237; 329 or 341; (332b and one of 332a, 334a, 334b) or (342/343).

The cumulative averages required are 60% overall and 65% in the Mathematics courses. A student must complete this programme in not more than five academic years.

A programme which will provide the minimum course requirements is described below. Better students are encouraged to take an additional elective in each of years 2, 3, and 4.

**Year 1** Mathematics 129; 130; 132a,b and three electives.

**Year 2** Mathematics 229; 233; 237. One other Mathematics course. Two electives, one of which may be another Mathematics course.

**Year 3** At least four three hundred level Mathematics courses which include the Departmental requirements. Two electives, one of which may be another Mathematics course.

**Year 4** Honours Mathematics students will normally take at least four four-hundred level Mathematics courses or their equivalent. Students in Joint Mathematics programmes will normally take at least two four-hundred level Mathematics year courses or equivalent. Two electives, one of which may be another Mathematics course.

It should be noted that timetables are based on recommended programmes and students whose programmes deviate markedly from these programmes may encounter timetable conflicts. Each student entering Year 3 is to be affiliated with a department and all Honours students should consult with their department to ensure that the departmental regulations are fulfilled. Some of the departmental requirements are set out below.
Academic Programmes

**Applied Analysis** Details of the undergraduate programme in Applied Analysis may be obtained from the chairman of the Applied Analysis and Computer Science Department.

**Computer Science** Mathematics courses taken must include: 240 (a) and 240 (b); at least four full (eight half) courses in Computer Science at the three-hundred or four-hundred level; at least three full (six half) mathematics courses from other Departments in the Faculty at the three-hundred or four-hundred level; at least three full (six half) courses at the four-hundred level; the Faculty requirements, 329 and 332(b) and at least one of 332 (a), 334 (a) or 334 (b).

Computer Science courses offered by the department fall in three areas:
- **Numerical Analysis**: Mathematics 334a, 334b, 470a, 470b.
- **Software**: Mathematics 340a, 340b, 371b, 474a, 474b, 474c, 474d.
- **Theory of Computation**: Mathematics 371a, 372b, 472b, 472c.

At least three half courses must be selected from one area and at least three half courses must be selected from the other two areas combined.

**Applied Mathematics** Four credits chosen from 234a, 234b, 360a, 360b, 361a, 361b, 362a, 362b, 363, 434, 462.

**Combinatorics and Optimization** Mathematics 239a and 239b are recommended; two third and two fourth year course credits from the department.

**Teaching Option** Additional requirements: Mathematics 300a, 300b, 446a, 446b. Psyc. 241/242, Phil. 311/312, Soc. 207G. Recommended courses include Math 239a, 239b, 240, 307, 330, 334, 425, 436. Students in the co-operative teaching option must obtain two credits in Computer Science.

**Pure Mathematics** Mathematics 341; 342; 343; 344a; two four-hundred level courses in Pure Mathematics.

**Statistics** Mathematics 338; 339; 438; 439 (a); 467 (b).

**Actuarial Science** Mathematics 235; 336; 437; one of 335; 435; 461.

**Honours Statistics** Students must satisfy all requirements of the honours programme in Statistics, and in addition, must obtain credit in the following Computer Science courses:
- Mathematics 240, 474 (a).
- Two of Mathematics 334 (a), 334 (b), 340 (a), 340 (b).
- One additional half course in Computer Science which must be a fourth year course or one of the third year courses listed above.

**Honours Computer Science** Students must satisfy all requirements of the honours programme in Computer Science, and in addition, must obtain credit in Mathematics 338a,b or 349a,b; 467b; and on one of 439 (a) or 449 (a).
Joint Mathematics Programmes with other Faculties

Honours
Applied Mathematics
with Physics Minor

Year 1
Mathematics 129, 130, 132.
Physics 121*/122* or 162*/163*
Chemistry 121*/122*
One elective.

Year 2
Mathematics 229, 233, 234, 237.
Physics 252*/253*, 255*
Physics 256* or 259* or one elective half course.

Year 3
Mathematics 332, 360a, 362a, 362b, 363.
Physics 355*, 358*/359*
One elective.

Year 4
Mathematics 329, 441, two of 361, 434, 462.
Physics 435, 441
One elective half course

The foregoing programme may be modified subject to the approval of the Applied Mathematics Department.

Mathematics – Economics Programme
Choice of Degree
Students in Years 1 and 2 may take this programme in either faculty, but at the end of the second year they must decide whether to continue toward a degree in Arts or a degree in Mathematics. The programme must then be approved by both the Economics Department and by the appropriate department in the Faculty of Mathematics.

Requirements for all Students
(Other requirements will depend on which degree is taken; the student will have to add to these to meet the requirements of his faculty.)

Economics
101*/102*
201*/202*
231*, 311*, 312*
Three and one half others including 221* and 321* if Math 233 is not selected.

Mathematics
1) 129, 130, 229
2) 237, one of 228, 233, 234, 239, 240†
3) Two others.

†Math 132 is a prerequisite of Math 240, and should be taken in Year 1 by students wishing to specialize in Computer Science.
Joint Mathematics Programmes

Further Requirements for the Degree B.Math. (Mathematics and Economics)
Students entering Year 3 must have credit for the five Mathematics courses specified under (1) and (2) above. They must pass at least seven further Mathematics courses approved by one of the departments in the Mathematics Faculty.

See page 234 for Mathematics courses required for students studying toward a B.Math. (Honours) degree.

Further Requirements for the Degree B.A. (Economics and Mathematics)
Please refer to the Faculty of Arts portion of the Calendar.

Mathematics-French Programme
Choice of Degree
Students in Years 1 and 2 may take this programme in either faculty, but at the end of the second year they will decide whether to continue toward a degree in Arts or a degree in Mathematics. The programme must then be approved by both the French Department and by the appropriate department in the Faculty of Mathematics.

Requirements for all Students
(Other requirements will depend on the degree taken; the student will have to add to these to meet the requirements of his Faculty.)

French
Year 1 French 190 Group B
Year 2 Three full courses in French
Year 3 Two full courses in French
Year 4 Two full courses in French

Mathematics
1) 129, 130, 229, 237
2) One of 228, 233, 234, 235, 239, 240
3) Two others

Further Requirements for the Degree B.Math. (Mathematics and French)
Students entering Year 3 must have credit for the five Mathematics courses specified under (1) and (2) above. They must pass at least seven further Mathematics courses approved by one of the departments in the Mathematics Faculty.

Further Requirements for the Degree B.A. (French and Mathematics)
Please refer to the Faculty of Arts portion of the Calendar.

Mathematics-Geography Programme
Choice of Degree
Students in Years 1 and 2 may take this programme in either faculty, but at the end of the second year, they must decide whether to continue toward the degree B.E.S., B.A. or B.Math. The programme must then be approved by both the Geography Department and by the appropriate department in the Faculty of Mathematics. The Department of Geography requires students to take a minimum of seven Geography credits. Students intending to qualify for the Type A Certificate for high school teaching require a minimum of nine credits in Geography.

Requirements for all Students
(Other requirements will depend on which degree is taken; the student will have to add to these to meet the requirements of his faculty.)
Joint Mathematics Programmes

Geography
Geog 102* and one of Geog 101*, 110*, 125R*, 126R*, 127*, or EnvS 195*
EnvS 200*, Geog 201*, 202* and one of Geog 203*, 232*, 320
Geog 260*, 271*, 275* 391*, 481*, 490

Mathematics
1) 129, 130, 229.
2) 237; one of 228, 233, 234, 239, 240†
3) Two others.

†Math 132 is a prerequisite for Math 240, and should be taken in Year 1 by students wishing to specialize in Computer Science.

Note Where the requirements of Mathematics and Geography would otherwise result in the duplication of material, the requirement shall be met in one department only. Students should obtain clarification from respective Undergraduate Officers before registration:

Further Requirements for the Degree B.Math. (Mathematics and Geography)
Students entering Year 3 must have credit for the five Mathematics courses specified under (1) and (2) above. They must pass at least seven further Mathematics courses approved by one of the departments in the Mathematics Faculty.
See page 234 for Mathematics courses required for student studying toward a B.Math. (Honours) degree.

Further Requirements for the Degree B.A. (Geography and Mathematics)
Please refer to the Faculty of Arts portion of the Calendar.

Mathematics – Philosophy Programme
Choice of Degree
Students in Years 1 and 2 may take this programme in either faculty, but at the end of the second year, they will decide whether to continue toward a degree in Arts or a degree in Mathematics. The programme must then be approved by both the Philosophy Department and by the appropriate department in the Faculty of Mathematics.

Requirements for all Students
(Other requirements will depend on which degree is taken; the student will have to add to these to meet the requirements of his faculty.)

Philosophy
280/1, 283/3, 340, 358/9. Three others, one of which is in a value area.

Mathematics
1) 129, 130, 229;
2) 237; one of 228, 233, 234, 239, 240†
3) Two others, including one foreign language.

†Math 132 is a prerequisite for Math 240, and should be taken in Year 1 by students wishing to specialize in Computer Science.
Joint Mathematics Programmes

Further Requirements for the Degree B.Math.
(Mathematics and Philosophy)

Students entering Year 3 must have credit for the five Mathematics courses specified under (1) and (2) above. They must pass at least seven further Mathematics courses approved by one of the departments in the Mathematics Faculty.

See page 234 for Mathematics courses required for students studying toward a B.Math. (Honours) degree.

Further Requirements for the Degree B.A.
(Psychology and Mathematics)

Please refer to the Faculty of Arts portion of the Calendar.

Mathematics - Psychology Programme

Choice of Degree

Students in Years 1 and 2 may take this programme in either faculty, but at the end of the second year, they must decide whether to continue toward a degree in Arts or a degree in Mathematics. The programme must then be approved by both the Psychology Department and by the appropriate department in the Faculty of Mathematics.

Requirements for all Students

(Mathematics and Philosophy)

(Other requirements will depend on which degree is taken; the student will have to add to these to meet the requirements of his faculty.)

Psychology

101/2; 499; five additional psychology courses chosen in consultation with the Psychology Department to fulfill their research requirements.

Mathematics

1) 129; 130; 132; 229; 233; 237;
2) 329 or 341;
3) 332 (b) and one of 332 (a), 334 (a), 334 (b) or (342/343).

Further Requirements for the Degree B.Math.
(Mathematics and Psychology)

Students entering Year 3 must have credit for the six Mathematics courses specified under (1) above. They must pass at least seven further Mathematics courses approved by one of the departments in the Mathematics Faculty.

See page 234 for Mathematics courses required for students studying toward a B.Math. (Honours) degree.

Further Requirements for the Degree B.A.
(Psychology and Mathematics)

Please refer to the Faculty of Arts portion of the Calendar.

Mathematics - Sociology Programme

Choice of Degree

Students in Years 1 and 2 may take this programme in either faculty, but at the end of the second year, they must decide whether to continue toward a degree in Arts or a degree in Mathematics. The programme must then be approved by both the Sociology Department and by the appropriate department in the Faculty of Mathematics.

Requirements for all Students

(Mathematics and Philosophy)

(Other requirements will depend on which degree is taken; the student will have to add to these to meet the requirements of his faculty).
Sociology 101*, 321*/322*, 425*/426*, 480*/481*, 499; Plus 3 and ½ other full courses in Sociology.

Mathematics 1) 129; 130;
2) 229, 233, 237;
3) two other full courses.

Further Requirements for the Degree B.Math. Mathematics and Sociology) Math 132 must be taken by students wishing a B.Math. degree. Students entering Year 3 must have credit for the five Mathematics courses specified under (1) and (2) above. They must pass at least seven further Mathematics courses approved by one of the departments in the Mathematics Faculty.

See page 234 for Mathematics courses required for students studying toward a B.Math. (Honours) degree.

Further Requirements for the Degree B.A. (Sociology and Mathematics) Please refer to the Faculty of Arts portion of the Calendar.

Co-operative Mathematics Programme

The arrangement of a Co-operative programme is as shown below. Students, when they arrive on campus, may elect to spend either eight months in university before proceeding on their first work term, or four months in university before proceeding on their first work term.

<table>
<thead>
<tr>
<th>F=Fall Term</th>
<th>W=Winter Term</th>
<th>S=Spring Term</th>
<th>X=Work Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>X</td>
<td>1</td>
<td>X</td>
</tr>
</tbody>
</table>

Group 1

Group 2

Students entering in September split into two groups which spend alternating four-month terms in university (the numbered squares) and in industry; the honours students in the programme graduate with the equivalent of two years' work experience. The University's Co-ordination Department provides liaison between the University and Industry and makes arrangements for placing of students during their work terms.

The University does not guarantee that all students will obtain positions. Every effort is made to place each student in a position consistent with his interests and capabilities. Experience indicates that there are sufficient positions for all conscientious students who maintain good academic records. However, some students do not obtain positions because of lack of maturity or ability to impress company representatives. Students are required to work at least two terms with each employer. However, companies are not obligated to have a student return if his performance or attitude is not acceptable. With each term the student is given more challenging work and assumes more responsibility. Because of this, most stay with their first employer for most, if not all, of their work terms. Many join the company after graduation; however, there is no obligation on either side.
Graduates of a Co-operative programme, because of the experience gained during their university careers, can generally expect to earn a higher salary and attain positions of greater responsibility sooner than graduates of the Regular programme.

It should be expected that a student in this programme will need financial assistance. By the time living expenses are paid, it is doubtful that enough money can be saved to cover completely the costs of the next term at university. However, since work terms occur more frequently in this programme than in the regular one, the student has a better opportunity to pay for his own education. This is particularly true in Years 3 and 4 when salaries are higher.

Honours Programmes

The academic content of the Co-operative programmes in Actuarial Science, Computer Science, Combinatorics and Optimization, Statistics, and Teaching, is exactly the same as the content of the regular programmes previously outlined.

Special Options

Business Administration Option

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Honours Programme</th>
<th>General Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>M129, 130, 132A, B</td>
<td>M119, 120, 132A, B</td>
<td></td>
</tr>
<tr>
<td>Economics 101/102 191/192</td>
<td>Economics 101/102 191/192</td>
<td></td>
</tr>
<tr>
<td>Business 111/121</td>
<td>Business 111/121</td>
<td></td>
</tr>
<tr>
<td>Year 2</td>
<td>M229, 233, 237</td>
<td>M217, 219, 223A, B</td>
</tr>
<tr>
<td>two of M235A, 239B, 240A</td>
<td>two of M235A, 239B, 240A</td>
<td></td>
</tr>
<tr>
<td>Business 212/222</td>
<td>Business 212/222</td>
<td></td>
</tr>
<tr>
<td>one elective †</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 3</td>
<td>M349A, B; 352A, B</td>
<td>three math courses</td>
</tr>
<tr>
<td>two additional math* courses</td>
<td>(M349, 352 recommended)</td>
<td></td>
</tr>
<tr>
<td>Business 388/398</td>
<td>Business 388/398</td>
<td></td>
</tr>
<tr>
<td>one elective †</td>
<td>one elective †</td>
<td></td>
</tr>
<tr>
<td>Year 4</td>
<td>three math from 3rd or 4th year*</td>
<td>two math courses*</td>
</tr>
<tr>
<td>Business 481/491</td>
<td>Business 481/491</td>
<td></td>
</tr>
<tr>
<td>two electives †</td>
<td>two electives †</td>
<td></td>
</tr>
</tbody>
</table>

† The electives may be math or non-math.

* Recommended courses are:

- Operations Research: M451A, B; 452; 453A, B; 455A, B; 456A.
- Computer Science: M240B; 340A, B; 474C, D.
- Statistics: M339; 449A; 466A; 467A.
- Actuarial Science: M437A, B.

At least seven 300 and 400 level courses must be included in the Honours programme, with at least two of them from the 400 level; of these seven courses, at least one full course must be chosen from each of the areas: Optimization, Computer Science, Statistics.
Chartered Accountancy Option

It is possible for students enrolled in the Co-operative Mathematics Programme to choose their non-mathematics elective courses in such a manner that they may be able to write their final Chartered Accountancy examination within a few months after graduation. This programme is offered in co-operation with the Institute of Chartered Accountants of Ontario.

Honours Programme

<table>
<thead>
<tr>
<th>Year 1</th>
<th></th>
<th>General Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M129, 130, 132A, B</td>
<td>M119, 120, 132A, B</td>
</tr>
<tr>
<td></td>
<td>Economics 101/102</td>
<td>Economics 101/102</td>
</tr>
<tr>
<td></td>
<td>191/192</td>
<td>191/192</td>
</tr>
<tr>
<td></td>
<td>Business 111/121</td>
<td>Business 111/121</td>
</tr>
<tr>
<td>Year 2</td>
<td>M229, 233, 237</td>
<td>M217, 219, 223</td>
</tr>
<tr>
<td></td>
<td>two of M235A, 239B, 240A</td>
<td>Economics 291/292</td>
</tr>
<tr>
<td></td>
<td>Economics 291/292</td>
<td>Business 477/216</td>
</tr>
<tr>
<td></td>
<td>Business 477/216</td>
<td></td>
</tr>
<tr>
<td>Year 3</td>
<td>M349A, 352A, B</td>
<td>three other math courses</td>
</tr>
<tr>
<td></td>
<td>two and a half additional math courses*</td>
<td>(M235A, 239B, 240A, 349A, 352 recommended)</td>
</tr>
<tr>
<td></td>
<td>Economics 391/392</td>
<td>Economics 391/392</td>
</tr>
<tr>
<td></td>
<td>one elective †</td>
<td>one elective †</td>
</tr>
<tr>
<td>Year 4</td>
<td>three math from 3rd or 4th year*</td>
<td>three math courses*</td>
</tr>
<tr>
<td></td>
<td>Economics 393/394</td>
<td>Economics 393/394</td>
</tr>
<tr>
<td></td>
<td>Business 457/</td>
<td>Business 457/</td>
</tr>
<tr>
<td></td>
<td>Business 363/WLU taxation</td>
<td>Business 363/WLU taxation</td>
</tr>
<tr>
<td></td>
<td>one elective †</td>
<td>one elective †</td>
</tr>
</tbody>
</table>

† The electives may be math or non-math.

* Recommended courses are:

Operations Research M451A, B; 452; 453A, B; 455A, B; 456A.
Computer Science M240B; 340A, B; 474C, D.
Statistics M339; 449A; 466A; 467A.
Actuarial Science M437A, B.

At least seven 300 and 400 level courses must be included in the Honours programme, with at least two of them from the 400 level; of these seven courses, at least one full course must be chosen from each of the areas: Optimization, Computer Science, Statistics.
Statistics – Economics

Option

**Year 1** Mathematics 129, 130, 132.
A Term: Economics 101*; two electives.
B Term: Economics 102*; two electives.

**Year 2** Mathematics 229, 233, 237.
and two of Mathematics 234a, 239a, 239b, 240a, 240b, 235a.
A Term: Economics 203*; one of Economics 205*, 231*.
B Term: Economics 204*; one of Economics 206*, 232*.

**Year 3** Mathematics 329; 332b; one of 332a, 334a, 334b; 338.
Two of Mathematics 340a, 340b, 352a, 352b.
Four half courses at 300 level or above.

**Year 4** Two of Mathematics 339; 438; 439a and 467b.
One other Mathematics course.
Four half courses from Economics 401*, 402*, 411*, 412*, 421*, 422*.

Faculty of Mathematics Departments

**Applied Analysis and Computer Science**

**Department**

*Computer Science*

The computational power made available by the electronic computer has revolutionized the approach taken in many areas toward problem solving and research. In recent years a knowledge of Computer Science has become a valuable asset for work in many fields.

In addition to providing the student with a strong core of Mathematics, the Computer Science programme gives him a solid foundation in programming languages, numerical methods, data structures, switching theory and machine architecture. Advanced students are offered courses in numerical analysis, scientific applications, operating systems, business systems analysis, simulation, automata theory, computability theory and formal languages. The student is also encouraged to take a series of courses in some other discipline to which he can apply his knowledge of Computer Science.

Upon completion of the Computer Science programme, the student is qualified to enter a rewarding career in the computing profession. In addition, he is well prepared to undertake graduate study in Computer Science.

*Applied Analysis*

Applied Analysis is concerned with the study of functional equations and their applications, i.e., the theory of determining functions from elementary equations containing them. It is a field of mathematics with a two century history, although the somewhat more general theory has developed only in the last two decades. Functional equations have applications in many classical and modern disciplines including probability and information theory, mathematical psychology, nomography, functional analysis, geometry and universal algebra. After attending these courses, the student will be well prepared for graduate studies in several fields
of Mathematics and its applications to science, engineering and social sciences.

The Applied Mathematics Department

Traditionally, Applied Mathematics has been almost synonymous with Mathematical Physics but times change and today Applied Mathematics, while retaining its interest in the physical sciences, is broadening its scope and is becoming concerned with the applications of mathematics to the social and biological sciences. To handle the types of problems that arise in these areas the Applied Mathematician requires two things: a firm background in mathematics with a mastery of techniques and an ability to understand a problem when that problem is stated in the language of biology, economics, engineering, chemistry, physics or business.

With these considerations in mind the Honours Applied Mathematics programme at Waterloo has been developed as follows: in the first two years the student follows essentially the same programme as every other student in the Faculty of Mathematics and acquires a basic mathematical background; in year three he is given some of the mathematical tools that will be indispensable — calculus of variations, tensor calculus and ordinary differential equations, and gets a firm grounding in mechanics and an introduction to partial differential equations. In his fourth year he is expected to choose some of the purely mathematical subjects such as partial differential equations, non-linear differential equations, Lebesgue integration and operator theory but equal emphasis is placed on the application of mathematics; for example, there is a one term course in continuum mechanics which is followed by either a course in elasticity or hydrodynamics or (we expect) aerodynamics; other courses are: statistical mechanics, quantum mechanics, general relativity theory, electromagnetic theory, control theory and differential geometry.

It is our belief that a graduate from this programme will be able to turn his hand to many things ranging from meteorology, oceanography, seismic exploration and supersonic flow to the problems of navigation in space, control problems, ecological population studies and the study of epidemics.

The Applied Mathematics Department offers only an honours programme which is made up of courses chosen from M 234, 360, 361, 362, 363, 413, 434, 441, 442, 443, 444, 445, 447, 448, 462, 463, 464.

For those students who wish a strong emphasis on Physics, the Department offers the programme "Honours Applied Mathematics with Physics Minor."
The Department of Combinatorics and Optimization

Combinatorics
Combinatorics, also referred to as combinatorial mathematics and combinatorial analysis, can be described as the study of the arrangement of elements into sets. Examples of this type of mathematics are found in magic squares known to the Chinese 4,000 years ago, in permutations studies at least 3,000 years ago, and in today's newspapers which occasionally publish mathematical puzzles of a combinatorial nature. Fascinating new combinatorial problems have arisen in the study of both Pure and Applied Mathematics and entire new subjects are developing. A particularly fine example is the theory of linear graphs which has recently blossomed. Combinatorics cuts across many areas of mathematics, and researchers in the field today study a wide diversity of intriguing problems.

Optimization
The ultimate objective of nearly every Applied Mathematics study is to improve something; this is especially true in Business and Industry, and to a certain extent in Pure Science. A variety of mathematical methods have evolved which can be classified as optimization techniques. Every student of calculus finds the maximum of a function by setting its derivative equal to zero. The engineer uses more sophisticated methods of analysis to optimize hardware design. The well known travelling salesman problem in which a salesman desiring to visit a number of cities selects an itinerary to minimize travelling costs is an example of a combinatorial optimizing problem. Optimization is particularly important in Business and Industry. For example, in an inventory or a scheduling problem the purpose of developing a mathematical model is to minimize cost or maximize efficiency or some other criterion. During the past decade several new general optimization techniques (e.g. linear programming, dynamic programming) have been developed specifically to handle such optimization problems.

The following undergraduate courses are offered by the Department of Combinatorics and Optimization: 239, 300, 307, 345, 351, 352, 417, 418, 419, 420, 446, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460.

Department of Pure Mathematics

Pure Mathematics has been termed the study of mathematics for its own sake, and many pure mathematicians would agree with this. Besides developing the fundamental areas of mathematics such as algebra, analysis and geometry, many pure mathematicians are interested in the philosophical foundations and historical development of the subject. A mastery of these fundamental subjects is also essential for a person who would prefer to apply mathematics, either to other basic sciences or to more practical matters. Thus, in addition to those who are especially attracted to pure mathematics, the department's programme is designed also for students who wish ultimately to apply their knowledge, but who would prefer to obtain a thorough understanding of much basic mathematics before committing themselves to some particular area of application. Many of those pure mathematics graduates who do not become direct applieds of their mathematics enter the field of education, anywhere from the primary level to the most advanced research institute. However, the ability to think clearly and
Faculty of Mathematics Departments

precisely, and to continue educating oneself (major parts of our objectives), are valuable in any field of endeavour.

The following undergraduate courses are offered by the department. Note that some of the analysis courses are offered in conjunction with faculty in Applied Analysis and Applied Mathematics, and the geometry in conjunction with combinatorics. In addition these departments offer courses in closely related subjects. Not all of the 400 level courses are offered every year.

General 228
Algebra 341, 406, 407, 410, 411, 412, 428
Analysis 342, 343, 432, 433, 462
Geometry 330, 407, 409, 428, 430, 448
Logic and Foundations 408, 436
Number Theory 425
Topology 344, 426

Department of Statistics

In science one attempts to learn about the real world by making inferences from data. In reasoning from observations to general conclusions, some degree of uncertainty results. One aspect of statistics studies this form of reasoning and utilizes probability theory to specify the exact degree of uncertainty involved. Other aspects of statistics deal with such subjects as the design of experiments and sample surveys which try to ensure that the results contain the required information, and decision theory, which considers the probable losses for various courses of action under conditions of uncertainty.

In addition to the Regular and Co-operative Honours Statistics programmes, the Department offers joint honours programmes with Computer Science, Psychology, and Economics. Other joint honours programmes can be arranged. The following undergraduate courses in probability and statistics are offered by the Department: Mathematics 223, 233, 243, 338, 339, 349, 438, 439, 449, 466, 467.

The Department of Statistics also is responsible for Actuarial students and courses. The Regular and Co-operative programmes in Actuarial Science are planned to provide the knowledge of pure and applied mathematics which the Actuary must possess, and to provide theoretical preparation for the first five examinations of the Society of Actuaries. By carefully selecting their electives, students can also gain valuable background knowledge in economics, finance, administration and law. Courses designed specifically for actuarial students are: Mathematics 235, 335, 336, 435, 437, 461.
Faculty of Science
The Faculty of Science

The first students were enrolled in the Faculty of Science in the autumn of 1959. Enrolments have increased significantly thereafter until by the autumn of 1973 over 1900 full-time students, of which more than 200 are graduate students, are taking programmes within the Faculty. In addition, courses are provided for students in arts, environmental studies, engineering, mathematics and kinesiology and recreation.

There are five teaching departments in the Faculty of Science: Biology, Chemistry, Earth Sciences, Physics and the School of Optometry. Extensive instruction is also given by members of the University's Faculties of Arts and Mathematics. Astronomy and Biophysics are 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 as well as the School of Optometry offer post-graduate programmes and research facilities and these are published in a separate Graduate Calendar. The new M.Sc. programme in Earth Sciences offers specialization in the area of Environmental Geology while the new Optometry graduate programme offers M.Sc. studies in Physiological Optics. The majority of the graduates in Honours programmes in Science undertake some post-graduate study.

The School of Optometry in the Faculty of Science developed from the former College of Optometry in Toronto. This has been integrated into the Faculty of Science and offers a 5-year programme leading to the degree of Doctor of Optometry (O.D.). This new Programme commenced in September of 1967. Further information appears on page 283.

Most Science students are enrolled on a full-time basis. Each year of any programme in this Faculty except Co-operative Applied Physics, Co-operative Applied Chemistry and Co-operative Honours Earth Sciences is offered in two terms throughout a conventional academic year. The Applied Physics and Applied Chemistry programmes are given exclusively on a co-operative basis with alternating terms of academic and industrial work; refer to Chapter 6 for further information on the Co-operative programmes.

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 undergraduate programmes involving Biology, Chemistry, Earth Sciences and Physics which are listed below. The ordinary or pass-level B.Sc. will be awarded on completion of the General Science Programme in either the three or four-year option. The honours degree, B.Sc. (Honours), will be awarded on completion of any of the honours programmes shown under Academic Programmes. The O.D. (Doctor of Optometry) degree is described above. M.Sc. and Ph.D. degrees are discussed in the Graduate Calendar.
Admission

The admission requirements and procedures for all programmes are outlined in Chapter 2 of this Calendar. The following points emphasize some of the admission requirements which relate specifically to programmes in the Faculty of Science.

Applicants from Ontario Grade 13
Applicants must present the following Mathematics courses - Relations and Functions, and Calculus (or the old 2-credit Math A), and two Science courses, one of which must be Physics or Chemistry. Both Physics and Chemistry are strongly recommended.

Year One Programmes
The following specifically labelled Year One programmes are offered: Co-operative Applied Chemistry, Co-operative Applied Physics and Regular Science. The Year One Regular Science Programme is a common first year for all students whether General or Honours and for all non-major or majoring programmes; there are a wide variety of elective courses available with certain courses required if a particular majoring area is desired in Year Two. Year One Regular Science also provides the background of the pre-professional year necessary to apply for admission to Year Two Optometry (the first year of the professional programme). Students planning to enter the Co-operative Earth Sciences programme in Year Two should also take Year One Regular Science.

Admission as an Adult Student
It is recommended that applicants obtain standing in Ontario Grade 13 Mathematics and Science courses or their equivalent in order to have the proper background for first year University courses in these areas.

Advanced Standing
Students applying to Co-operative programmes in the Faculty of Science will not be admitted above the Year 3 Term A level. Any student thus admitted would be required to complete a minimum of three work terms.

Students within the University desiring to transfer into the Faculty of Science will be given a choice of two methods as follows:

1) Admission credit for courses passed with a grade of C or better without a cumulative average or
2) Admission credit for all relevant courses (including Ds) passed, but with a cumulative average based on all courses attempted, whether passed or failed.

Students transferring from other universities are judged on their merits and will be allowed transfer credits on a basis similar to those allowed Waterloo students.

Registration
Registration and preregistration (course selection) dates are published in the front of this calendar.

To facilitate timetabling, all students are asked to select their programmes and courses in advance of their arrival on campus. Upper year students will do this as listed in the schedule (the normal preregistration period for most Science students is in mid-March). Further information will be announced prior to the
preregistration period. Newly-admitted students will be mailed information on course selection shortly after confirming their intention to enrol in the Faculty of Science (for most freshmen this will be in the latter part of June). This information is designed so that students can select their courses by mail; any student wishing to discuss course selection may arrange an on-campus personal interview as outlined in the information package.

Examinations and Standings

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

Students should note that the Faculty of Science now operates under a "course system" in which student progress is measured by courses successfully completed rather than by years. Students who have passed fewer than five courses will be considered Year 1 students; those who have passed at least five courses but fewer than ten will be considered Year 2 students; those with at least ten but fewer than fifteen, Year 3; and those with fifteen or more, Year 4; Year 5 students will exist only in the Optometry programme for those students in their graduating year.

1) Final Examinations

a) The faculty constitutes the examining body for all examinations. All examination results are considered by the Examinations and Standings Committee 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. Appeals against faculty decisions made under these regulations should be made in writing to the Registrar's Office within one month of the official announcement of term or year marks.

b) For Students in Regular Programmes:
Final examinations in one-term courses are held in December or in April. Final examinations for all full year courses are held in April, and cover the whole work of each course. Make-up examinations are held in July. The time normally allowed for each examination is three hours.

c) For Students in Co-operative Programmes:
In Year 1, final examinations in one-term courses are held at the end of the term in which the course is taken, whereas final examinations in full-year courses are held at the end of the second term and cover the whole work of each such course. Beyond first year, final examinations are usually held at the end of each term. The time normally allowed for each examination is three hours.

d) In all courses each student is required to submit, in such form and at such time as may be determined by the instructor, evidence of satisfactory participation in term work. The marks obtained for work during term are used, in part, in determining standing. The ratio in which marks for term work and written examinations are combined is at the discretion of the individual departments. To pass in a course, a student must obtain a minimum of 50% in
the combined term and examination marks. At the discretion of
the chairman of the department concerned and of the Dean, a
student may be barred from the final examination if the course
requirements are not completed to the satisfaction of his instructor.
Some courses and/or instructors may not require final examinations; in such cases term work only will be used in determining a
final grade.

e) Failure to write an examination is considered a failure to pass.
A student who defaults a final examination, except for a properly
certified reason, shall have no make-up examination privileges
and must repeat the work in class. If a student fails to write for
medical or health-related reasons, 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.

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

2) Standing

a) Marks in individual courses will be reported as numerical marks
on the scale 0 to 100. A mark of 50 or better is necessary to pass
and receive credit for a course. For Science students, the lowest
mark to be recorded and averaged will be 32, equivalent to the
weighting factor for the F— on the common grading system.

In addition to numeric marks, the following designations may be
used from time to time:
INC (either term work, lab work, examinations, etc., are incomplete)

AEG (aegrotat—signifying the student's work or examination was
incomplete for some acceptable reason (such as illness) and his
instructor felt the student should receive credit for the course
but a numerical mark could not be set).

CR (credit granted where performance was satisfactory but no
specific mark is given and AEG is not applicable).

NCR (credit is not granted where performance was unsatisfactory
but no specific mark is given).

AUD (a course which is audited only and is neither averaged nor
counted for credit).

NMR (no mark reported).

DNW (final examination not written in a course that has not
been dropped officially).

AEG or CR will count as a course passed towards the total neces-
sary but will not count in the overall average. INC, NMR or
DNW will indicate a situation that will have to be resolved to the
satisfaction of the Examinations and Standings Committee.

Unless there are medical or other extenuating circumstances, a
DNW will usually be weighted for averaging purposes as the
Examinations and Standings

The lowest possible failing mark (32, equivalent to F— on the common grading system) in determining standing.

b) **Overall standing** will be determined at the end of each year by the cumulative average of all courses taken at the University (at any time, whether passed or failed).

To proceed in the General programme requires a cumulative average of 50% overall; if a field of specialization is chosen after Year 1, a 60% cumulative average in this field will also be required. To proceed in an Honours programme requires a cumulative average of 60% overall and 60% in the courses of the major subject(s). The Optometry programme is evaluated in the same manner as the regular Honours programmes of the Faculty.

Since Year 1 Science is essentially a common year a student may enter any Year 2 programme in good standing if the appropriate courses were selected and if the Year 1 programme is completed with the required overall average; the only exception to this is in the Optometry programme where enrolment limitation may be necessary in Year 2 (see page 285 for further details).

Normally a 60% or better standing in a major field subject is required to enrol in a majoring programme; this requirement may be waived in consideration of an otherwise good overall record or for other acceptable reason at the discretion of the Undergraduate Officer or the Chairman of the majoring Department concerned.

If an upper year student fails to meet either of the above required cumulative averages he will be designated as in Conditional Standing for the following year. A General student in Conditional Standing must improve his standing to at least the minimum overall level noted or else he will be required to withdraw from the Faculty; students in the 4-year majoring programme may be transferred to the 3-year programme where no major field average is required. An Honours student in Conditional Standing may elect to transfer to the General programme in good standing (if this is possible) or may endeavour to improve his Honours average to the cumulative minimum required; if such improvement is not forthcoming such a student will be transferred to the General programme. Alternatively, the Examinations and Standing Committee may decide that such a student must transfer to the General programme (either option). An Honours student in Conditional Standing may be required by his major Department to repeat certain courses in which he has done poorly or he may elect to do so himself in order to improve his performance in subsequent years.

A student's standing (overall) will be interpreted each year according to the following terms:

<table>
<thead>
<tr>
<th>Cumulative Average</th>
<th>Honours Programme</th>
<th>General Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.00-100</td>
<td>First Class Honours</td>
<td>Excellent</td>
</tr>
<tr>
<td>70.0-79.9</td>
<td>Second Class Honours</td>
<td>Very Good</td>
</tr>
<tr>
<td>60.0-69.9</td>
<td>Third Class Honours</td>
<td>Good</td>
</tr>
<tr>
<td>50.0-59.9</td>
<td></td>
<td>Passing</td>
</tr>
</tbody>
</table>

Below these levels will be *Conditional Standing* or *Failure*, *required to withdraw*, depending upon circumstances. Normally, Conditional standing will be allowed the first time unless the
Note In cases where a course (failed or passed) is repeated, both marks will be used in calculating the student's cumulative overall average. If a passing grade is achieved more than once in the same course, it will still only count as one course passed towards the total necessary for graduation. Students in good standing will not normally repeat courses they have passed. No course may be repeated more than once.

c) Programme selection:
Full-time students. All first year students must take a minimum of 5 courses and no more than 6 courses will be permitted except in exceptional cases. In subsequent years, a General student will normally take 5 courses minimum, 6 courses maximum per year, unless fewer are needed for graduation. Honours students in upper years will follow Department recommendations (usually 6-7 courses per year). An extra course once completed will normally count as a course passed or failed as well as in calculation of the cumulative average (the only exception to this would be for graduating students taking more than the minimum number of courses needed for graduation). All students taking extra courses should have a cumulative average of 70% or better (or in the case of Year 1 students, a Grade 13 average of 70% or better).
Part-time studies or reduced programmes: Except in exceptional circumstances, an Honours programme may not be taken on a completely part-time or reduced-programme basis; at least two of the upper three years must be taken on a full-time (full programme) basis and no student may spend more than 5 years of full-time study (or its equivalent) for an Honours degree. The Science Faculty does allow the General degree in either option, to be pursued on a part-time or reduced programme basis subject to approval by the Associate Dean (Undergraduate Affairs) and the Department concerned (where the programme involves a major field). Normally, no first year programme for a full-time student may be reduced below the 5 course minimum except in exceptional circumstances.

d) Co-operative Programmes: Students in Co-operative programs will be evaluated by the rules shown modified where necessary to suit their special needs. In particular:

Evaluation in Year 1 will be made at the end of term IB on the entire year's work. Students must have a 60% average to proceed to term 2A. Those below this average may be transferred to the
General programme (non-Co-op) in good standing if possible or may be allowed to repeat the 1B term in Conditional Standing in order to remain in the Co-op programme. Students who have done very poorly and who are felt unable to repeat the 1B term will be transferred to the Year 1 regular programme in Conditional Standing, or else may be asked to withdraw from the Faculty.

II Upper year assessments will be made on a term by term basis and cumulative average, make-up examination privileges, conditional or good standing, etc., decided then. Beyond Year 1, the various programmes are mostly composed of one-term courses in which all marks are final. Depending on electives chosen there may be some mixture of term and full-year courses. Assessments made in terms 2A and 3A will be on the basis of marks in all courses taken; no make-up examinations will be given in the first half of a full-year course; for assessments in terms 2B and 3B, marks given for the second half of a full-year course will be the final mark for the course and will replace the A term mark for average purposes. Make-up examinations may be allowed in one-term courses at any time and in full-year courses at the end of the second term only. Terms 4A and 4B will normally be assessed as a unit at the end of the 4B term when both terms are taken consecutively from September to April. Students from any Co-operative programme may be transferred to the General programme (non-Co-op) if they are deemed to be making unsatisfactory progress towards their Honours degree. Normally, a student may take no more than two upper year terms on a part-time or reduced-programme basis and must have special permission from his Department to do so.

Make-up Examinations The Faculty of Science will no longer grant automatic supplemental examinations to all students in good standing. This is in line with general practice in other Faculties and Universities operating on a credit system. It has been the experience in the Faculty of Science at Waterloo that the majority of students who have failed courses have subsequently failed to pass supplemental examinations. The Science Faculty realizes that course prerequisites are important to students proceeding to a Science degree and will endeavour to grant make-up examination privileges to deserving students in good standing but only in a limited number of cases according to the following general principles:

A) In any case where failure to pass is attributable to extraordinary circumstances, especially medical or health-related problems.

B) In any year, normally only where such failed courses could not be repeated and where a student's progress could be unduly held up by lack of one prerequisite. Non-prerequisite courses would have to be repeated, i.e. most Arts courses and non-required Mathematics or Science courses, and many others could be repeated on a co-requisite basis.

In all cases regarding make-up examinations the student must have satisfied all term work requirements in the course and must have the permission of the Examinations and Standings Committee (who must be satisfied the student has a fair chance to pass the examination – the student's overall University record may be used in making this assessment). Regardless of standing, no student will be allowed make-up privileges if he has failed more
than two full courses or their equivalent in a given year (except on medical grounds as in A).

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

Except in extraordinary circumstances, (e.g. A above), when a make-up examination is passed, the course will count as a course passed toward the degree, but the mark obtained will not be counted in determining cumulative averages (i.e. the original mark will normally be the mark which counts).

Other General Comments

a) Transfer Students: Students will be accepted for transfer from other Year 1 programmes in the University or from other Universities. Their programmes will be evaluated in terms of the number of course credits allowed and the number remaining for a degree. Students from other Universities will not have previous background used in calculating Cumulative Averages. Students from other Faculties at Waterloo may have cumulative averages which include courses transferred for credit (See Admission Requirements).

Students will be accepted for transfer at other than the Year 1 level but will normally be required to complete at least the equivalent of two years' work while registered in the Faculty of Science (i.e. at least 10 full-year courses) regardless of the number of transfer credits they present.

b) Transferability or Upgrading of B.Sc. Degree: A student who has graduated with a 3-year General degree may successfully complete the requirements of the 4-year degree with an official major field designation and exchange his old diploma for a new one, although he will not "graduate" a second time. Normally a student from this University or from another University may not upgrade a General B.Sc. or its equivalent to a Waterloo Honours B.Sc. However, from time to time such conversion privileges may be allowed in exceptional cases on the recommendation of the Department(s) concerned and with the approval of the Examinations and Standings Committee.

c) Future Requirements: The Faculty of Science changed to a course-credit system in 1969. As the Faculty gains experience in the operation of such a system, these rules may be modified from time to time. Every effort will be made to operate consistent practices within each programme and broadly across the Faculty and the University where desirable. Normally, students will be given advance warning of changes in regulations but the Faculty reserves the right to make changes without notice where necessary.

Course and Programme Changes

a) Students may add and drop half courses during the first three weeks of the Fall, Winter and Spring terms upon having the appropriate change form completed.
b) Students may add and drop full-year courses during the first three weeks of the Fall term upon having the appropriate change form completed.

c) After these periods, students will be allowed to add courses only with the permission of the instructor and the appropriate undergraduate officer and upon completing the appropriate change form.

d) After these periods and until the last day of lectures, students may reduce their programmes from honours to general where appropriate.

e) Extra courses may be dropped after the normal three week change period but normally not after November 15 or July 1 for Fall and Spring one-term courses or March 1 for Winter one-term or full-year courses. An extra course is defined as one course beyond the minimum of five required in Year 1 or any year of the General Programme or one beyond the published minimum required for an Honours Programme (usually 6-7 courses depending on major field of study). Under the course-credit system, extra courses, once completed, are included in the cumulative average. All students other than those in Year 1 should clearly indicate to the appropriate Faculty advisor at Registration time which courses are to be regarded as extra.

Academic Programmes

Students entering first year in the Faculty of Science are essentially enrolled in a common year. Year 1 Co-operative Applied Chemistry and Co-operative Applied Physics are labelled as such but all other students are officially in Year 1 Regular Science. Year 1 Regular Science students are not designated as Honours or General or according to any specific programme. (Students planning to enter Co-operative Earth Sciences in Year 2 should enrol in Year 1 Regular Science.) Essentially the same courses are available to all first year students and any student may enter any Year 2 programme in Science provided he or she has taken the necessary courses in Year 1 and has achieved the necessary passing average; the only exception to this is in the Optometry programme where enrolment limitation may be necessary in Year 2 (see page 285 for further details).

In descriptions of programmes to follow, the term “course” refers to a course which extends for one full academic year; two half-year (or one-term) courses are the equivalent of one full course (one-term courses are marked with * following the course number). The symbol * after the number of laboratory hours indicates a laboratory taken in alternate weeks.

First Year Programmes
(Regular and Co-operative)

The Year 1 Science programme requires 5 full courses in first year of which at least two must be Faculty of Science courses and one of which should be an Arts elective (preferably English or Psychology). Only students whose Grade 13 average was 70% or better may select 6 courses if they wish (recommended for students intending to take an Honours Physics programme).
No more than 6 courses will be allowed except in exceptional cases. Courses should be chosen with a Year 2 goal in mind or else should be made general enough to cover many Year 2 programmes. The recommended Year 1 selections for various Year 2 Honours or General Science-Major programmes are shown below; in most cases the number of required courses has been held to only two with up to two more recommended (but not compulsory). To enter a Year 2 programme a student must achieve the Year 1 average necessary and must have taken the required courses. Students who elect 6 courses instead of 5 will have one less elective to take in one of the upper years, or else may enrich their programme with extra courses.

### Year 1 Science Programme Selections Leading to Year 2 Honours or Major Programmes

<table>
<thead>
<tr>
<th>Regular Programmes</th>
<th>Options Required in Year 1</th>
<th>Options Recommended in Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Field of Study</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology (see Note 1)</td>
<td>Biology 132, Chemistry 121*-122*</td>
<td>Physics 101*-102*, Mathematics 101, Earth Sciences 130</td>
</tr>
<tr>
<td>Biology and Chemistry (see Note 1)</td>
<td>Biology 132, Mathematics 130, Chemistry 121*-122*</td>
<td>Physics 101*-102* or 111*-112*, or 121*-122*</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Mathematics 130, Chemistry 121*-122*</td>
<td>Physics 121*-122* or 162*-163*</td>
</tr>
<tr>
<td>Chemistry (Mathematics Option)</td>
<td>Mathematics 130, 131A*-131B*, Chemistry 121*-122*</td>
<td>A Computer Science course</td>
</tr>
<tr>
<td>Chemistry (Physics Option)</td>
<td>Mathematics 130, Physics 121*-122* or 162*-163*, Chemistry 121*-122*</td>
<td>A Computer Science course</td>
</tr>
<tr>
<td>Earth Sciences (see Note 8)</td>
<td>Earth Sciences 130, Chemistry 121*-122*</td>
<td>Physics 101*-102*, or 121*-122*, or 162*-163*, Mathematics 130</td>
</tr>
<tr>
<td>Earth Science and Geography</td>
<td>Earth Sciences 130*, Chemistry 121*-122*, Geography 102* and one of: Geography 101*, 125R*, 126R*, 127 or Environmental Studies 195*</td>
<td>Mathematics 121-122*</td>
</tr>
<tr>
<td>Optometry (see Note 7 and page 283 for further details)</td>
<td>Mathematics 130, Biology 132, Physics 111*-112* or 121*-122* or 162*-163*, Psychology 101*</td>
<td>Chemistry 121-122*, Psychology 102*</td>
</tr>
<tr>
<td>Physics (see Notes 2, 3, 4, 10)</td>
<td>Mathematics 130, Physics 121*-122* or 162*-163*</td>
<td>Mathematics 131A*-131B*, Chemistry 121*-122*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Co-operative Programmes</th>
<th>Options Required in Year 1</th>
<th>Options Recommended in Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Field of Study</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applied Chemistry (see Note 5)</td>
<td>Mathematics 130, Chemistry 121*-122*</td>
<td>A Computer Science course, Physics 121*-122* or 162*-163*</td>
</tr>
<tr>
<td>Applied Physics (see Notes 6, 10)</td>
<td>Mathematics 130, Physics 121*-122* or 162*-163*</td>
<td>Mathematics 131A*-131B*, Chemistry 121*-122*</td>
</tr>
<tr>
<td>Co-operative Earth Sciences (see Note 8)</td>
<td>Earth Sciences 130, Chemistry 121*-122*</td>
<td>122* or 162*-163*, Mathematics 130</td>
</tr>
</tbody>
</table>
Note 1 Students wishing to pursue Honours Biology or Honours Biology and Chemistry who elect Physics 121*-122* or Physics 161*-162* in Year 1 would normally be expected to elect Physics 222*-223* (Electricity and Magnetism) in Year 2 or 3. Biology 131 may, by special permission and if a mark of at least 70% has been obtained, be accepted in place of Biology 132.

Note 2 Students desiring the Biophysics option of the Honours Physics programme are advised to include Biology 131 in their programme. Students wishing the Theoretical Physics option are advised to select Mathematics 130, 131A*-131B*, and a computing course.

Note 3 Students desiring the geophysics option of the Honours Physics programme are advised to include Earth Sciences 130 and Chemistry 121*-122* in Year 1.

Note 4 Students wishing any of the Business Administration options are advised to select Economics 101*-102*. The special four-year General Science and Business Programme also requires Physics (101*-102* recommended), Chemistry (121* and 122*), Earth Sciences 130 and Mathematics 130.

Note 5 Students in the Co-operative Applied Chemistry programme have two methods of taking Year 1: (i) two terms in a row (September-April) or (ii) fall term on campus (September-December), winter term at work (January-April) and spring term on campus (April-August). Since no first-year Biology or Earth Sciences courses are offered in the spring term (April-August), only students who plan to take two terms in a row may elect these courses. Students completing term 1B in the spring must elect both Chemistry 121*-122* and Physics 121*-122* to fulfill the requirement of two Science courses in first year.

Note 6 All Co-operative Applied Physics Students take Year 1 as two terms in a row (see page 280).

Note 7 Students planning to apply for admission to Year 2 Optometry should note that a year of Chemistry is required for all students lacking a good Chemistry background in Ontario Grade 13 or its equivalent -- for these students Chemistry 111*-112* is recommended rather than 121*-122*.

Note 8 Earth Science majors planning to enter the co-operative programme and desiring elective courses in Biology should take Biology 131 during their first year.

Note 9 The Ontario Ministry of Education has strongly recommended that all students who are preparing to teach science in high school should take at least one full-year course in Biology.

Note 10 Science 209* is a recommended elective.

A brief discussion of the above courses and some other courses available for selection is given below. See Course Descriptions, Chapter 16 of this Calendar for more details.

Faculty of Arts Courses

Usually selections are made from the introductory courses offered in various Departments. English 102 (Regular students only), 105*, 108*, and 190* are strongly recommended for consideration as are Psychology 101* and 102*. Some other popular areas for consideration might be Anthropology, Economics, French, Geography, German, History, Philosophy, Political Science, Russian, Sociology or Religious Studies. Other areas may be suitable if available.
Faculty of Mathematics Courses
The first year Mathematics courses, 130 (Calculus), 131A*-131B* (Algebra and Solid Geometry) may be chosen. Calculus is either required or recommended in all programmes in Science and should be strongly considered. For students wishing some computer science, Science 160* or the sequence Math 122A*-132B* or Math 132A*-132B* are suggested depending on the level of intensity desired in the subject. Science 160* (Computational Methods in Science) is a Science Faculty course, while Math 122A* (Introduction to Computing) and Math 132A* and 132B* (Introduction to Computer Science 1 and 2) are offered by the Faculty of Mathematics. Only students who are above average in Mathematics (e.g. approximately 70% or better in at least two Grade 13 Mathematics courses) should normally choose three Mathematics courses. Mathematics 101A*-101B* (Applications of Mathematics in the Sciences) is recommended for potential Biology majors.

Faculty of Science Courses
Introductory courses are offered in Biology, Chemistry, Earth Sciences and Physics. Courses from at least two of these areas must be elected. Although there are several first year courses available in Physics there is sufficient overlapping of material that only one of the full-year sequences may be chosen, i.e. only one of Physics 101*-102*, 111*-112*, 121*-122*, 162*-163* and only one of Chemistry 111*-112* or 121*-122*.

Biology
Biology 131 Introduction to Biology (2 lectures, 3 hours laboratory). This course is the normal selection for those wishing a Biology elective in first year and who are not intending to major in Biology or to enter the School of Optometry. It is for all students whether or not Grade 13 Biology was taken at school. Students with 80% or better, in Grade 13 Biology may, with special permission from the Chairman, Department of Biology, bypass this course and select a Year 1 programme without a Biology course.

Biology 132 Principles of Biology (2 lectures, 3 hours laboratory). This course is for those wishing to major in Biology or to enter the School of Optometry. It is for all such students whether or not Grade 13 Biology was taken at school. However students who have achieved at least a 70% overall Grade 13 average with 80% or better in Biology may, with special permission from the Chairman, Department of Biology, be allowed to select a second year Biology course instead of Biology 132.

Earth Sciences
Earth Sciences 130 Introductory Geology (2 lectures, 3 hours laboratory) This course is an ideal elective for first year students who are not familiar with this area. It is not necessary to have a Geography or other specific high school background for this course. Students with potential interest in Geochemistry or Geophysics should select this course.
Chemistry

Chemistry 111* General Chemistry 1 *(Prerequisite: Grade 12 Chemistry, 3 lectures, 3 hours laboratory, fall term)
Chemistry 112* General Chemistry 2 *(Prerequisite: Chemistry 111*, 3 lectures, 3 hours laboratory, winter term)
Chemistry 121* Chemical Structure (3 lectures, 3 hours laboratory, fall term only)
Chemistry 122* Chemical Reaction (3 lectures, 3 hours laboratory, offered in winter and spring terms)

Chemistry 111*-112* are designed for students who have NOT completed Ontario Grade 13 chemistry and who may wish to pursue higher level chemistry courses. Only in exceptional circumstances will this course sequence be open to students who have taken Ontario Grade 13 chemistry or its equivalent. Such students should take 121* followed by 122*. Credit will not be allowed for both 111*-112* and 121*-122*.

Physics

Physics 101* General Physics (3 lectures and a tutorial period on alternate weeks, fall term)
Physics 102* General Physics (3 lectures and a tutorial period on alternate weeks, winter term)
Physics 111* General Physics (3 lectures, 3 hours laboratory or a tutorial period on alternate weeks, fall term)
Physics 112* General Physics (3 lectures, 3 hours laboratory or a tutorial period on alternate weeks, fall term)
Physics 121* Introductory Physics 1 (3 lectures, 3 hours laboratory or 2 hours tutorial on alternate weeks, fall term)
Physics 122* Introductory Physics 2 (3 lectures, 3 hours laboratory or 2 hours tutorial on alternate weeks, fall term)
Physics 162* Mechanics, Wave Motion and Heat 1 (3 lectures, 3 hours laboratory or 2 hours tutorial on alternate weeks, fall term)
Physics 163* Mechanics, Wave Motion and Heat 2 (3 lectures, 3 hours laboratory or 2 hours tutorial on alternate weeks, offered in winter or spring term)

Any of the above course sequences, 101*-102*, 111*-112*, 121*-122* or 162*-163* constitute sufficient preparation for higher year courses in physics.

Physics 121*-122* would be the normal selection for those students intending to continue in a physics major programme. Students of demonstrated ability (at least 75% average in Grade 13 Physics and Functions and Relations and Calculus or their equivalent) who prefer an enriched and slightly more challenging course are encouraged to take Physics 162*-163*. Physics 101*-102* is a one-year survey of the main fields of Physics for students who plan to proceed in Biology, Biology and Chemistry or Earth Sciences.

Physics 111*-112* is recommended rather than Physics 101*-102* for those students who want some practical laboratory experience to complement their theoretical studies or to fulfill entrance requirements of certain medical or dental schools.

Students do not need Grade 13 Physics as prerequisites to take 101*-102* or 111*-112* although it would be desirable.
Type A Teaching Certification

Admission to the Type A Certification programme at the Ontario Colleges of Education requires the completion of a programme of at least twenty full-year University courses, including one or two specialist fields in which the student has obtained at least second class (honours) or equivalent standing. A programme of twenty courses and one specialist field must include at least nine full courses in the field. A programme of twenty courses and two specialist fields must include fourteen full-year courses in the two combined fields, with at least six in each field. The Ontario Ministry of Education approved specialist fields are as follows: Agriculture, Anglais, Art, Biology, Chemistry, Computer Science, Drama or Theatre Arts, Economics, English, Francais, French, Geography, Geology, German, Greek, History, Home Economics, Italian, Latin, Mathematics, Music, Physical and Health Education, Physics, Political Science, Psychology, Russian, Sociology, Spanish.

Honours Programmes

The normal route to attain professional standing in Science is to take an Honours Programme in the appropriate field or combination of fields. The Honours Programmes are of four years' duration and are approximately 22-24 courses in length depending on the programme and in some cases on the electives chosen; they are rather specialized in content, and the syllabus in each is prescribed in terms of a core of compulsory courses plus various electives which allow some flexibility of choice. Students enrolled in a given programme must complete the total number of courses listed for that programme before graduation. Most Honours Programmes allow at least 25% of the courses to be taken as electives of the student's choice, although recommended courses are shown as a guide. The minimum standard for graduation from any Honours Programme is a cumulative (overall) average of 60% calculated for all courses taken (in any year - whether passed or failed) plus a 60% cumulative average for the major field courses. Those graduating with at least second-class honours standing are granted preferred treatment for post-graduate study in Canadian Universities.

Honours Biology

(For Year 1, see page 262)

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 233</td>
<td>Vertebrate Zoology</td>
<td>2</td>
</tr>
<tr>
<td>Biology 234</td>
<td>Plant Biology</td>
<td>2</td>
</tr>
<tr>
<td>Biology 235</td>
<td>Fundamentals of Microbiology</td>
<td>2</td>
</tr>
<tr>
<td>Biology 236</td>
<td>Ecology 1</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 266*</td>
<td>Organic Chemistry 1 (fall term)</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 267*</td>
<td>Organic Chemistry 2 (winter term)</td>
<td>2</td>
</tr>
<tr>
<td>One non-Biology elective</td>
<td>(Physics 301* - 302* is recommended) as specified</td>
<td></td>
</tr>
</tbody>
</table>

Year 3† At least two full courses from

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 333</td>
<td>Invertebrate Zoology</td>
</tr>
<tr>
<td>Biology 334*</td>
<td>The Flowering Plants</td>
</tr>
<tr>
<td>Biology 338*</td>
<td>Plant Morphology &amp; Morphogenesis</td>
</tr>
<tr>
<td>Biology 335</td>
<td>Microbial Form and Function</td>
</tr>
</tbody>
</table>
Plus at least two full courses from

- Biology 341* Cell Physiology 2 3
- Biology 342 Vertebrate Physiology 2 3
- Biology 343* Histology & Cytology 2 3
- Biology 344* Cytogenetics 2 3
- Biology 345* Plant Physiology 2 3

- Chemistry 332* Biochemistry 1 2 3
- Chemistry 333* Biochemistry 2 2 3

One full-year Elective as specified

†All Honours Biology students who have completed their third year are required to participate in an off-campus field course before entering Year 4; this will cost each student approximately $50-$100. All students must fulfill this field course requirement to obtain their B.Sc. Honours degree in this programme.

Year 4 5 courses, at least 3 of which are Biology 400-level courses. This year is designed to be the specialist year. The student now has a wide grounding in basic biology and biochemistry and can choose courses covering his particular area of interest. (Chemistry 427*-428* and/or Chemistry 432*-433* are recommended.)

Note regarding electives A listing of Science and other electives is found on page 291. Although this list was prepared for the General Science programme many of the courses would be suitable here. Other Honours level courses in Chemistry, Physics or Psychology should also be considered.

Honours Biology and Chemistry (For Year 1, see page 262)

Year 2 Lectures Labs

Chemistry 210* Non-Aqueous Solvents and Non-Transition Metal Chemistry 2 0
Chemistry 211* Chemical Bonding in Inorganic Chemistry 2 0
Chemistry 260* Organic Chemistry 1 2 3+1
Chemistry 261* Organic Chemistry 2 2 1
Chemistry 220* Introductory Analytical Chemistry 1 6
Chemistry 221* Analytical Chemistry of Multi-Component Systems 2 0
Chemistry 291* Laboratory (winter term) 0 6
Elective (Mathematics 236 recommended) as specified

Two of:

- Biology 233 Vertebrate Zoology 2 3
- Biology 234 Plant Biology 2 3
- Biology 235 Fundamentals of Microbiology 2 3
- Biology 236 Ecology 1 2 0
### Year 3

<table>
<thead>
<tr>
<th>Course / Elective</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 356*</td>
<td>General Physical Chemistry 1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 357*</td>
<td>General Physical Chemistry 2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 332*</td>
<td>Biochemistry 1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 333*</td>
<td>Biochemistry 2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 360*</td>
<td>Organic Chemistry 3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 361*</td>
<td>Organic Chemistry 4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td>(Physics 222*-223* and 222L*-223L* strongly recommended if Physics 121*-122* or 162*-163* taken in Year 1)</td>
<td>Two full courses of:</td>
<td></td>
</tr>
<tr>
<td>Biology 333</td>
<td>Invertebrate Zoology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 334*</td>
<td>The Flowering Plants</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 338*</td>
<td>Plant Morphology &amp; Morphogenesis</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 335</td>
<td>Microbial Form and Function</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 341*</td>
<td>Cell Physiology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 342</td>
<td>Vertebrate Physiology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 343*</td>
<td>Histology &amp; Cytology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 344*</td>
<td>Cytogenetics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 345*</td>
<td>Plant Physiology</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

### Year 4

<table>
<thead>
<tr>
<th>Course / Elective</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 316*</td>
<td>An Introduction to Transition Metal Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 317*</td>
<td>Solid State Inorganic Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 437*</td>
<td>Biochemistry 3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 433*</td>
<td>Biochemistry 4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Three of: Any 400-level courses offered in Biology</td>
<td>as specified</td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

### Honours Chemistry

*(For Year 1, see page 262)*

### Year 2

#### Fall Term

<table>
<thead>
<tr>
<th>Course / Elective</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 210*</td>
<td>Non-Aqueous Solvents and Non-Transition Metal Chemistry</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 220*</td>
<td>Introductory Analytical Chemistry</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 240*</td>
<td>Introductory Theoretical Chemistry</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 250*</td>
<td>Introductory Thermodynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 260*</td>
<td>Organic Chemistry 1</td>
<td>2</td>
<td>3+1</td>
</tr>
<tr>
<td>One elective</td>
<td>(Physics 222* and 222L* are recommended)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Winter Term

<table>
<thead>
<tr>
<th>Course / Elective</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 211*</td>
<td>Chemical Bonding in Inorganic Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 221*</td>
<td>Analytical Chemistry of Multi-Component Systems</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 251*</td>
<td>Applications of Chemical Thermodynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 252*</td>
<td>Quantum Chemistry 1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 261*</td>
<td>Organic Chemistry 2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 291*</td>
<td>Laboratory</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>One elective</td>
<td>(Physics 223* and 223L* are recommended)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Year 3

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 310*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Transition Metal and Coordination Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 350*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Spectroscopy and Molecular Structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 351*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Statistical Thermodynamics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 360*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Organic Chemistry 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 390*</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>Advanced Laboratory 1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**One elective**

(subject to availability and compatibility with the timetable, the following are recommended: Chemistry 332*, Biochemistry 1, Chemistry 353*, Introduction to Polymer Science; or Physics 222* and 222L* if not taken previously.)

#### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 311*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Radiochemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 352*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemical Kinetics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>or Chemistry 354*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Applied Kinetics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 361*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Organic Chemistry 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 391*</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>Advanced Laboratory 2</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

**Two electives**

(subject to availability and compatibility with the timetable, the following are recommended: Chemistry 332*, Biochemistry 1; Chemistry 362*, Theoretical Organic Chemistry; Chemistry 395*, History of Chemistry; or Physics 223* and 223L* if not taken previously.)

### Year 4

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 409*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Solid State Chemistry 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 411*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Organometallic Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 416*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Applied Inorganic Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 420*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Analytical Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 432*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Biochemistry 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 450*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Group Theory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 451*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Statistical Mechanics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 453*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Polymer Properties and Polymerization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 454*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Surface Chemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 455*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Electrochemistry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 460*</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Spectroscopy in Organic Chemistry</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Eight electives**

of which at least four must be Chemistry 400-level courses listed below:
### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 414*</td>
<td>Kinetics of Inorganic Reactions</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 417*</td>
<td>Synthesis and Structure of Inorganic Compounds</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 419*</td>
<td>Biological Aspects of Inorganic Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 421*</td>
<td>Spectrometric Analysis</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 433*</td>
<td>Biochemistry 4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 434*</td>
<td>Applied Biochemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 452*</td>
<td>Quantum Chemistry 2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 457*</td>
<td>Experimental Aspects of Polymer Science</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 456*</td>
<td>Catalysis</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 461*</td>
<td>Special Topics in Organic Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note 1:** From Chemistry 409*, 411*, 414*, 416*, 417*, a maximum of three can be taken.

**Note 2:** From courses Chemistry 450*, 451*, 452*, 453*, 454*, 455*, 456*, a maximum of four can be taken.

**Note 3:** Courses will be given subject to sufficient demand.

### Honours Chemistry (Mathematics Option) (For Year 1, see page 262)

**Year 2**

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 210*</td>
<td>Non-Aqueous Solvents and Non-Transition Metal Chemistry</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 220*</td>
<td>Introductory Analytical Chemistry</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 240*</td>
<td>Introductory Theoretical Chemistry</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 250*</td>
<td>Introductory Thermodynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 760*</td>
<td>Organic Chemistry 1</td>
<td>2</td>
<td>3-1</td>
</tr>
<tr>
<td>Mathematics 234a*</td>
<td>Differential Equations</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>One elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 211*</td>
<td>Chemical Bonding in Inorganic Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 251*</td>
<td>Applications of Chemical Thermodynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 252*</td>
<td>Quantum Chemistry 1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 261*</td>
<td>Organic Chemistry 2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 291*</td>
<td>Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics 240a*</td>
<td>Numerical Applications in Computer Science</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>One elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Electives should be selected from Mathematics 236, 233 or 243, Physics 222*-223* or 252*-253* (and 222L*-223L* or 252L*-253L*)
### Year 3

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 310* Transition Metal and Coordination Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 350* Spectroscopy and Molecular Structure</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 351* Statistical Thermodynamics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>or Chemistry 360* Organic Chemistry 3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 390* Advanced Laboratory 1</td>
<td>0</td>
<td>9†</td>
</tr>
<tr>
<td>Mathematics 237 Advanced Calculus (first term)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 219 Linear Algebra (first term)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>or Mathematics 312b* An Introduction to Complex Variable Theory</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>One elective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Subject to availability and compatibility with the timetable, the following are recommended: Chemistry 332*, Biochemistry 1; Physics 226*, Optics; Physics 352*, Electronics; additional mathematics courses approved by the Chemistry Department.)

#### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 311* Radiochemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>or Chemistry 361* Organic Chemistry 4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 352* Chemical Kinetics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>or Chemistry 354* Applied Kinetics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 391* Advanced Laboratory 2</td>
<td>0</td>
<td>9†</td>
</tr>
<tr>
<td>Mathematics 237 Advanced Calculus (second term)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Mathematics 219 Linear Algebra (second term)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>or Mathematics 234b* Mathematical Modelling</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>One elective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Subject to availability and compatibility with the timetable, the following are recommended: Chemistry 333*, Biochemistry 2; Physics 227*, Optics; Physics 353*, Electronics; additional mathematics courses approved by the Chemistry Department.)

†Chemistry 390* and 391* will be only 6 hours if 360* and 361* are not selected.

### Year 4

Chemistry 490*, 491*.  
Four one-term Chemistry courses of which two must be at the 400-level.  
Two full-year Mathematics courses at the 300- or 400-level.

#### Honours Chemistry  
(Physics Option)  
(For Year 1, see page 262)

### Year 2

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 210* Non-Aqueous Solvents and Non-Transition Metal Chemistry</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 220* Introductory Analytical Chemistry</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 240* Introductory Theoretical Chemistry</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 250* Introductory Thermodynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 260* Organic Chemistry 1</td>
<td>2</td>
<td>3+1</td>
</tr>
<tr>
<td>Physics 222* or 252* Electricity and Magnetism 1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 222L* or 252L* Electricity and Magnetism Laboratory</td>
<td>0</td>
<td>3*</td>
</tr>
</tbody>
</table>
### Winter Term

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 211*</td>
<td>Chemical Bonding in Inorganic Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 251*</td>
<td>Applications of Chemical Thermodynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 252*</td>
<td>Quantum Chemistry 1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 261*</td>
<td>Organic Chemistry 2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 291*</td>
<td>Laboratory</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Physics 223* or 253*</td>
<td>Electricity &amp; Magnetism 2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 223L* or 253L*</td>
<td>Electricity &amp; Magnetism Laboratory</td>
<td>0</td>
<td>3*</td>
</tr>
<tr>
<td>Physics 227*</td>
<td>Optics 2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 227L*</td>
<td>Optics 2 Laboratory</td>
<td>0</td>
<td>3*</td>
</tr>
</tbody>
</table>

### Year 3

#### Fall Term

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 310*</td>
<td>Transition Metal and Coordination Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 350*</td>
<td>Spectroscopy and Molecular Structure</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 351*</td>
<td>Statistical Thermodynamics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>or Chemistry 360*</td>
<td>Organic Chemistry 3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 390*</td>
<td>Advanced Laboratory 1</td>
<td>0</td>
<td>9†</td>
</tr>
<tr>
<td>Mathematics 237</td>
<td>Differential and Integral Calculus (first term)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 324*</td>
<td>Atomic and Nuclear Physics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 352*</td>
<td>Electronics 1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 352L*</td>
<td>Electronics 1 Laboratory</td>
<td>0</td>
<td>3*</td>
</tr>
</tbody>
</table>

†Chemistry 390* will be only 6 hours if 360* is not selected.

### Winter Term

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 352*</td>
<td>Chemical Kinetics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>or Chemistry 354*</td>
<td>Applied Kinetics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 391*</td>
<td>Advanced Laboratory 2</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics 237</td>
<td>Differential and Integral Calculus (second term)</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 325*</td>
<td>Atomic and Nuclear Physics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 353*</td>
<td>Electronics 2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 353L*</td>
<td>Electronics 2 Laboratory</td>
<td>0</td>
<td>3*</td>
</tr>
</tbody>
</table>

### Year 4

Four one-term Chemistry courses of which two must be at the 400-level.

Two full-year Physics courses at the 300- or 400-level.

### Co-operative Applied Chemistry (Honours)

(For Year 1, see page 262) Information about the Co-op work terms and the Coordination Department can be found in Chapter 6. Both streams run until the end of academic term 3B whereupon the stream taking 3B in the fall term will have a double work term to combine with the other stream. This procedure will allow both streams to take Year 4 over the regular academic year (fall-winter) when more course electives and opportunities exist and to graduate at the same time in May.
### Year 2A

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 210*</td>
<td>Non-Aqueous Solvents and Non-Transition Metal Chemistry (Fall Term Stream)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>or Chemistry 211*</td>
<td>Chemical Bonding in Inorganic Chemistry (Winter Term Stream)</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 240*</td>
<td>Introductory Theoretical Chemistry</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 250*</td>
<td>Introductory Thermodynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 260*</td>
<td>Organic Chemistry 1</td>
<td>2</td>
<td>3+1</td>
</tr>
<tr>
<td>Chemistry 220*</td>
<td>Introductory Analytical Chemistry</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

**One elective**

It is recommended that Physics 222*-223* or 252*-253* be strongly considered as electives sometime during Years 2 & 3.

### Year 2B

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 211*</td>
<td>Chemical Bonding in Inorganic Chemistry (Spring Term Stream)</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>or Chemistry 210*</td>
<td>Non-Aqueous Solvents and Non-Transitional Metal Chemistry (Fall Term Stream)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 261*</td>
<td>Organic Chemistry 2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 251*</td>
<td>Applications of Chemical Thermodynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 252*</td>
<td>Quantum Chemistry 1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 221*</td>
<td>Analytical Chemistry of Multi-Component Systems</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 291*</td>
<td>Laboratory</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>

**One elective**

### Year 3

Terms 3A and 3B will be taken in different sequence for different Co-operative streams as noted.

#### Year 3A (winter) or 3B (winter)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 311*</td>
<td>Radiochemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 320*</td>
<td>Chemical Instrumentation</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 352*</td>
<td>Chemical Kinetics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>or Chemistry 354*</td>
<td>Applied Chemical Kinetics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 391*</td>
<td>Advanced Laboratory 2</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>

**Two electives**

(Subject to availability and compatibility with the timetable, the following are recommended: one of Chemistry 332*, Biochemistry 1; Chemistry 333*, Biochemistry 2 (see note below); Chemistry 362*, Theoretical Organic Chemistry; Chemistry 395*, History of Chemistry; Chemical Engineering 550*, Metallurgical Chemistry.)

#### Year 3B (fall) or 3A (spring)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 350*</td>
<td>Spectroscopy and Molecular Structure</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 353*</td>
<td>Introduction to Polymer Science</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 363*</td>
<td>Applied Organic Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 390*</td>
<td>Advanced Laboratory 1</td>
<td>0</td>
<td>9</td>
</tr>
</tbody>
</table>

**Two electives**

(Subject to availability and compatibility with the timetable, the following are recommended: Chemistry 310*, Transition Metal and Co-ordination Chemistry; Chemistry 332*, Biochemistry 1; Chemistry 333*, Biochemistry 2 (see note below); Chemical Engineering 550*, Metallurgical Chemistry; Chemical Engineering 551*, Introduction to Extractive Metallurgy.)
Academic Programmes

Note  Chemistry 332* and 333* are a full-year sequence. Chemistry 333* can only be taken if Chemistry 332* has been completed.

**Year 4A and 4B**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 490*</td>
<td>Advanced Laboratory 1</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 491*</td>
<td>Advanced Laboratory 2</td>
<td>0</td>
</tr>
<tr>
<td>Eight electives</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fall Term**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 409*</td>
<td>Solid State Chemistry 1</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 411*</td>
<td>Organometallic Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 416*</td>
<td>Applied Inorganic Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 420*</td>
<td>Analytical Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 432*</td>
<td>Biochemistry 3</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 450*</td>
<td>Group Theory</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 451*</td>
<td>Statistical Mechanics</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 452*</td>
<td>Polymer Properties and Polymerization</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 454*</td>
<td>Surface Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 455*</td>
<td>Electrochemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 460*</td>
<td>Spectroscopy in Organic Chemistry</td>
<td>2</td>
</tr>
</tbody>
</table>

**Winter Term**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 414*</td>
<td>Kinetics of Inorganic Reactions</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 417*</td>
<td>Synthesis and Structure Chemistry of Inorganic Compounds</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 419*</td>
<td>Biological Aspects of Inorganic Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 421*</td>
<td>Spectrometric Analysis</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 433*</td>
<td>Biochemistry 4</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 434*</td>
<td>Applied Biochemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 452*</td>
<td>Quantum Chemistry 2</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 456*</td>
<td>Catalysis</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 457*</td>
<td>Experimental Aspects of Polymer Science</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 461*</td>
<td>Special Topics in Organic Chemistry</td>
<td>2</td>
</tr>
</tbody>
</table>

**Note 1** From Chemistry 400*, 411*, 414*, 416*, 417*, a maximum of three can be taken.

**Note 2** From courses Chemistry 450*, 451*, 452*, 453*, 454*, 455*, 456*, a maximum of four can be taken.

**Note 3** Courses will be given subject to sufficient demand.

Honours Earth Sciences (Geology Option)  (For Year 1, see page 262)

**Year 2**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 231*</td>
<td>Mineralogy</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 232*</td>
<td>Petrography</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 235*</td>
<td>Stratigraphy</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 236*</td>
<td>Principles of Paleontology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 241*</td>
<td>Optical Mineralogy and Crystallography</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 260*</td>
<td>Introductory Structural Geology</td>
<td>2</td>
</tr>
</tbody>
</table>
Three full year electives (or their equivalent) as follows:

**Science elective**: Physics 101*-102*, General Physics, or an equivalent physics course.

**Mathematics elective**: By the end of Year 2, students will be required to have completed Mathematics 130, Calculus, and a course involving computer programming (for example Mathematics 122a* or 132a*, or General Engineering 121*).

For students who completed the Science or Mathematics electives in Year 1, the following electives are recommended: Biology 131, Introduction to Biology (or a second or third year Biology course); Mathematics 236, Elementary Differential Equations.

**Arts elective**: as specified.

### Year 3

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 331*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 332*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 333*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 336*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 342*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 345*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 360*</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 370*</td>
<td>3</td>
</tr>
<tr>
<td>Arts Elective (full year course or equivalent)</td>
<td>3</td>
</tr>
</tbody>
</table>

Earth Sciences 355* Mathematical Geology 1

Other Science elective as specified

### Year 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 436</td>
<td>0</td>
</tr>
<tr>
<td>Earth Sciences 427*</td>
<td>2</td>
</tr>
<tr>
<td>One non-Earth Sciences elective</td>
<td>3</td>
</tr>
</tbody>
</table>

**Seven half-courses from:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 421*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 432*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 433*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 434*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 435*</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 438*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 439*</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 440*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 456*</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 461*</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 470*</td>
<td>3</td>
</tr>
</tbody>
</table>
Honours Earth Sciences 
and Geography

**Year 1** *(For a complete discussion of Year 1, see page 262)*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 130</td>
<td>Introductory Geology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Geography 102*</td>
<td>Introduction to Physical Geography</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 121*</td>
<td>Chemical Structures</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 122*</td>
<td>Chemical Reaction</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Geography 101*</td>
<td>Introduction to Human Geography</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Geography 125R*</td>
<td>Introduction to the Developing World</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Geography 126R*</td>
<td>The Emerging Third World</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Geography 127*</td>
<td>Regional Problems of Europe</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Environmental Studies 195*</td>
<td>Introduction to Environmental Problems</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Two electives</td>
<td></td>
<td>as specified</td>
<td></td>
</tr>
</tbody>
</table>

*One of:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geography 203*</td>
<td>Some Basic Topics of Cultural and Regional Geography</td>
</tr>
<tr>
<td>Geography 232*</td>
<td>Geography of Population</td>
</tr>
<tr>
<td>Geography 320*</td>
<td>World Regional Geography</td>
</tr>
</tbody>
</table>

*One elective (full-year course or equivalent) as specified

**Year 2**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 231*</td>
<td>Mineralogy</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 232*</td>
<td>Petrography</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 235*</td>
<td>Stratigraphy</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 236*</td>
<td>Principles of Paleontology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 241*</td>
<td>Optical Mineralogy and Crystallography</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 260*</td>
<td>Introductory Structural Geology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Environmental Studies 200*</td>
<td>Field Ecology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Geography 201*</td>
<td>Some Basic Topics of Physical Geography</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Geography 202*</td>
<td>Some Basic Topics of Economic and Urban Geography</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Year 3**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 331*</td>
<td>Igneous Petrology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 332*</td>
<td>Metamorphic Petrology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 333*</td>
<td>Sedimentology 1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 336*</td>
<td>Paleontology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 342*</td>
<td>Geomorphology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 345*</td>
<td>Historical Geology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 360*</td>
<td>Introduction to Applied Geophysics</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 370*</td>
<td>Geology of non-renewable Primary Resources</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

*One Geography elective (full-year course or equivalent) as specified

*One elective (full-year course or equivalent) as specified

**Year 4**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 436</td>
<td>Honours Thesis</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Three other Earth Sciences courses at the 400 level

One full-year Geography elective

One elective
The Co-operative programme in Earth Sciences is an Honours programme designed to satisfy the requirement of many potential employers that graduating geologists have practical experience as well as good academic training. In the first year, students take the regular Year 1 Science programme selecting options necessary for Earth Science majors. The Co-operative Earth Sciences programme will begin in the fall term of the second year and will be operated as a single co-operative stream. The first work term begins in the Winter term following the Fall term 2A and thereafter academic and work terms alternate until the Winter following term 3B when a double work term commences. Students then take their terms 4A and 4B as a full academic year, graduating the following Spring.

The normal progress of a student entering Co-operative Earth Sciences in his second academic year in the Fall of 1974 is shown in the table above. The core and elective programme descriptions follow.

**Year 2A**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 231*</td>
<td>Mineralogy</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 236*</td>
<td>Principles of Paleontology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 235*</td>
<td>Stratigraphy</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Plus 3 one-term electives, one of which should be an Arts elective. Note that Mathematics 130 (Calculus) or its equivalent and at least a one-term course in Computer Science (General Engineering 121* or Mathematics 122a* recommended) must be completed by the end of second year. Similarly, Physics 101*-102* or an equivalent Physics course should also be completed by the end of second year.

**Year 2B**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 232*</td>
<td>Petrography</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 241*</td>
<td>Optical Mineralogy and Crystallography</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 260*</td>
<td>Introductory Structural Geology</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Plus 3 one-term electives (one of which should be an Arts elective)

**Year 3A**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 332*</td>
<td>Metamorphic Petrology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 333*</td>
<td>Sedimentology 1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 345*</td>
<td>Historical Geology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 370*</td>
<td>Geology of non-renewable Primary Resources</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
Academic Programmes

Plus 1 Science and 1 Arts one-term elective or equivalent. (Physics 369* — Geology of the Ocean Basins may be taken as a Science elective)

**Year 3B**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 331* Igneous Petrology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 336* Paleontology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 342* Geomorphology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 360* Introduction to Applied Geophysics</td>
<td>3</td>
</tr>
</tbody>
</table>

Plus 1 Science and 1 Arts one-term elective or equivalent. Earth Sciences 355*, Mathematical Geology 1 is strongly recommended as background for Earth Sciences 421*, 438*, 439* and 461* and is prerequisite for 456* in fourth year. Physics 368* — Introductory Topics on Physics of the Earth may also be taken as a Science elective.

**Year 4A, 4B** Identical to Regular programme in Honours Earth Sciences.

**Honours Physics** *(For Year 1, see page 262)*

The Honours programme is in the form of a core of required courses, plus appropriate electives. The elective courses 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, Business Administration). 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 programme must include a total of twenty-four course credits (including year one). It is recommended that students intending to take an Honours Physics programme should take six course credits in first year. Examples of possible elective programmes are given following pages the core programme which is listed below. Detailed descriptions of the courses start in Chapter 16.

**Year 2 Core**

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 252*-253* Electricity and Magnetism 1 and 2</td>
<td>1.00</td>
</tr>
<tr>
<td>Physics 252L* 253L* Electricity and Magnetism Labs</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 256* Optics (first term)</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 256L* Optics Laboratory</td>
<td>.25</td>
</tr>
<tr>
<td>Physics 255* Quantum Physics (second term)</td>
<td>.50</td>
</tr>
<tr>
<td>Mathematics 237 Advanced Calculus</td>
<td>1.00</td>
</tr>
<tr>
<td>Mathematics 31* Differential Equations</td>
<td>.50</td>
</tr>
</tbody>
</table>

**Note 1** Mathematics 31* may be replaced by Mathematics 236.
**Note 2** If Physics 265* is elected, Physics 253L* may be omitted.

**Year 3 Core**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 360A* Intermediate Laboratory</td>
<td>.25</td>
</tr>
<tr>
<td>Physics 360B* Intermediate Laboratory</td>
<td>.25</td>
</tr>
<tr>
<td>Two of Physics 371A*, 371B*, 352L* or 353L*</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 362*-363* Classical Mechanics 1 and 2</td>
<td>1.00</td>
</tr>
<tr>
<td>Physics 365* Physical Mathematics 2</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 354* Atomic and Molecular Physics</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 358* Thermodynamics</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 359* Statistical Mechanics</td>
<td>.50</td>
</tr>
</tbody>
</table>
Note 1  Students desiring Physics 444* must elect Physics 355*.

Note 2  Physics 364* is recommended.

Year 4  Core
Physics 434A*  Introductory Quantum Mechanics .50
Physics 441  Electromagnetic Theory 1.00
Physics 355*  (if not taken in Year 3) .50

Note  Physics 434B* is strongly recommended for students intending to do graduate work.

Elective Programmes
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. In choosing his electives the student should make sure that his programme contains a minimum of 24 course credits.

Ex 1 Honours Physics  (with extra emphasis on experimental physics)
Core plus: Year 2  Physics 259*, 259L*, 270*-271*, Mathematics 240a* and 240b*
Year 3  Physics 352*-353*, 352L*-353L*, 364*, 371A*, 371B*
Year 4  Physics 432*, 433, 435*, 436
Two of: Physics 442*, 443*, 445*, 452*, 453*

Ex 2 Honours Physics  (especially suitable as preparation for high school teaching)
Core plus: Year 2  Physics 265*, 250*-251*, Mathematics 240a*
Year 4  Physics 433 or 437*, 435*, Chemistry 356*-357*, Science 400, Arts Electives totalling .50 or 1.00 credit.

Ex 3 Honours Physics  (with Biophysics)
Core plus: Year 2  Mathematics 51*,
Three of: Chemistry 250*, 251*, 260*, 261*, Biology 245*, 246*
Year 3  Four of: Physics 352*, 352L*, 353*, 353L*, 364*, 380*, 381*
One of: Biology 341*, 343*, 344*, Chemistry 356*, 357*, 332*, 333*, 353*
Year 4  Physics 433*, 434B*, 435*, 480*, 481*
2.00 credits from: Biology 434, 448, 449, Chemistry 432*, 433*, 434*, 453*, 454*, 457*

Ex 4 Honours Physics  (with Computing)
Core plus: Year 2  Physics 259*, 259L*, Mathematics 240a*-240b*, Physics 265* or Arts Elective*
Year 3  Physics 352*, 352L*, 353*, 353L*
Two of: Mathematics 51*, 334, 340
Year 4  Physics 435*, 452*, 453*, E.E. 324*, Physics 433 or 437*, electives totalling 1.00 or 1.50 credits

Ex 5 Honours Physics  (with Chemistry)
Core plus: Year 2  Chemistry 210* 211*, 250*-251*, Mathematics 240a* or 240b*
Year 3  Physics 352*, 352L*, 364*, 371A*, Chemistry 266*-267* or 260*-261*, Elective*
Year 4  2.00 credits from Physics 434B*, 435*, Chemistry 350*-351*, 352*, 310*, 311*. Elective*
Ex 6 Honours Physics (with Astrophysics)

Core plus: Year 2
- Physics 250*, 251*, 270*, Mathematics 240a*-240b*

Year 3
- Physics 364*; two of: 350*, 351*, 352*-352L*, 353*-353L*, 449*, 450*, 451*, Arts Electives totalling 1.00 credit

Year 4

Ex 7 Honours Physics (with Business Administration Option)

See comments regarding the Business Administration Option on page 295.

Core Plus: special requirements in Year 1 – Economics 101*-102*, Mathematics 122A* or 112A*

Year 2
- Economics 201*-202*, 191*-192*

Year 3
- Economics 301*, Business (WLU) 212*.222*, 285*-295*, Management Sciences 406*

Year 4
- Economics 393*-394*, Business (WLU) 385*-395*, 388*-398*, Management Sciences 407*

(Physics 360A* and 360B* are not normally taken with this option)

Ex 8 Honours Physics (with Geophysics)

Core plus: Year 2
- Physics 259*, 259L*, Earth Sciences 231*, 235*, 241*

Year 3
- Physics 368*, 369*, Earth Sciences 260*, 1.0 credit from Earth Sciences

Year 4

Theoretical Physics Programme

Students with an interest in theoretical physics may wish to emphasize the more mathematical aspects of the subject. A suitable programme consists of the "Honours Physics" core plus the following elective scheme:

Core plus: Year 3
- Physics 259*, 259L*, Mathematics 229, elective*

Year 3
- Physics 355*, 364*, Mathematics Elective, elective*

Year 4
- Physics 431*, 434B*, 435*, 436, 437*, plus 1/2 electives

Note

Students interested in this programme are advised to take Mathematics 130, 131A*-131B*, and a computing course in Year 1 to ensure having the necessary prerequisites for later year Mathematics courses. Suggested Mathematics electives are the following: Mathematics 334A*-334B*, 351A*-351B*, 352A*-352B*, 360A*, 361A*, 371A*-371B*, 372B*, 413, 417, 453A*-453B*, 463*, 474D*, 480.

Co-operative Applied Physics (Honours)

Applied Physics is an Honours programme in the form of a core of required courses plus appropriate electives. The electives available in the second, third and fourth years allow students to strengthen complementary areas of interest whether in some specific field in physics or in some other subject area.

Through the Co-operative part of the programme Applied Physics students have the opportunity of exposure to practical research and development situations in Government and Industry. Work opportunities, which are available on a competitive basis, are co-ordinated to complement the students, course work and interests where possible. Many work term experiences, especially in the upper years, provide the student with a deeper
insight into the meaning and methods of research as well as an incentive to develop course work. Such experience provides a contribution to the development of a scientist which cannot be learned in lecture courses, and helps prepare him to apply his fundamental physics background to the solution of practical problems.

The programme must include a total of twenty-four course credits (including Year One). It is recommended that students intending to take an honours physics programme should take six credits in first year. Examples of possible elective programmes are given in the following pages.

The core programme is listed below. A detailed description of the courses starts in Chapter 16.

The following table shows the normal progress of students in the Applied Physics programme. This arrangement has been found advantageous since it provides more relevant work experience in senior years.

<table>
<thead>
<tr>
<th>Year 2A</th>
<th>Course Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td></td>
</tr>
<tr>
<td>Physics 252*</td>
<td>Electricity &amp; Magnetism 1</td>
</tr>
<tr>
<td>Physics 252L*</td>
<td>Electricity &amp; Magnetism 1</td>
</tr>
<tr>
<td></td>
<td>Laboratory</td>
</tr>
<tr>
<td>Physics 256*</td>
<td>Optics</td>
</tr>
<tr>
<td>Physics 256L*</td>
<td>Optics Laboratory</td>
</tr>
<tr>
<td>Mathematics 237a*</td>
<td>Advanced Calculus</td>
</tr>
<tr>
<td>Mathematics 31*</td>
<td>Differential Equations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2B</th>
<th>Course Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td></td>
</tr>
<tr>
<td>Physics 253*</td>
<td>Electricity &amp; Magnetism 2</td>
</tr>
<tr>
<td>Physics 253L*</td>
<td>Electricity &amp; Magnetism 2</td>
</tr>
<tr>
<td></td>
<td>Laboratory</td>
</tr>
<tr>
<td>Physics 255*</td>
<td>Quantum Physics</td>
</tr>
<tr>
<td>Mathematics 237b*</td>
<td>Advanced Calculus</td>
</tr>
</tbody>
</table>

Note Physics 265 is recommended.
Academic Programmes

**Year 3A**

Core
- Physics 354* Atomic and Molecular Physics .50
- Physics 358* Thermodynamics .50
- Physics 360A* Intermediate Laboratory .25
- Physics 362* Classical Mechanics 1 .50

One of Physics 371A*, 352L* Laboratory .25

**Note** Physics 364* is recommended.

**Year 3B**

Core
- Physics 360B* Intermediate Laboratory .25
- Physics 359* Statistical Mechanics .50
- Physics 363* Classical Mechanics 2 .50
- Physics 365* Physical Mathematics 2 .50

One of Physics 371B*, 353L* Laboratory .25

**Note** Students desiring Physics 444* must elect Physics 355*.

**Year 4A - 4B**

Core
- Physics 434A* Introductory Quantum Mechanics .50
- Physics 441 Electromagnetic Theory 1.00
- Physics 355* (if not taken in Year 3) .50

**Note** Physics 434B* is strongly recommended for students intending to do graduate work.

**Options**

Some suggested programs are given below.

In choosing his electives the student should make sure that his programme contains a minimum of 24 course credits.

**Ex 1 Co-op Applied Physics** (Solid State)

Core plus: **Year 2A** Physics 270*, Mathematics 240b*.
**Year 2D** Physics 259*, 259L*, 271*, Chemistry 311* or Mathematics 240a*.
**Year 3A** Physics 352*, 352L*, 364*, 371A*.
**Year 3B** Physics 355*, 353L*, 355*, 371B*.
**Year 4A** Physics 433, 435*, 436, 452*.
**Year 4B** Physics 433, 434B*, 436, 442*, 453*.

**Ex 2 Co-op Applied Physics** (Biophysics)

**Year 2B** 1.00 credit from: Chemistry 251*, 261*, 332*, 353*, Physics 265*.
**Year 3A** 1.00 credit from: Chemistry 332*, 353*, Physics 352*, 352L*, 364*, 371A*.
**Year 3B** 1.00 credit from: Chemistry 251*, 261*, 333*, 357*, Biology 246*, 343*, Physics 353*, 353L*, 355*, 381*.


Optometry Programme

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

The immediate purpose of the programme is to qualify men and women for the practice of Optometry. However, the programme is designed to provide the student with sufficient general and specialized knowledge in Science so that he may follow a career in research and teaching if he so wishes. Students who desire to transfer from Optometry to other areas in Science, especially General Science, may do so at any time, although it is best to do so after Years 1 or 2. Students thus transferring will receive credit for all appropriate courses taken and will then take whatever courses are necessary to complete the programme chosen.

Upon completion of their training in Optometry, graduates will be eligible to apply for registration as optometrists in the province of their choice or to undertake Graduate Studies. Graduate training will lead to the degrees of Master of Science and Doctor of Philosophy. A graduate programme in Physiological Optics, leading to the Master of Science degree, is now available.

Inquiries regarding admission requirements should be sent to the Registrar of the University. Specific admissions requirements and regulations for Examinations and Standings may be found on page 255. The Optometry programme requires the same academic standard as do the Honours programmes in the Faculty. All other
Note

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

Academic Programme

In considering applications for admission to the first professional year (Year 2), the Admissions Committee will review the high school and university transcripts to ensure a satisfactory academic background in physics, mathematics, psychology, biology and chemistry. For students at the University of Waterloo, the Pre-Professional Year 1 is the normal Year 1 programme of the Faculty of Science (see page 262) with Mathematics 130, Physics 111*—112* or 121*—122* or 162*—163*, Psychology 101*, and Biology 132 required. Recommended options are Chemistry 121*—122*, and Psychology 102*.
**Optometry Programme**

**Note 1** A year of Chemistry is required for all students lacking a good Chemistry background in Ontario Grade 13 or its equivalent. For these students, Chemistry 111*-112* is recommended rather than Chemistry 121*-122*.

**Note 2** Non-Science students intending to apply for Optometry should ensure they complete the laboratory work in their chosen Science courses.

### Year 2

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall Term</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 201</td>
<td>Anatomy, Histology and Embryology</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>(first term)</td>
<td>Introduction to Organic and Biochemistry</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 216*</td>
<td>History and Orientation</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Psychology elective</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 200*</td>
<td>Geometrical Optics</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 206*</td>
<td>Anatomy of the Eye and Associated Structures</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Winter Term</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 201</td>
<td>Anatomy, Histology and Embryology</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>(second term)</td>
<td>Introduction to Organic and Biochemistry</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 211*</td>
<td>Physiological Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 234*</td>
<td>Anatomy of the Eye and Associated Structures</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 246*</td>
<td>Physical Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physics 246L*</td>
<td>Optics Laboratory</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Psychology 283*</td>
<td>Statistical Methods in Psychology</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note** An elective from Arts, Science or Mathematics may be substituted for the Psychology elective with the permission of the School of Optometry.

### Year 3

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fall Term</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 301</td>
<td>Vertebrate Physiology (first term)</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 301*</td>
<td>Physiological Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 302*</td>
<td>Clinical Optometry</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 305*</td>
<td>General Pathology</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 306*</td>
<td>Optometrical Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Psychology elective*</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Winter Term</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biology 301</td>
<td>Vertebrate Physiology (second term)</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 311*</td>
<td>Physiological Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 312*</td>
<td>Clinical Optometry</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 315*</td>
<td>General Pathology</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 316*</td>
<td>Optometrical Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Psychology 206*</td>
<td>Perceptual Processes</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note** An elective from Arts, Science or Mathematics may be substituted for the Psychology elective with permission of the School of Optometry.
### Year 4

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 401*</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 402*</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 404*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 405*</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 406*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 407*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 408*</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 409*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 411*</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 412*</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 414*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 415*</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 418*</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 427*</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 408*</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 409*</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Summer

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 428</td>
<td></td>
</tr>
</tbody>
</table>

(total 120 hours)

### Year 5

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 500*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 501*</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 502*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 504*</td>
<td>1</td>
</tr>
<tr>
<td>Optometry 508*</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 509*</td>
<td>4</td>
</tr>
<tr>
<td>Psychology 357*</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 510*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 511*</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 512*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 513*</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 514*</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 518*</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 519*</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Note

*Students with a particular interest in and an aptitude for research in physiological optics may substitute Optometry 501*-511* for Psychology 357* and Optometry 513*. A student is required to complete one or the other of these alternatives.*
The Honours Science Programme

The Honours Science programme allows a student to study sciences in greater depth than permitted in the General Science programme, but without as intense a degree of specialization as required in the more specialized programmes such as Honours Biology, Honours Chemistry, etc. The programme may be taken without a field of specialization (i.e. a non-major programme) or with a specified major field of study (chosen from Biology, Chemistry, Earth Sciences or Physics). Students desiring a somewhat broader background in the Sciences might find this programme more suitable than the more traditional specialized programmes. However, students contemplating graduate study in the traditional disciplines following their undergraduate studies are advised to pursue the more specialized Honours programmes.

Course programmes must have the approval of a faculty advisor and, in the case of a majoring programme, must be discussed with and approved by the appropriate Department Undergraduate Officer or his delegate. Normally no more than eight term courses (or their equivalent) offered under the "Science" label at the 100-, 200- or 300-level may be applied towards any Science degree programme.

Overall Requirements

22 course-credits; total of which at least 14 should be Science Faculty course-credits normally distributed as follows:

Year 1
Common first year in Regular Science: 5 course-credits of which at least 2 are Science course-credits (for any majoring programme, the standard requirements are listed on page 262).

Year 2
6 course-credits each year of which at least 4 are Science and 3 course-credits

Year 4
5 course-credits of which at least 4 are Science course-credits

Note
At least 10 of the 14 Science Faculty course-credits must be at the 200-level or higher and at least 4 must be at the 300- or 400-level.

† “course-credit” denotes a full year course or its equivalent in term courses

Promotion standard: 60% cumulative overall average required plus 60% cumulative average in a major field (if applicable)
This is the same as for all Honours programmes in the Science Faculty.

Specific Requirements

Honours Science (non-major) (For Year 1, see page 262)

Year 2
4 Science course-credits
2 other course-credits (from any area)
Year 3  4 Science course-credits at least 2 of which are at the 300-level
2 other course-credits

Year 4  4 Science course-credits at least 2 of which are at the 300- or
400-level
1 other course-credit

Honours Science
(Biology major)  (For Year 1, see page 262)

Year 2  3 of Biology 233, 234, 235, 236
Chemistry 266*-267*
2 other course-credits

Year 3  3 course-credits from Biology 333, 334*, 335, 338*, 341*, 342,
343*, 344*, 345*
Chemistry 332*-333*
2 other course-credits

Year 4  4 Science course-credits at least 2 of which are Biology course-
credits from the 400-level or the list of 300-level courses above
1 other course-credit

Honours Science
(Chemistry major)  (For Year 1, see page 262)

Year 2  3 Chemistry course-credits at least 2 of which must be chosen from
Chemistry 210*-211*, 220*-221*, 250*-251*, 240*-252* or
260*-261*.
The third course-credit must be from a non-similar 200-level
offering.
1 other Science course-credit chosen from Physics, Biology or
Earth Sciences.
2 other course-credits.

Year 3  3 Chemistry course-credits at least 2 of which are at the 300-level
(Notes 1 and 2) 1 other Science course-credit at the 200-level or higher
2 other course-credits

Year 4  2 or 3 Chemistry courses chosen at the 300- or 400-level
(Notes 1 and 2) 2 or 1 other Science course-credit(s)
1 other course-credit

Note 1  Before graduation, a student must take at least one full-year
equivalent course in each of the following areas of Chemistry:
Analytical, Inorganic, Organic, Physical.

Note 2  Before graduation, a student must have taken at least one full-year
equivalent laboratory (i.e. 3 hours per week for 2 terms) in each
of the four areas of Note 1. Wherever possible, the laboratory
chosen should accompany the appropriate course. (When separate
lab courses such as 291*, 390*, 391*, etc. are submitted, such
courses will be in addition to the normal total of 22 course-credits
required.)
Honours Science (Earth Sciences major)

(For Year 1, see page 262)

In total, 22 course-credits of which 10 are Earth Sciences course-credits, selected as indicated below. In addition at least four other Science course-credits and eight other course-credits must be chosen (Chemistry 121*-122*, Physics 101*-102* or equivalent, Mathematics 130 and 122a* or equivalent should be among these choices). A suggested year by year breakdown is as follows:

**Year 2**

Earth Sciences 231*, 232*, 235*, 236*, 241*, 260*
1 other Science course-credit
2 other course-credits

**Year 3**

3 or 4 Earth Sciences course-credits at the 300 level (chosen from Earth Sciences 331*, 332*, 333*, 336, 342*, 345*, 360*, 370*)
At least 1 other Science course-credit
At least 1 other course-credit (for a total of 6 course-credits in Year 3)

**Year 4**

4 Science course-credits of which at least 2 are Earth Sciences course-credits at the 300-level shown above or from the 400-level
1 other course-credit

Honours Science (Physics major)

This programme is designed to allow a student the broadest possible selection of courses consistent with a Physics major.

**Years 1 and 2** normally include the following Honours courses from Mathematics and Physics:

Physics 121*-122* or 162*-163*, Mathematics 130

In **Years 3 and 4**, to complete this programme, the student must elect at least 9 course-credits of Physics (including the above Physics courses) of which 6 must be chosen from the 300- and 400-level courses. In the total of 22 course-credits of the programme, at least one course-credit of Physics laboratory must be included. As well as the overall 60% average, an average of 60% must be obtained in any nine Physics course-credits.

The General Science Programme

The General Science Programme is available as a three- or four-year option. Students may specialize in a particular subject area in the three-year programme or may elect to pursue a broad range of Science subjects (essentially a “non-major” programme). The three-year programme is titled “General Science” with no area of specialization designated. The four-year programme is the official majoring General Science programme. It is only available with a selected major field (Biology, Chemistry, Earth Sciences, Physics, or as a General Science and Business programme in which a broad range of specified Science courses is required, rather than a majoring area). It is officially titled “General Science, Biology Major”, “General Science, Chemistry Major”, etc.
The General Science Programme

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

Graduates of the four-year programme who have taken appropriate courses will be eligible for certain categories of industrial and government employment for which the three-year programme will not fit them; likewise they can meet the subject requirements for application to Type-A courses at a College of Education in Ontario with specialization in a single subject.

Depending on the option chosen, a student may graduate with the General B.Sc. after either three or four years; the graduation diploma will indicate whether the three or four-year programme has been completed. A student who has graduated from the three-year programme may apply to register for the four-year programme; upon successful completion of the latter, a new graduation diploma will be issued in exchange for the original, but the student will not "graduate" a second time. Students may transfer from one of these options to the other; for transfer from the three- to the four-year programme, the student must have the necessary course selection and standing required for a major field.

The three-year programme requires the successful completion (with at least a passing mark in each) of 15 courses for the B.Sc. Normal progress is 5 courses per year. At least half of the 15 courses must be Science courses and normally no more than 7 courses are allowed from the same subject area (i.e., no more than 7 Biology courses or 7 Mathematics courses or 7 English courses, etc.). Also, at least 6 of the 15 courses must be at the 200-level or higher.

If a student wishes to specialize in a particular subject area in Science he (or she) is advised to follow the recommendations of Years 1-3 of the four-year programme. Alternatively, a broader selection of science subjects may be chosen but students should be warned not to make their course selection so broad and varied as to find their background of little use following graduation. The responsibility of arranging a programme selection over the three years ultimately rests with the student and he (or she) should ensure it meets his (her) needs. To ensure that proper advice is available and given regarding course selection, the student's programme must be approved at Registration time each year by a Faculty advisor.

Students are encouraged to take at least 4 courses (an average of better than one per year) from non-Science areas such as Arts or Mathematics.

The minimum standard for graduation from the three year programme will be a cumulative (overall) average of 50% calculated for all courses taken (in any year – whether passed or failed).
Recommended Programme

**Year 1**
Any 5 courses, two of which must be Science courses. Since Year 1 is common to all subsequent programmes in Science, the student is advised to select a Year 1 programme which can lead to an area of specialization in Year 2 if desired (see page 262).

**Year 2**
5 courses of which 2 or 3 should normally be Science courses.

**Year 3**
5 courses of which 2 or 3 should normally be Science courses.

**Note**
Selections should be made so that at the end of Year 3 the total programme will include 15 courses (total) completed with at least half of them in Science and no more than 7 from the same subject area. In addition at least 6 of the 15 courses must be 200 or higher level courses.

Some possible electives (other than Year 1 courses described on page 262).

The following list, while not complete, indicates some of the courses from which a choice should be made. Since some Departments offer Honours or General equivalents of the same course area or Co-operative or Regular versions of the same course area, duplication of subject matter is not allowed. It is usually obvious from the course descriptions where such duplication is possible and care should be taken to avoid it as credit for only one such overlapping courses will be allowed (e.g. credit for one of Chemistry 26*, 260*-261*, 266*-267*; one of Chemistry 220*-221*, 226*-227*, 427*-428*; one of Physics 101*-102*, 111*-112*, 121*-122*, 162*-163*; etc.). In addition, where Departmental course listings clearly indicate an elective as available only to Arts students, or Engineering students or Human Kinetics and Leisure Studies students, etc., such courses may not be selected in the General Science programme. Students must also have any necessary pre-requisites listed before attempting upper year courses; these are listed in the Departmental descriptions. More courses are offered under the Science listing this year (e.g. Science 219*) and are especially recommended for consideration (normally no more than eight such term courses at the 100-, 200- or 300-level may be selected).

Science courses recommended (other than Year 1 courses)

Biology 234, 236, 243*-244*, 245*-246*, 333, 334*, 335, 338*, 341*, 342, 343*, 344*, 345* but not 110*, 201, 233, 235, 301, 303*-304*


Physics 222*-223* and 222L*-223L*, 226*-227* and 226L*-227L*, 250*-251*, 301*-302*, 324*-325*, 352*-353* and 352L*-353L*, 358*-359*, 368*-369*, 380*-381*

Mathematics courses recommended
Mathematics 101a*, 101b*, 122a*, 130, 131a*-131b*, 132a*-132b* (if not taken in Year 1); 236, 240a*, 240b*, 243

Arts courses recommended
It is impossible to list all options here since tastes vary. Many students select first or second year options from the following subject areas: Anthropology, Arts, Economics, English, French, Geography, German, History, Philosophy Political Science, Psychology, Russian, Sociology, Religious Studies. Subject to pre-requisites and timetable a wide range of Arts courses is available.

General Science - Four-year Majoring Programmes

The four-year programme requires the successful completion (with at least a passing mark in each) of 20 courses for the B.Sc. Normal progress is 5 courses per year. An official major field (from Biology, Chemistry, Earth Sciences and Physics) must be selected: at least 8 courses from this major field must be completed as specified and normally not more than 10 courses from the major field area will be allowed. The only exception to the requirement of a major field is in the General Science and Business programme where a broad range of specified Science courses is required.

While considerable flexibility to take electives exists in this programme, students must take the courses required by their major Departments (there are at least 8 free electives available in each programme; Departments may have published recommendations regarding electives which should be strongly considered although they are not compulsory). Upon graduation, at least half of the 20 courses presented must be Science courses. Students are encouraged to take at least 4 courses (an average of one per year) from non-Science areas such as Arts or Mathematics.

The minimum standard for graduation from the four-year majoring programmes will be a cumulative (overall) average of 50% calculated for all courses taken (in any year – whether passed or failed) plus a 60% cumulative average for the major field courses. Students who do not maintain their major field average in the four-year programme will be transferred to the three-year (“non-major”) programme where a major field average is unnecessary.

Recommended Programme

The selection of courses in upper years will be restricted partly by limitations imposed by the timetable, and partly by the necessity in many courses of having completed prerequisites. Each student’s programme must, therefore, be approved by the Undergraduate Officer 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.
**Biology Major**

**Year 1** Including Biology 132 and Chemistry 121*-122* (see page 262).

**Year 2** Two of: Biology 233, 234, 235, 236
Chemistry 266*-267*
Two non-Biology electives.

**Year 3** Two or three full courses† of: Biology 333, 334*, 335, 338*, 341*, 342, 343*, 344*, 345*
Three or two non-Biology electives (Chemistry 332*-333* recommended).

†Students wishing to apply for the Ontario Department of Education Type A certificate must choose three courses in Biology in Year 3 or take a third Biology course as an extra course. In Year 4, three Biology courses should be selected.

**Year 4** Five courses at least two† of which are 400-level Biology courses or courses from the above list.

**Note** Some possible electives are shown in the list under the three-year programme. These courses would be suitable choices here. (Physics 301*-302* and Chemistry 427*-428* are especially recommended.)

**Chemistry Major**

**Year 1** Including Chemistry 121*-122* and Mathematics 130 (see page 262).

**Year 2** Chemistry 226*-227*, 266*-267*
Three full-year electives (or their equivalent)†

**Year 3** Chemistry 218*-219*, 356*-357*
Three full-year electives (or their equivalent)†

**Year 4** Chemistry 316*-317*, 366* 367*
Two other 300- or 400-level one-term Chemistry courses
Two full-year electives (or their equivalent)†

†Electives At least 3 other full-year non-Chemistry Science courses (or their equivalent), usually one per year, should be selected in Years 2 - 4. Some possible choices can be found in the elective listings for the three-year programme. Courses specially recommended for consideration are Mathematics 236, Biology 245*-246*, Physics 222*-223* and Physics 222L*-223L* (Year 2); Mathematics 243, Science 251*-252*, Physics 226*-227*, 250*-251*. Chemistry 332*-333*, 395* (Year 3); Science 400 (Year 4). Other Year 3 and Year 4 Chemistry courses may be chosen subject to pre-requisite and timetable requirements.
The General Science Programme

Earth Science Major

Year 1 Including Earth Sciences 130 and Chemistry 121*-122* (see page 262).

Year 2 Earth Sciences 231*, 232*, 236*, 235*, 260*, 241*
Two electives

Note Students should note that Physics 101*-102* is a prerequisite for the Applied Geophysics course Earth Sciences 360* given in the third year. Mathematics 130 and an introductory course in computer programming are prerequisites for Mathematical Geology courses Earth Sciences 355* and 456* given in the third and fourth years.

Year 3 Two or three of: Earth Sciences 331*, 332*, 333*, 336*, 342*, 345*, 355*, 360*, 370*
One or two of Chemistry 226*-227*, Biology 234, Physics 250*-251*, Mathematics 132
Arts elective

Three or two non-Earth Sciences electives

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

Physics Major

Year 1 Including Physics 121*-122* or 162*-163* and Mathematics 130 (see page 202).

Year 2 Physics 222*-223* and 222L*-223L*, 226*-227* and 226L*-227L*
One of: Mathematics 236, 217 or a course in computing
One of: Chemistry 218*-219*, 266*-267*, Science 251*-252*, Earth Sciences 130 or 231*-241*
Elective

Year 3 Physics 324*-325*
One or two of: Physics 250*-251*, 352* and 352L*, 353* and 353L*, 358*-359*, 368*-369*, 380*-381*; or 364*-365*
Two or one of: Mathematics 219 or 243; Chemistry 218*-219* or 356*-357*
Arts or Mathematics Elective

Year 4 Two or three of: Physics 250* 251*, 352* and 352L*, 353* and 353L*, 358*-359*, 362*-363*, 364*-365*, 368*-369*, 480*-481*, 441
Two or one non-Physics Science courses
Arts or Mathematics Electives
There is a growing need for graduates who have a competence in the combined disciplines of science and business administration. For those students whose leanings are towards administration in industry, marketing, analysis, etc., rather than scientific research or teaching, the following courses are strongly recommended for inclusion in the four year majoring programmes shown above. In some terms, six half courses are required. Because courses for this option are given by several faculties at two universities, timetable changes may occur from time to time. It is the students' responsibility to keep informed about these changes. (These business and economics courses normally provide the prerequisite background for a one year Master of Business Administration course. Admission requirements for postgraduate studies in Business Administration depend on the admitting university. In some instances, an entrance examination may be required. It is the students' responsibility to obtain information regarding admission from the university of his choice).

**Year 1**
Special requirement: Economics 101*-102*; Mathematics 122A* or 112A*

**Year 2**
Mechanical Engineering 001* or Civil Engineering 221*, Mathematics 31*, Economics 201*-202*, 191*-192*

**Year 3**
Business (WLU) 212*-222*, 285*-295*, Economics 301*, Management Sciences 406*

**Year 4**
Economics 393*-394*, Business (WLU) 385*-395*, 388*-398*, Management Sciences 407*

(a four-year General Science Programme)

The following programme provides a broad scientific background in many relevant areas of Science and Mathematics (without requiring a particular majoring area of Science) and is designed for the student wishing to combine the disciplines of science and business administration/economics. Students whose leanings are towards administration in industry, marketing, analysis, etc., will find it ideal for their purposes.

The programme is made up of 20 courses with 10 required in Science (including at least 4 at the 300 level or higher) and the remainder in Mathematics, Economics and Business Administration. The Business courses are given at Wilfrid Laurier University and may be taken by University of Waterloo students through co-operation between the two Universities; Economics courses are offered by the Department of Economics, University of Waterloo. Because courses for this option are given by several faculties at two universities, timetable changes may occur from time to time. It is the students' responsibility to keep informed about these changes. The business and economics courses normally provide the prerequisite background for a one-year Master of Business Administration programme. Admission requirements for postgraduate studies in Business Administration depend on the admitting university. In some instances, an entrance examination may be required. It is the students' responsibility to obtain information regarding admission from the university of his choice. Some variation in the Science courses recommended will be allowed for
timetable and other valid reasons, but alternate courses must be relevant to the intentions of this programme. Massive substitutions will not be allowed. Transfer into the programme will not normally be made beyond the Year 2 level.

Year 1

Physics 101*-102* General Physics
Chemistry 121*-122* Chemical Structure; Chemical Reaction
Earth Sciences 130 Introductory Geology
Mathematics 130 Calculus
Economics 101*-102* Introduction to Microeconomics and Macroeconomics
Mathematics 122A* or 112A* Introduction to Computer Programming

Note Physics 111*-112* or 121*-122* are acceptable alternatives to Physics 101*-102*

Year 2

Science 219*-220* Chemistry in Modern Society; Chemistry of Pollution
or
Science 251*-252* Genetics and Evolution; Biology and Society
Chemistry 266*-267* Organic Chemistry 1 and 2
Economics 191*-192* Introduction to Financial Accounting 1 and 2
Business 212*-222* (WLU) Introduction to Marketing; Marketing Functions
Economics 201*-202* Microeconomic Theory; Macroeconomic Theory

Year 3

Science 209* Scientific Literature and Writing
Science 230* Environmental Geology
Science 351*-352* Human Biology 1 and 2
Physics 324*-325* Atomic and Nuclear Physics 1 and 2
Economics 221* Statistics for Economists
or
Business 285*-295* (WLU) Statistical Analysis 1 and 2
Economics 301* Intermediate Microeconomics
Economics elective

Year 4

Science 400 History of Science
Physics 368*-369* Geophysics 1 and 2
Business 398* (WLU) Administrative Practices
Economics 393*-394* Corporate Finance 1 and 2
Business 385*-395* (WLU) Operations Analysis and Control Techniques; Operations Management
Business 388* (WLU) Organizational Behaviour
Course Descriptions

16 Undergraduate Course Descriptions
16

Undergraduate Course Descriptions
Arts

Visiting Professor  G A. Newcombe, B.A. (McMaster), M.A., Ph.D. (Toronto)


Associate Professors  G F. H. Epp, B. A. (Bethel), M.A., Ph.D. (Minnesota)
D. R. Gordon, B.A. (Queen’s), M.A. (Toronto)
G W. Klassen, B.A. (McMaster), B.D. (McMaster Divinity School), D.Phil. (Oxford)
P. H. Smith, Jr., B.A. (Harvard), Ph.D. (Pennsylvania)

Lecturers  C.M. Lim, B.A.(Taiwan Provincial – Chung-Hsing University)
C.C. Wang, B.S. (Taiwan Provincial Chung-Hsing University), B.A., M.A.(Taiwan National University)

Undergraduate Courses

Several courses formerly offered under the designation “Arts” are now offered under “Interdisciplinary Social Science”. See course descriptions in the Social Science (Applied) section of the Calendar.

Courses designated “Arts”, such as those listed below, usually cover some topics and themes of general interest to several disciplines and their presentation is often made with this interdisciplinary perspective in view. Arts courses are elective courses in General and Honours programmes and do not satisfy either the Group A or Group B requirements. Arts courses are administered through the Office of the Dean of Arts.

100 Communications  An examination of the origins, evolution and future dimensions of communications media designed to facilitate an understanding of the adequacies and inadequacies of media, to relate them to the purposes of human awareness and to explore needs and means of maintaining accountable controls over the media. The course seeks to assist students in discovering the range of informational, research and exploratory resources open to them; in gaining some preliminary experience in utilizing such sources; and in applying a critical judgment of material secured.

105* Introduction to the Sciences of Man  The course is intended to introduce the engineering, mathematics and science undergraduates to two of the sciences of man (anthropology and sociology). The course will be conducted on the basis of both lecture and tutorial hours. Lectures will be under the supervision of a single person responsible for the conduct of the course. He will have charge of inviting participants from among faculty members in the interested disciplines.

This course will not substitute for Anthropology 101*/102*; Sociology 101*.
120G*/121G* Focal Issues in Contemporary Society
An attempt to bring together and condense what are believed to be essential elements of the several social science disciplines. The core of the study is a group of selected contemporary issues with implications that cut across all the various disciplines. An effort will be made to discuss values appropriate for our age. Integrating concepts are personality and culture.

122G*/123G* Quest for Meaning in the 20th-Century
Against the background of rapidly shifting values in western culture, this course asks the student to examine his or her perspective and then face the resources of others in answering the question of Who am I? What is my obligation to society? What is my relationship to the natural world? Is there an ultimate meaning to life? Teaching methods include personal statements, thematic and biographical books and films.

190*/191* Introductory Chinese
A course designed to impart a knowledge of the basic structure and grammar of modern Chinese. Emphasis will be placed upon a reading knowledge of (modified) historic and philosophical sources, and the student will be expected to master a minimum of 500 characters. Some conversational work may be included.
3 hours per week.
Prerequisite: Permission of instructor.

200G* Issues in Mass Communication
The emphasis of the course is on the role of mass media in national and international communications and covers such topics as truth and deception, propaganda, legal controls, economic and political factors, government information systems, language and stereotypes, and mass media systems.

211*/212* Computing Techniques in Language and Literature
An introduction to computer programming, with special emphasis on the manipulation of language data. The programming language used will be PL/1. Applications will include word indexes, text concordances, methods of computer-aided text comparison. No prerequisite: No previous knowledge of computing is assumed. 212* presupposes 211* or permission of the instructor.

215 Man in Crisis (Literary Views)
The study of representative European prose, drama, and poetry, from the writings of Dostoevsky, Nietzsche, Zamiatin, Hesse, Kafka, Brecht, Pasternak, Solzhenitsyn, Camus, Malraux, Sartre, and others. An attempt will be made to critically analyse the creative writer's artistic presentation of the ever-widening rift between environment and "inner man", the will of the collective and non-conformity of the individual; nihilism – the result of extreme rationalization –; the mystic longing for the transcendental, and other related themes.
Prerequisite: Open to all students. Taught in English.

218G* Love in the Western World
A historical, psychological and sociological study of love in western culture from early Christianity and subsequent waves of Romanticism to the passionless malfunctions delineated by Kollo May; and, current developments symbolized by Manson and contemporary films. Communities of love and the tensions between love and justice.
3 lectures. Fall term.
Instructor: D. Smucker
219G* Dissent  
A study of individuals who emerge in every society to challenge the prevailing consensus as advance agents of a new cultural outlook. Consideration will be given to Socrates, Jeremiah, Jesus, Galileo, Conrad Grebel, Marx, Wilberforce, Woodsworth, Riel, Gandhi and Martin Luther King. Through these studies the course will formulate a conception of innovation and social change.  
3 lectures. Winter term.

220R* Chinese Thought and Culture 1  
An introduction to China’s traditional culture nexus as shown in literature, religion, and philosophy.  
3 hours per week, Fall term  
Instructor: to be announced.

221R* Chinese Thought and Culture 2  
Contemporary changes in China’s traditional culture pattern and its Institutional Framework.  
3 hours per week, Winter term  
Instructor: to be announced.

230G* Non-Violence and Political Reality  
This course will concentrate on the question of the possibility of a nonviolent approach to resolving human conflict, with special emphasis on the nature and uses of power, the nature of the nation state, and the problem of relating a personal ideal to the realities of communal life.

250R Art and Society  
An examination of man and society through the arts. Art as “need”; personal expression, display, celebration, communication. Themes of love and relatedness, death and illness, anxiety and despair, politics and ideology, festivity and fantasy. Art and therapy. This course will emphasize a combination of lectures and studio work.  
3 hours per week. Year course.  
For those with little or no previous work in art.  
Instructor: T. Kobayashi

271G*-272G* Scientific Peace Research Studies  
This course will focus on the current basic issues including personality and aggression, international tension, causes of war and the predictability of war, United Nations voting patterns, disarmament studies, and case studies in non-violence and peace activism.  
3 lectures. Fall and Winter terms.  
Instructor: A. Newcombe

Arts 290*/291* Intermediate Chinese 1 and 2  
This course is designed to extend the knowledge of the structure and grammar of mandarin Chinese beyond the base provided by Arts 190*/191*.  
Prerequisite: Arts 190*/191*.

301G*/302G* Seminar in 20th Century Values  
The purpose of this course is to help members of the University struggle with current value questions that have arisen because of the development of technology. The precise topics may vary from year to year. Examples might be the role of computers, genetic engineering, and “law and order”. Resource persons from within and outside the University will provide expertise. Open to third and fourth year students.  
3 lectures. Fall and Winter terms.
390 The Literary Revolution in China

The course is centred upon the twentieth century revolution in the language and literature of China, but will survey also the earlier forms of prose and prose fiction, and the later polemics and philosophical writing of the Nationalists and Communists.

Prerequisite: Permission of instructor.

Not offered in 1974/75.
Department of Biology

Professor and Chairman of Department
P. S. Corbet, B.Sc. (Reading), Ph.D. (Cambridge), D.Sc. (Reading), F.I. Biol.

Professor and Graduate Officer
A.D. Harrison, M.Sc., Ph.D. (Capetown)

Associate Professor and Undergraduate Officer
H.R.N. Eydt, M.Sc., Ph.D. (McMaster)

A. G. Kempton, M.S.A. (Toronto), Ph.D. (Michigan State)

Associate Professor and Associate Chairman of Department

Professors
C. H. Fernando, B.Sc. (Ceylon), D.Phil. (Oxford), F.R.E.S.
H. B. N. Hynes, Ph.D., D.Sc. (London), A.R.C.S.
W. B. Kendrick, B.Sc., Ph.D. (Liverpool)
J. K. Morton, B.Sc., Ph.D. (Durham), F.L.S.
G. Power, B.Sc. (Durham), Ph.D. (McGill)

Associate Professors
C. R. Barnes, B.Sc. (Birmingham), Ph.D. (Ottawa)
A. M. Charles, M.Sc., Ph.D. (Manitoba)
E. B. Dumbroff, M.Forestry, Ph.D. (Georgia)
H. C. Duthie, B.Sc., Ph.D. (Wales)
W. E. Inniss, M.S.A. (Toronto), Ph.D. (Michigan State)
J. Kruu, M.Sc. (Waterloo), Ph.D. (Western)
P. F. Morrison, M.Sc. (Western), Ph.D. (McMaster)
G. G. Mulamoottil, B.Sc. (Mysore), M.Sc. (Bombay), Ph.D. (Delhi)
J. J. Pasternak, M.A. (Toronto), Ph.D. (Indiana)
J. E. Thompson, B.S.A. (Toronto), Ph.D. (Alberta)

Assistant Professors
R. D. Beauchamp, B.A. (McMaster), M.A., Ph.D. (Brown)
J. C. Carlson, M.Sc., Ph.D. (Massachusetts)
R. G. H. Downer, M.Sc. (Queen's University, Belfast), Ph.D. (Western)
H. W. Elmore, B. Sc. (Western Kentucky), Ph.D. (Vanderbilt)
M. Globus, M.Sc. (McGill), Ph.D. (Toronto)
D. E. Hart, M.Sc. (Western), Ph.D. (Carleton)
W. R. Hawthorn, M.Sc. (McMaster), Ph.D. (Western)
C. I. Mayfield, B.Sc., Ph.D. (Liverpool)
S. M. Smith, M.Sc. (McMaster), Ph.D. (Manitoba)
J. B. Theberge, B.Sc. A. (Guelph), M.Sc. (Toronto), Ph.D. (U.B.C.)

Faculty members holding cross appointments as shown
1 Biology and Earth Sciences
2 Biology and Physics
3 Biology and Urban and Regional Planning
4 Biology and Optometry
Undergraduate Course Descriptions

By special arrangement courses labelled (†) may be taken in 2 sequential halves by students in co-operative programmes. Co-operative students in other Departments or Faculties should note there are available a number of one-term electives (e.g. 243*, 244*, 245*, 246*) offered in the fall or winter terms. All Honours Biology students who have completed their third year are required to participate in an off-campus field course before entering Year 4. These courses are held either in April (following examinations but before the end of term) or the following September (after Labour Day). The cost will be approximately $50-$100 per student.

Note The Huntsman Marine Laboratory, St. Andrews, New Brunswick offers a summer course “Introduction to Marine Biology”. This course will be accepted as 0.50 transfer course credit towards a B.Sc. if taken by students of the University of Waterloo.

110* Introductory Zoology
An introduction to the principles of zoology. The course will include a survey of cell structure and function, animal growth and development, genetics, and ecological concepts, with emphasis placed on the role of man in the biosphere.
2 lectures, 3 hours laboratory, Winter term.
(Primarily for students of Kinesiology. Available also to students in Faculties other than Science)

131 Introduction to Biology
The principles of biology are developed by reference to all biology (including genetics), growth and development, and to selected organisms. Man is discussed as a biological organism.
2 lectures, 3 hours laboratory
(For all students other than those intending to major in Biology or to enter the School of Optometry)

132 Principles of Biology
An introductory course designed to give a grounding in the main branches of biology. Emphasis is laid on an understanding of biological processes and on relating these to the structure and diversity of living organisms.
2 lectures, 3 hours laboratory
(For Science students intending to major in Biology or to enter the School of Optometry)

201 Anatomy, Histology and Embryology
A survey of functional mammalian anatomy and histology, with particular emphasis on the human, and an introduction to basic embryology.
Prerequisite: Biology 132 or equivalent
2 lectures, 3 hours laboratory
(For Optometry students only)

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.
Prerequisites: Biology 131 or 132
2 lectures, 3 hours laboratory
(For Honours Biology and 4-year Biology majors only)
234† Plant Biology
A survey of the major groups of plants, including their evolution, morphology, ecology and importance to man.
Prerequisites: Biology 131 or 132
2 lectures, 3 hours laboratory

235 Fundamentals of Microbiology
Introduction to fundamental theories, principles and methods of microbiology. Structure, systematics, growth and metabolism of microorganisms. Outline of the major groups of microorganisms. Discussion of their role in natural habitats, industrial processes and disease.
Prerequisites: Biology 131 or 132
2 lectures, 3 hours laboratory
(Only for Honours Biology and 4-year Biology majors and Regular Honours Chemistry students)

236 Ecology 1
An introduction to the study of the relationship of plants and animals to their environment. The nature of ecosystems, energy flow, biogeochemical cycling, concepts of habitat and ecological niche. Introduction to population and community ecology. Physiological ecology, environmental factor interaction. Plant and animal biogeography, the major ecosystems of Canada.
Prerequisites: Biology 131 or 132
2 lectures, plus field trips as required

243* Principles of Vertebrate Zoology 1
An introduction to the vertebrates: their taxonomy, anatomy, distribution and evolution. Laboratory dissections of representative vertebrate types form an integral part of the course.
Prerequisite: Biology 110*, 131 or 132
2 lectures, 3 hours laboratory, Fall term
(Not available to students who are Honours Biology or 4-year Biology majors)

244* Principles of Vertebrate Zoology 2
Structure and function of the vertebrate body with emphasis on comparative aspects. Special topics in vertebrate biology, including histology, embryology and parasitology of the vertebrates.
Prerequisite: Biology 243*
2 lectures, 3 hours laboratory, Winter term
(Not available to students who are Honours Biology or 4-year Biology majors)

245* General Microbiology 1
History and scope of microbiology. Study of the characteristics of bacteria and other microorganisms.
2 lectures, 3 hours laboratory, Fall term
(Not available to students who are Honours Biology or 4-year Biology majors)

246* General Microbiology 2
Relationships of microorganisms to man and his environment.
Prerequisite: Biology 245*
2 lectures, 3 hours laboratory, Winter term
(Not available to students who are Honours Biology or 4-year Biology majors)
301 Vertebrate Physiology  The physiology of the major organ systems of the vertebrate body, with emphasis on the human. The topics discussed include circulation, respiration, digestion and nutrition, metabolism, muscle, nervous system, special senses, and the endocrine system.  
Prerequisite: Biology 131 or 132  
2 lectures, 3 hours laboratory  
(For Optometry students only)

303* Vertebrate Physiology  An integrated study of basic physiological phenomena with particular emphasis placed on the cardiovascular and respiratory systems. Other topics which will be discussed include digestion, excretion and endocrinology.  
Prerequisite: Biology 110* or 131 or 132  
2 lectures, 3 hours laboratory, Fall term  
(Primarily for students of Kinesiology. Available also to students in faculties other than Science)

304* Vertebrate Physiology  A detailed study of physiological processes associated with nerve and muscle function, and consideration of the integrative role of the central nervous system.  
Prerequisite: Biology 110* or 131 or 132  
2 lectures, 3 hours laboratory, Winter term  
(Primarily for students of Kinesiology. Available also to students in faculties other than Science)

333† Invertebrate Zoology  A survey of the major invertebrate phyla with emphasis on the anatomy, taxonomy, and ecology of selected representatives.  
Prerequisite: Biology 110*, 131 or 132  
2 lectures, 3 hours laboratory

(Students entering this course are required to make a plant collection during the long vacation prior to the course.)  
2 lectures, 3 hours laboratory, Fall term

335† Microbial Form and Function  The effects of cultural conditions on the morphology and molecular architecture of microorganisms. Other topics to be discussed will include the interactions of structure and function and the biology and genetics of bacterial viruses.  
Prerequisite: Biology 235 or permission of instructor  
2 lectures, 3 hours laboratory

338* Plant Morphology and Morphogenesis  Plant structure in relation to function and development with particular reference to the vascular plants. Cell, tissue and organ differentiation.  
Prerequisite: Biology 234  
2 lectures, 3 hours laboratory, Winter term
341* Cell Physiology  The functional organization of cells with particular reference to cell-cell interaction, the structure, function and development of organelles and the biological roles of cellular membranes.
Prerequisite: Biology 131 or 132
2 lectures, 3 hours laboratory, Fall term
(Available only to students who are also taking Chemistry 332*-333*)

342 Vertebrate Physiology  A study of the physiology of vertebrate organ systems and their integration, with emphasis placed upon the effects of current developments on basic physiological concepts.
Prerequisites: Biology 233 or 243*-244*
2 lectures, 3 hours laboratory
(Available only to students who are also taking Chemistry 332*-333*)

343* Histology and Cytology  The structure of mammalian cells, tissues and organs interpreted in functional terms. Cell reproduction and differentiation, with some discussion of the embryological origin of tissues and the regulation of tissue growth. Light and electron microscopy techniques.
Prerequisites: Biology 131 or 132
2 lectures, 3 hours laboratory, Winter term

344* Cytogenetics  Chromosomes as the physical basis of heredity. Chromosomal mechanisms in mitosis and meiosis. The origin, inheritance and adaptive significance of aberrations and changes in number. Variant chromosomal systems.
Prerequisites: Biology 131 or 132
2 lectures, 3 hours laboratory, Fall term

345* Plant Physiology  An integrated study of plant function: the dynamics of nutrient and water movement, photosynthesis, control mechanisms of growth and development.
Prerequisite: Biology 234
2 lectures, 3 hours laboratory, Winter term
(Available only to students who are also taking Chemistry 332*-333*)

431 Ecology 2  Quantitative and dynamic ecology. The species and the individual in the ecosystem. Population and community ecology; competition and predation, population regulation, community metabolism and productivity. Plant synecology; vegetation and ecosystem classification, the analysis and description of plant communities. Experimental ecology. Introduction to systems ecology; the development of models, analysis of model properties.
Prerequisite: Biology 236, plus attendance of at least one off-campus field course. It is recommended that this course be taken in conjunction with Biology 436, Biostatistics
2 lectures plus field trips or projects
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.  
*Prerequisite: Biology 235  
2 lectures, 3 hours laboratory

433 Entomology An introduction to the classification, functional anatomy and physiology of insects.  
(Students entering this course are required to make an insect collection preferably during the long vacation prior to the course.)  
*Prerequisite: Biology 333  
2 lectures, 3 hours laboratory

434 Genetics A survey of genetics with emphasis on bacterial and bacteriophage genetics and the molecular basis of gene action.  
2 lectures, 3 hours laboratory

435 Microbial Physiology The study of microorganisms with special reference to the physiology and metabolism of bacteria. Cell-permeability, macromolecular biosynthetic processes, cellular regulatory mechanisms, quantitative experimental methodology.  
*Prerequisite: Biology 235, Chemistry 332*-333* or 337  
2 lectures, 3 hours laboratory

436 Biostatistics A critical consideration of statistical techniques used in the design and analysis of biological experiments.  
2 lectures, 3 hours laboratory  
(Only open to Biology majors)

437* Biosystematics A study of living organisms in relation to evolutionary processes and classification.  
*Prerequisite: Biology 344*  
3 lectures, Fall term

441 Plant Physiology A detailed study of the physical and chemical processes that govern plant growth and function.  
*Prerequisite: Biology 345*  
2 lectures, 3 hours laboratory

442 Comparative Animal Physiology A comparative study of physiological processes in the animal kingdom and their relation to environmental microbiology.  
*Prerequisite: Biology 342  
2 lectures, 3 hours laboratory

443 Applied Microbiology Properties of pathogenic microorganisms and special groups related to food and fermentation microbiology.  
*Prerequisite: Biology 335  
2 lectures, 3 hours laboratory

*Prerequisite: Biology 233  
2 lectures, 3 hours laboratory, Winter term
Prerequisite: Biology 234  
2 lectures, 3 hours laboratory, Fall term

446* Phycology  A study of selected topics in the biology of algae.  
Prerequisite: Biology 234  
2 lectures, 3 hours laboratory, Winter term

447* History of Biology  The development of biological thought from Greek and Roman times to the present; i.e. from classification to the present experimental approach.  
No prerequisites  
3 lectures, Winter term  
(Not to be taken in conjunction with Science 400)

448 Developmental Biology  Analysis of embryonic development of selected organisms with emphasis on growth and the processes of sub-cellular, cellular and organ differentiation stressing recent experimental methodology.  
Prerequisite: Biology 343* is strongly recommended as preparation for this course  
2 lectures, 3 hours laboratory

449 Immunology and Virology  The course will consist of an introduction to the nature of antigens and antibodies and their reactions, hypersensitivity and blood groups, as well as a study of the nature and interactions of animal, insect bacteria and plant viruses and their hosts.  
Prerequisite: Biology 235  
2 lectures, 3 hours laboratory

450 Limnology and Oceanography  A survey course covering the following topics:  
physical and chemical properties of fresh and marine waters including temperature, salinity and light; waves and tides; circulation of the oceans; structure and origins of lakes and ocean basins; marine and freshwater sediments; coral reefs and atolls; circulation of nutrients and eutrophication; biologically important properties of marine and fresh waters; ecological divisions of the marine and freshwater biological communities; phytoplankton and aquatic plants; zooplankton; benthos; nekton; aquatic food chains and productivity; man's influence on aquatic ecosystems.  
Prerequisites: Biology 236, Biology 333, and a minimum of one week of off-campus field trips.  
3 lectures

499 Seniors 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 professors under whose direction they wish to work and the chairman of Biology.
Canadian Studies

The Programme

The Departments of Economics, English, French, Geography, History, Political Science and Sociology co-operate in the offering of a special programme in Canadian Studies designed to provide the student with an interdisciplinary approach to the study of all aspects of Canada.

Students who propose to concentrate in Canadian Studies (see the outline of the programme on p. 120 of the Calendar) complete a standard first year programme (in which French 190 is required, or French 101*/102* if the equivalent of Grade 13 French has not been passed) and then follow the Honours programme of one of the above departments, or a double Honours programme with two of the above departments.

In each of Years 2, 3, and 4 the student takes the equivalent of three full courses (four if double Honours) in his major department(s), one of which (or one each if double Honours) is the department's principal Canadian course at that level. In each year electives are chosen from among the various Canadian content courses offered by each participating department (as listed below).

The core course for each year of the programme is an interdisciplinary study of Canadian problems, offered either in a lecture/tutorial format or a seminar format (depending on the number of students registered), and staffed by interested faculty members of the participating departments and of the University and by eminent scholars from other parts of Canada who will visit the University for brief or extended periods during the year.

The student is granted, upon successful completion of the 22-course programme, an Honours B.A. in his major subject with the subtitle of Canadian Studies.

Core Courses

Canadian Studies 201* An interdisciplinary course offered both through lectures and discussion groups devoted to the Canadian social and physical environments.

Canadian Studies 202* Also an interdisciplinary approach to the study of the cultural environment in Canada.

Canadian Studies 300 A seminar course, staffed by at least two faculty members from different departments, in which particular themes and problems relating to Canada will be investigated. The content of the programme each year will vary according to the interest and inclination of faculty and students.

Prerequisite: Canadian Studies 201*/202*

Canadian Studies 400 An extensive senior research essay, supervised by a committee composed of faculty members from two or more of the participating departments, which deals with a specific aspect of Canada utilizing material and methods from several different disciplines.

Prerequisite: Canadian Studies 300
Principal Canadian Content Courses Offered by the Participating Departments

**Economics**
- 101* Introduction to Microeconomics
- 102* Introduction to Macroeconomics
- 241* Cost-Benefit Analysis and Project Evaluation
- 263* Economic History of Canada
- 341* Public Finance
- 343* Urban Economics
- 347* Industrial Organization
- 351* Labour Economics
- 353* Population Economics
- 355* Economics of Energy and National Resources
- 363* Contemporary Canadian Problems
- 364* Contemporary Canadian Problems

**English**
- 140* The Use of English
- 205R* The Canadian Short Story
- 208F* Themes in Canadian Literature
- 313* Canadian Literature to 1920
- 314* Canadian Poetry Since 1920
- 315* Canadian Prose Since 1920
- 316* Canadian Drama
- 495 Senior Honours Essay in Canadian Literature

**French**
- 190 French Language, and French-Canadian Civilization (or French 101*/102* or French 151*/152* if students have not passed the equivalent of Grade 13 French
- 250 Intensive Language Training
- 271* Poetry and Song in Quebec
- 272* Introduction to French-Canadian Novel
- 300 Advanced Instruction in Written French
- 375* Contemporary French-Canadian Novel
- 376* The "essai" in French Canada
- 455* Training for Proficiency in Oral and Written Expression
- 456* Stylistics, Advanced Grammar and Composition
- 471* French-Canadian Poetry
- 472* Contemporary Quebec Theatre

**Geography**
- 195* Environmental Studies: Introduction to Environmental Problems
- 322* Geographical Study of Canada
- 341* Historical Geography of Canada 1
- 342* Historical Geography of Canada 2
- 411* Resource Studies
- 422* Canada
### History

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>222*</td>
<td>Modern French Canada</td>
</tr>
<tr>
<td>224*</td>
<td>Canadian History Since 1867</td>
</tr>
<tr>
<td>265</td>
<td>Canadian History</td>
</tr>
<tr>
<td>266</td>
<td>The History of Selected Racial and Regional Minorities</td>
</tr>
<tr>
<td>267*</td>
<td>Canadian Non-Indigenous Minorities 1</td>
</tr>
<tr>
<td>268*</td>
<td>Canadian Non-Indigenous Minorities 2</td>
</tr>
<tr>
<td>379</td>
<td>Pre-Confederation Canada 1760-1867</td>
</tr>
<tr>
<td>380</td>
<td>Canada 1867-1967</td>
</tr>
<tr>
<td>382</td>
<td>Canadian Intellectual History</td>
</tr>
<tr>
<td>383</td>
<td>History of French Canada in 1867</td>
</tr>
<tr>
<td>384</td>
<td>Canada in Crisis</td>
</tr>
<tr>
<td>386*</td>
<td>Ontario History to Confederation</td>
</tr>
<tr>
<td>387*</td>
<td>Ontario History Since Confederation</td>
</tr>
<tr>
<td>389</td>
<td>Canada in World Affairs: The Twentieth Century</td>
</tr>
<tr>
<td>390</td>
<td>History of North American Indians</td>
</tr>
<tr>
<td>420</td>
<td>Senior Seminar in Nineteenth-Century Canadian History</td>
</tr>
<tr>
<td>421</td>
<td>Senior Seminar in Ontario History</td>
</tr>
<tr>
<td>423</td>
<td>Senior Seminar in Modern Quebec</td>
</tr>
<tr>
<td>425</td>
<td>Senior Seminar in Canadian Cultural History</td>
</tr>
</tbody>
</table>

### Political Science

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>116*</td>
<td>Introduction to Politics 2</td>
</tr>
<tr>
<td>260</td>
<td>Canadian Government and Politics</td>
</tr>
<tr>
<td>330</td>
<td>Public Administration</td>
</tr>
<tr>
<td>341*</td>
<td>Provincial Politics</td>
</tr>
<tr>
<td>343*</td>
<td>Urban Politics 1</td>
</tr>
<tr>
<td>373*</td>
<td>Political Parties</td>
</tr>
<tr>
<td>374*</td>
<td>Interest Group Politics</td>
</tr>
<tr>
<td>377*</td>
<td>Political Socialization</td>
</tr>
<tr>
<td>431*</td>
<td>Canadian Public Policy 1</td>
</tr>
<tr>
<td>432*</td>
<td>Canadian Public Policy 2</td>
</tr>
<tr>
<td>442*</td>
<td>Politics in Ontario</td>
</tr>
<tr>
<td>443*</td>
<td>Politics in Western Canada</td>
</tr>
<tr>
<td>444*</td>
<td>The Politics in Quebec</td>
</tr>
<tr>
<td>445*</td>
<td>Politics in the Atlantic Provinces</td>
</tr>
<tr>
<td>451*</td>
<td>Comparative Parliamentary Systems</td>
</tr>
<tr>
<td>461*</td>
<td>Problems in Canadian Politics 1</td>
</tr>
<tr>
<td>462*</td>
<td>Problems in Canadian Politics 2</td>
</tr>
<tr>
<td>473*</td>
<td>Voting Behaviour</td>
</tr>
<tr>
<td>478*</td>
<td>Research Seminar in Political Socialization</td>
</tr>
</tbody>
</table>

### Sociology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>101*</td>
<td>Introduction to Sociology</td>
</tr>
<tr>
<td>120R</td>
<td>Fundamentals of Sociology</td>
</tr>
<tr>
<td>205*</td>
<td>Social Problems</td>
</tr>
<tr>
<td>215*</td>
<td>Sociology of Sex Roles</td>
</tr>
<tr>
<td>250*</td>
<td>Crime and Society</td>
</tr>
<tr>
<td>251*</td>
<td>Ethnic and Racial Relations</td>
</tr>
<tr>
<td>262*</td>
<td>Canadian Population</td>
</tr>
<tr>
<td>300*</td>
<td>Canadian Social Institutions</td>
</tr>
<tr>
<td>301*</td>
<td>Urban Sociology</td>
</tr>
<tr>
<td>315*</td>
<td>Social Stratification</td>
</tr>
<tr>
<td>320R</td>
<td>Canadian Ethnic and Cultural Minorities</td>
</tr>
<tr>
<td>321*</td>
<td>Research Methods 1</td>
</tr>
<tr>
<td>323*</td>
<td>Project in Sociological Research</td>
</tr>
<tr>
<td>399*</td>
<td>Research Seminar in Canadian Society</td>
</tr>
<tr>
<td>499</td>
<td>Honours Essay</td>
</tr>
</tbody>
</table>
Principal Canadian Content Courses Offered by Other Arts Departments

Anthropology 233* Eskimo Cultures
234* North American Indians
235* Contemporary Canadian Indian Scene
310* Peoples of the North American Subarctic

Fine Arts 316* Canadian Art
317* Canadian Art

Inter-Disciplinary Social Science
210R Community Issues

Philosophy 225* Problems in Social and Political Philosophy in Canada
312* Philosophy of Education 2

Psychology 242* Educational Psychology: Learning Disabilities
454* Senior Seminar in Educational Psychology

Religious Studies 339J Theologians of Renewal

Social Work 120R* Introduction to Social Work
125R* Social Problems
Department of Chemical Engineering

Professor and Chairman of Department
K.F. O'Driscoll, B.Ch.E. (Pratt Inst.), M.A., Ph.D. (Princeton)

Professor and Associate Chairman (Graduate Studies)
E. Rhodes, B.Sc., Tech., M.Sc., Ph.D. (Manchester).

Associate Professor and Associate Chairman (Undergraduate Studies)

Professors
T.L. Batke, B.A.Sc., Ph.D. (Toronto).
T. Z. Fahidy, B.Sc., M.Sc., (Queen's), Ph.D. (Illinois).
R. Y. M. Huang, B.Sc., (National Taiwan University), M.A.Sc., Ph.D. (Toronto).
M. Moo Young, B.Sc., (London), M.A.Sc. (Toronto), Ph.D. (London).
D. C. T. Pei, B. Eng. (McGill), M.Sc. (Queen's), Ph.D. (McGill).
P. M. Reilly, U.E., B.A.Sc. (Toronto), D.I.C., Ph.D. (London), F.S.S.
P. L. Silveston, B.S., M.S. (M.I.T.), Dr. Ing. (Munich).
B. M. E. van der Hoff, Ing. (Amsterdam), Ir. (Delft).

Professor Emeritus
A. H. Heatley, B.Sc., M.A., Ph.D. (Toronto).

Associate Professors
C. M. Burns, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (Polytechnic Inst., Brooklyn).
J. D. Ford, B.Eng. (McGill), M.A.Sc., (Queen's), Ph.D. (Minn.).
C. E. Gall, B.A.Sc. (Toronto), M.Sc., (Queen's), Ph.D. (Minn).

Assistant Professors

Undergraduate Course Descriptions

The number of lectures, laboratories and/or tutorials associated with each course is given in the earlier section of the calendar, on the general description of the Chemical Engineering Undergraduate Programme.
100* Introductory Engineering Concepts 1
An introduction to the basic methods and principles used by engineers in the analysis and design of physical processes. Topics covered by means of lectures, case studies, and problem assignments are: units, dimensions, and measurements; mass balances, behaviour of fluids. Consideration is given to the non-technical and social implications of the engineer's work. Laboratories on freehand sketching and blueprint reading are included.
3 hours lectures, one hour tutorial, 6 hours lab. for first 6 weeks only, Fall term

101* Introductory Engineering Concepts 2
An extension of the topics covered in Ch.E. 100: energy balances; unsteady-state behaviour of engineering systems.
Laboratory experiments illustrate the physical principles discussed.
3 hours lectures, 1 hour tutorial, 3 hours laboratories, Winter, Spring terms

211* Transport Processes 1
(Fluid Mechanics)
Fundamental physical concepts of fluid flow; conservation laws for mass momentum and mechanical energy; flow of fluid in conduits; flow past immersed bodies. Description, collection and separation of particular systems.
3 hours lectures, 3 hours laboratories, Spring, Fall terms

220* Applied Mathematics 1
3 hours lectures, Fall, Winter terms

230* Physical Chemistry 1
Introduction to Physical Chemistry. Ideal and real gases, the kinetics theory of gases. First law of thermodynamics (classical vs. statistical thermodynamics, energy, heat and work, functions of state, internal energy, enthalpy). Thermochemistry, heats of reaction. Second law of thermodynamics (entropy of a system, reversible thermodynamics cycles, Carnot cycle). Chemical equilibria in simple systems (free energy and the equilibrium constant). Phase equilibria in simple systems (Clapeyron equation, the phase rule). The third law of thermodynamics.
3 hours lectures, 1 hour tutorial, Fall, Winter terms

231* Physical Chemistry 2
Prerequisites: Ch.E. 230
3 hours lectures, 1 hour tutorial, Spring, Fall terms

232* Inorganic Chemistry 1
3 hours lectures, Fall, Winter terms
233* Physical-Chemical Laboratory

A laboratory to demonstrate common physico-chemical principles and techniques of physical measurements. Training in technical report writing is included. Experiments on viscosity of gases and liquids, chemical kinetics, adsorption homogeneous and heterogeneous catalysis, thermochemistry, phase equilibria, diffusion, determination of molecular weight of polymers and complex formation.

3 hours laboratories, Spring, Fall terms

312* Transport Processes 2

(Heat Transfer)

Introduction to heat transfer. Momentum heat transfer analogies and dimensional analysis. Steady and transient heat conduction, convection and applications to engineering problems. Radiant heat transfer and heat transfer with change of phase.

Prerequisite: Ch.E. 2211

3 hours lectures, 1 hour tutorial, Winter, Spring terms

313* Transport Processes 3

(Mass Transfer)

Mass transfer by molecular (diffusion) and convective action. The application of mass transfer concepts to the design and analysis of both stage-wise and continuous separation processes such as: distillation, extraction, absorption and others. Analogies and interrelationships between momentum, energy and mass transport phenomena.

Prerequisite: Ch.E. 312

3 hours lectures, 2 hours tutorials, Fall, Winter terms

315* Chemical Engineering Laboratory

Experimental application of physical and chemical principles using pilot scale equipments. Representative experiments illustrating major unit operations (distillation, absorption, extraction, drying, humidification) are available.

Prerequisite: Ch.E. 312

6 hours laboratories, Fall, Winter terms

320* Applied Mathematics 2

Review of determinants and basic matrix operations. Advanced functions: gamma-, beta-, and error-functions; sine-, cosine-, exponential – and elliptic-integrals. Linear differential equations: Wronskian and Green function; initial and boundary value problems; Bessel functions; applications to certain chemical engineering problems. Fourier Series and Integrals: Application to ODE, Fourier transforms; Orthogonal functions; Application to PDE Laplace Transforms: Review of fundamental theorems; application to ODE and PDE. Numerical Solution Techniques for ODE and PDE.

Prerequisite: Ch.E. 220

3 hours lectures, Winter, Spring terms

330* Chemical Engineering Thermodynamics


Prerequisite: Ch.E. 231

3 hours lectures, Winter, Spring terms
331* Chemical Reaction Engineering
Application of reaction kinetics. Homogeneous Reactors: batch, CSTR, tubular flow systems; ideal models (perfect mixing and plug flow); residence time distributions in ideal reactors; temperature effects; steady states; semibatch systems. Nonideal behaviour of homogeneous reactors. Elements of heterogeneous catalysis: mass transfer effects; catalytic rate equations. Simplified analysis and design of heterogeneous reactors: fixed-bed catalytic reactors: fixed-bed catalytic reactors; fluidized bed reactors.
Prerequisite: Ch.E. 231
3 hours lectures, Fall, Winter terms

332* Inorganic Chemistry 2
Prerequisite: Ch.E. 232
3 hours lectures, Winter, Spring terms

334* Instrumental Methods of Chemical Analysis
An introduction to modern analysis including optical, electrochemical, radiochemical, chromatographic and spectroscopic methods.
3 hours laboratories, Winter, Spring terms

420* Process Dynamics and Control 1
Block and signal flow diagrams, proportional-integral-derivating controllers, frequency response techniques, analytical and graphical stability criteria. Introduction to modern control theory.
Prerequisites: Math 31, Ch.E. 312
3 hours lectures, Spring, Fall terms

422* Engineering Economics
Mathematics of annuities, mortgages, bonds and small loans. Cost accounting, including direct costing, depreciation, taxes and financial statements. Estimation of sales and capital and operating costs of a new process or product. Study of criteria for the appraisal of capital expenditures. Introduction to the Critical Path Method Introduction to Linear Programming.
3 hours lectures, Spring, Fall terms

482* Technical Seminar and Process Design
Study and presentation of material in recent literature, or from industrial experience. Technical seminars will be presented and criticized. Subject material will be from recent literature or industrial experience. The other half of the course will include lectures in equipment on the sizing and costing, as well as problems on the design of process components.
3 hours lectures, Spring, Fall terms

510* Physical-Chemical Properties of Gases and Liquids
The most up-to-date methods available for the estimation of the more important physico-chemical properties of gases and liquids in cases where experimental values are not to be found. Prediction is usually based on correlations of a form suggested in part by theory, with empirical constants based on experimental data.
3 hours lectures, Winter term
511* Selected Topics in Process Applications
Chemical Engineering fundamentals in process applications such as pipeline flow, fluidized bed reactors, pneumatic reactors, two-phase system, drying, multiple-component distillation, and other unit processes.
3 hours lectures, Spring term

513* Non-Newtonian Flow and Heat Transfer
Qualitatively unique characteristics of Non-Newtonian fluids. Experimental techniques for measurement of material properties. Molecular and Continuum stress-shear rate theories. Some simple stress-shear rate theories in problems of fluid flow and heat transfer.
3 hours lectures, Winter term

520* Chemical Engineering Analysis
Application of advanced mathematical techniques to the analysis of chemical engineering processes.
Prerequisite: Permission of instructor
3 hours lectures, Fall, Winter terms

521* Process Dynamics and Control 2
Analog computation, time domain analysis, control of complex chemical systems.
Prerequisite: Ch.E. 420
3 hours lectures, Winter term

523* Process Control Laboratory
Experiments on process dynamics and control and analog simulation of chemical processes. Time constant, step and frequency response, controller settings, and cascade control of thermal, liquid level, and reaction systems.
Prerequisite: Ch.E. 420
4 hours laboratories, Winter term

540* Introduction to Polymer Science
Basic concepts of polymer chemistry, classification of polymers, introductory physical polymers, organic chemistry of polymerization reactions of polymers, naturally occurring polymers.
3 hours lectures, Spring, Fall terms

541* Physical Chemistry of Polymers
Polymer solutions, molecular characterization of polymers, molecular weight distributions, morphology and crystallinity in polymers, reaction kinetics and mechanism of addition and condensation polymerization.
Prerequisite: Ch.E. 540
3 hours lectures, Winter term

543* Polymer Laboratory
Experimental studies of polymerization and physical properties of polymers: condensation and addition polymerization, copolymerization, molecular weight, extrusion rheology, etc.
Co-requisite: Ch.E. 541
3 hours laboratories, Winter term

550* Introduction to Extractive Metallurgy
Physical and chemical nature of ores and intermediates. Introductory pyrometallurgy, hydrometallurgy and electrometallurgy. Survey of extraction processes. Application of the principles of thermodynamics and kinetics to metallurgical processes.
3 hours lectures, Spring, Fall terms
3 hours lectures, Winter term

553* Principles of High Temperature Extractive Metallurgy  Detailed study of the underlying principles of several metallurgical processes of importance in Canada. Subjects covered include kinetics and mechanisms of roasting and reduction reactions, industrial roasting, blast furnace and electric furnace reduction: nature of melts and slags, slag metal reactions; converting, refining and fused salt electrolysis. Problems being worked on in various extractive metallurgy research laboratories will be reviewed.
3 hours lectures, Winter term

560* Introduction to Biochemical Engineering  Aspects of the biological sciences, primarily microbiology and biochemistry, of interest to the biological process industries (fermentation and food products) and to environmental pollution (air and water). Classification and growth characteristics of micro-organisms. Physico-chemical properties of biological compounds. Metabolism and biochemical kinetics.
3 hours lectures, some laboratories, Spring, Fall terms

561 Fermentation Operations  Methods of solving engineering problems imposed by physical and biological factors in fermentation systems. The unifying principles of the processing operations involved in the production of antibiotics, yeast, enzymes, beverage alcohol and other microbial products, and in biological waste treatment. Specialized mass transfer, heat transfer, mixing and rheology applications. 
Prerequisite: Ch.E. 560 or permission of instructor
3 hour lectures, some laboratories, Winter term

563* Food Processing  Methods of solving engineering problems imposed by physico-chemical constraints in biological systems encountered in the food processing technologies. Formulation, processing, preservation and quality evaluation of natural and textured foods, food components and additives: mixing, extrusion, sterilization, separation, purification and concentration operations. Engineering development of unconventional food resources. 
Prerequisite: Ch.E. 560 or permission of instructor
3 hours lectures, some laboratories, Winter term

570* Air Pollution  Treatment of gaseous waste products from representative Canadian industries; characterization and toxicity of filtration, scrubbing, cycloning, electrostatic precipitation, and other chemical treatment. Legal, social-political, economic and engineering concepts of air pollution control. The course will be project oriented.
3 hours lectures, Fall term
571* Water Pollution  Physical/chemical treatment of waste water from metals processing and finishing industries; characterization of wastes; toxicity of wastes; recycle of untreated and partially treated wastes; application of electro-oxidation/reduction, ion exchange, solvent extraction, adsorption, electrodialysis, reverse osmosis etc. in waste treatment; economics of waste treatment; water pollution regulations – moral, legal, social and political implications.

3 hours lectures, Winter term

580* Research-Design  An individually supervised research and/or design project on any Chemical Engineering subject chosen by the student-professor group.

Project 1  6 hours laboratories, Spring, Fall terms

581* Research-Design  Continuation of Ch.E. 580.

Project 2  Equivalent to two one-term courses

12 hours laboratories, Winter term

583* Process System Design  The undergraduate curriculum is co-ordinated and brought together to accomplish by team effort the basic objective of the process engineer, the design of an integrated process.

4 hours laboratories, 2 hour tutorials, Winter term

585* Technical Elective  An individually supervised research or design project, based on one of the technical elective courses taken in the 4A term.

Project

007*, 280*, 281*, 380*, 381*, 480*, 481*, – General Awareness Seminar  Informal discussions on the Chemical Engineering Programmes. Descriptions of elective, option and research patterns available within the Department, as well as those in other Departments and Faculties. Professional ethics and the social implications of Chemical Engineering; career opportunities. Seminars by Alumni speakers.

Non-credit
Department of Chemistry

Professor and Chairman of Department  
W.A.E. McBryde, M.A.(Toronto), Ph.D.(Virginia), F.C.I.C.

Professor and Dean of the Faculty of Science  

Professor and Associate Dean of the Faculty of Science  
R.G. Woolford, M.Sc.,(Western), Ph.D.(Illinois), F.C.I.C.

Professors  
D.E. Irish, B.Sc.(Western), M.Sc.(McMaster), Ph.D.(Chicago)
F.W. Karasek, B.S. (Elmhurst), Ph.D.(Oregon State)
H.G. McLeod, M.A., Ph.D.(Toronto)
L.W. Reeves, B.Sc., Ph.D., D.Sc.(Bristol), F.C.I.C.
A. Rudin, B.Sc.(Alberta), Ph.D.(Northwestern)
G. Scoles, B.Sc., Ph.D.(Geneva)
H.D. Sharma, M.Sc., Delhi, Ph.D. (California)
T. Viswanatha, M.Sc., Ph.D. (Mysore)

Adjunct Professor  

Associate Professors  
G.F. Atkinson, M.A., Ph.D.(Toronto), F.R.I.C.
D.A. Brisbin, B.Sc.,(Alberta), Ph.D. (Toronto)
J.B. Capindale, M.A., D.Phil.(Oxford)
A.J. Carty, B.Sc., Ph.D.(Nottingham)
J. Cizec, R.N.Dr.(Charles University, Prague), CSc.(Czechoslovak Academy of Sciences, Prague)
W.L. Elsdon, M.Sc.,(Western), Ph.D.(McGill)
B.O. Fraser-Reid, M.Sc.(Queen's), Ph.D.(Alberta)
T.E. Gough, B.Sc., Ph.D. (Leicester)
J.L. Koppel, B.A., Ph.D.(Toronto)
D. Mackay, B.Sc., Ph.D.(Aberdeen)
A.D. Maynes, M.A., Ph.D.(Toronto)
F.R. McCount, B.Sc., Ph.D.(British Columbia)
J.B. Moffat, B.A., Ph.D.(Toronto)
J. Paldus, R.N.Dr.(Charles University, Prague), CSc.(Czechoslovak Academy of Sciences, Prague)
J.G. Smith, B.A., M.A., Ph.D.(Toronto)
V.A. Snieckus, B.Sc.(Alberta), M.S.(California), Ph.D.(Oregon)
G.E. Toogood, B.Sc., Ph.D.(Nottingham)

Assistant Professors  
L.J. Brubacher, B.A.(Goshen College, Indiana), Ph.D.(Northwestern)
P.C. Chieh, B.Sc.(Nat Taiwan) M.Sc.(Nat. Tsing Hua), Ph.D. (British Columbia)
R.J. Friesen, B.Sc., M.Sc.(Manitoba)
R.J. LeRoy, B.Sc., M.Sc.(Toronto), Ph.D.(Wisconsin)
M. Tchir, B.Sc.(Alberta), Ph.D.(Western)

Senior Demonstrators  
W.J. Byars, H.N.C.(Dundee Technical College), B.Sc.(Waterloo)
M.C. Michael (Miss), B.Sc.(Waterloo)
M. Vatcher, H.N.C.(Bolton Technical College)

Faculty members holding cross appointments as shown:  
1 Chemistry and Physics  
2 Chemistry and Applied Mathematics  
3 Chemistry and Chemical Engineering
Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found in Chapter 15. Prerequisites for a course are a reliable guide to the background necessary for the course. In lieu of the specific courses listed, an equivalent background from Waterloo or elsewhere is acceptable. With consent of the instructor, prerequisites may be waived in exceptional cases.

001* Pre-University Chemistry
Successful completion of this course fulfills the University Admission requirements where high school Chemistry is necessary.
Offered by correspondence only, one term.
No university credit.

11* General Chemistry
Stoichiometry, properties of gases, liquids and solutions, gas phase chemical equilibria. ionic equilibria in aqueous solutions, oxidation-reduction, chemical kinetics.
3 lectures, 1 tutorial, Fall term
(For students registered in the Year I Engineering programme.)

26* Organic Chemistry 1
The basic chemistry of the important classes of aliphatic and aromatic compounds. A laboratory course on preparative organic chemistry and organic techniques accompanies the lectures.
3 lectures, 3 hours laboratory, alternate weeks, fall and Winter terms

36* Organic Chemistry 2
An introduction to the important classes of heterocyclic compounds and natural products.
Prerequisite: Chemistry 26*
3 lectures, Fall and Spring terms

111* General Chemistry 1
Structure and properties of matter, molecular architecture, stoichiometry.
Prerequisite: Grade 12 Chemistry
3 lectures, 3 hours laboratory alternate weeks, Fall term
Laboratory optional for non-science students.

112* General Chemistry 2
Chemistry 111* continued to include chemical equilibria and rates of reaction.
Prerequisite: Chemistry 111*
3 lectures, 3 hours laboratory alternate weeks, Winter term
Laboratory optional for non-science students.
Chemistry 111*-112* are designed for students who have not completed Ontario Grade 13 chemistry and who may wish to pursue higher level chemistry courses. Only in exceptional circumstances will the course sequence be open to students who have taken Ontario Grade 13 chemistry or its equivalent. Such students should take 121* followed by 122*. Credit will not be allowed for both 111*-112* and 121*-122*.

121* Chemical Structure
Stoichiometry and structure; periodic atomic properties and their chemical implications; descriptive chemistry of selected compounds; special interest topics.
Prerequisite: Grade 13 Chemistry, Mathematics (Functions and Relations; and Calculus)
3 lectures, 3 hours laboratory, Fall term
Laboratory optional for non-science students

122* Chemical Reaction
Ionic equilibria in aqueous solutions; oxidation-reduction; reaction kinetics and mechanisms in aqueous solutions; special interest topics.
Prerequisite: Chemistry 121*.
3 lectures, 3 hours laboratory, Winter and Spring terms
Laboratory optional for non-Science students

210* Non-Aqueous Solvents and Non-Transition Metal Chemistry
Modern acid-base theory. Behaviour in specific non-aqueous systems. Application to the synthesis and reactivity of non-transition metal compounds. (Primarily for Honours Chemistry, Honours Applied Chemistry and Honours Biology and Chemistry.)
Prerequisite: Chemistry 121*-122*
2 lectures, 3 hours laboratory, Fall term only.
The laboratory is optional for all students except those enrolled in Honours Chemistry, Honours Chemistry (Physics or Mathematics Option) and Honours Applied Chemistry.

211* Chemical Bonding in Inorganic Chemistry
Concepts of molecular orbital and valence bond theories. Sigma pi and delta bonding in complex polyatomic inorganic molecules. Relationship of bonding to stereochemistry and electronic structure in specific groups of compounds. (Primarily for Honours Chemistry, Honours Applied Chemistry and Honours Biology and Chemistry.)
Prerequisite: Chemistry 121*
2 lectures, offered in Winter and Spring terms

216* Introduction to Organic and Biochemistry
A general survey of the important principles and application of organic and biochemistry for Optometry students only.
3 lectures, Fall term

218* Development of Chemical Bonding and Structure
Prerequisite: Chemistry 121*
2 lectures, 1 tutorial, Fall term
219* Chemistry of Non-Transition Metals  
Group trends in main group chemistry. Emphasis will be placed on correlation of structure with physical properties in various groups of compounds.  
Prerequisites: Chemistry 218*  
2 lectures, 1 tutorial, Winter term  
1 lecture, 6 hours laboratory, offered in Fall and Winter terms

220* Introductory Analytical Chemistry  
The principles underlying quantitative chemical measurements, with experiments to develop confidence in personal laboratory techniques and to provide experience in comparing and choosing analytical methods. (Primarily for Honours Chemistry, Honours Applied Chemistry and Honours Biology and Chemistry.)  
Prerequisite: Chemistry 121* and 122*  
1 lecture, 6 hours laboratory, offered in Fall and Winter terms

221* Analytical Chemistry of Multi-Component Systems  
Applications of electroanalytical methods, spectroscopic methods, and analytical separations to the quantitative description of multi-component systems.  
(Primarily for Honours Chemistry, Honours Applied Chemistry and Honours Biology and Chemistry.)  
Prerequisite: Chemistry 220*  
2 lectures, offered in Fall, Winter and Spring terms

224 Chemical Spectroscopy  
An introductory survey of the principles and applications of spectroscopic techniques used in the modern chemical laboratory. Topics will include electronic, vibrational and rotational spectroscopy, and magnetic resonance spectroscopy.  
2 lectures per week, 2 terms, (full-year course).

226* Chemical Analysis 1  
A variety of classical and modern methods will be discussed in principle and applied in the laboratory.  
Prerequisite: Chemistry 121* and 122*  
2 lectures, 6 hours laboratory, Fall term only

227* Chemical Analysis 2  
The evolution of some modern analytical methods will be discussed in the lectures. The laboratory will deal with their application to contemporary problems in chemistry and other sciences.  
Prerequisite: Chemistry 226* or 220*  
2 lectures, 6 hours laboratory, Winter term only

231 Chemical Bonding and Structure  
Prerequisite: A first year Chemistry course, e.g. Chemistry 121*-122*  
2 lectures, for two terms (full-year course)
240* Introductory Theoretical Chemistry
Partial differentiation and the calculus of several variables; solution of ordinary differential equations with emphasis on the special functions occurring in chemistry (e.g. Hermite, Legendre and associated Laguerre functions); fundamentals of linear algebra including vector spaces and matrices; introduction to operator concepts. All of these mathematical methods will be illustrated with examples taken from modern chemistry and their employment in further chemistry courses will be discussed.
Prerequisite: Chemistry 121* and Mathematics 130
2 lectures, 1 tutorial, offered in Fall and Winter terms

250* Introductory Thermodynamics
Laws 0,1,2,3 of Thermodynamics and their application to the properties of ideal systems; thermochemistry; spontaneity of chemical reactions and the criteria for chemical equilibrium; derivation of the phase rule and its application.
Prerequisite: Chemistry 121* and 122*; Mathematics 130
2 lectures, 1 tutorial, offered in Fall and Winter terms

251* Application of Chemical Thermodynamics to Real Systems
Partial molal quantities; Gibbs chemical potential and non-ideal systems; chemical equilibrium; theory of electrolytes.
Prerequisites: Chemistry 250*
2 lectures, 1 tutorial, offered in Fall, Winter and Spring terms

252* Quantum Chemistry 1
A review of classical wave motion; the postulates of quantum mechanics; quantum mechanics of the hydrogen atom; angular momentum and simple coupling schemes; selection rules and atomic spectroscopy of hydrogen-like systems and the helium atom; discussion of multi-electron atoms; fine and hyperfine structure.
Prerequisite: Chemistry 240*
2 lectures, 1 tutorial, offered in Fall, Winter and Spring

260* Organic Chemistry 1
The preparation and reactions of typical organic functional groups examined from the basis of the reaction mechanisms is presented. Spectroscopic correlations of these functional groups is introduced. Sterechemistry of organic molecules is discussed. (Primarily for Honours Chemistry, Honours Applied Chemistry and Honours Biology and Chemistry.)
Prerequisite: Chemistry 121*-122*
2 lectures, 1 tutorial, 3 hours laboratory, offered in Fall and Winter terms

261* Organic Chemistry 2
The treatment of organic chemistry in Chemistry 261* is continued and extended to aromatic compounds. (Primarily for Honours Chemistry, Honours Applied Chemistry and Honours Biology and Chemistry.)
Prerequisite: Chemistry 260*
2 lectures, 1 tutorial, offered in Fall, Winter and Spring terms

266* Organic Chemistry 1
The properties, preparation, reactions and basic structural theory of the common classes of aliphatic compounds. Introduction of electrophilic and nucleophilic reaction mechanisms.
Prerequisite: Chemistry 121* and 122*
2 lectures, 1 tutorial, Fall term
267* Organic Chemistry 2 The properties, preparation, reactions and basic structural theory of the common classes of aromatic compounds. A continuation of organic reaction mechanisms. Introduction to the chemistry of carbohydrates, proteins, steroids, etc.
Prerequisite: Chemistry 266*
2 lectures, 3 hours laboratory, Winter term

(For students needing a full year of Organic Chemistry as a prerequisite to medicine, the sequence 266*-267* should be selected.)

291* Laboratory Selected experiments to accompany the lecture work of Year 2 Honours Chemistry (incl. Math and Physics options) and Honours Biology and Chemistry and term 2B Honours Applied Chemistry. Only open to such students.
9 hours laboratory, offered in Fall, Winter and Spring terms
Students in Honours Biology and Chemistry or the Mathematics or Physics Options of Honours Chemistry take only 6 hours laboratory

Note Most 300-level honours courses are listed as 2 hours lectures; an additional 1 hour tutorial may be scheduled at the discretion of the instructor.

Prerequisites: Chemistry 210*, 211*
2 lectures; offered in Fall and Spring terms

Prerequisite: Chemistry 121* or equivalent
2 lectures, offered in Winter term

316* An Introduction to Transition Metal Chemistry The transition elements and their compounds. An elementary approach to crystal and ligand field theory will be used to rationalise the spectra, magnetism, structures and properties of transition metal complex compounds.
Prerequisite: Chemistry 218*, 219* or 211*
2 lectures, 3 hours laboratory, Fall term
Students in Honours Biology and Chemistry are not required to take the laboratory.

Prerequisites: Chemistry 218*, 219*, or 211*
2 lectures, Winter term
320* Chemical Instrumentation
The principles of operation, practical limitations and preferred uses of various devices commonly used to make accurate measurements of importance in modern chemistry. Transducers for temperature, pressure, solution potential, optical absorptivity, etc.
Prerequisites: Chemistry 220* or 226*-227*
2 lectures, 3 hours laboratory, offered in Winter term

332* Biochemistry 1
An introduction to the chemistry of amino acids, peptides, proteins, nucleic acids, carbohydrates and lipids.
Prerequisites: Chemistry 261* or 267*
2 lectures; offered in Fall, Winter and Spring terms

Note A 3 hour laboratory will be given for Honours Biology and for General Science students.

333* Biochemistry 2
Metabolism of carbohydrates and lipids. Structure and synthesis of proteins.
Prerequisite: Chemistry 332*
2 lectures, Fall and Winter terms

Note A 3 hour laboratory will be given for Honours Biology and for General Science students.

337 Biochemistry
Carbohydrates, lipids, proteins, hormones, nucleic acids, and vitamins. Metabolism of these groups of compounds. Physico-chemical aspects of biochemistry.
Prerequisite: Chemistry 260*, 261* or 266*, 267* or equivalent
2 lectures, two terms (full-year course for correspondence students, equivalent to 332*-333*)

344 Inorganic and Nuclear Chemistry
Survey of transition metal chemistry including ligand field theory of coordination compounds and an introduction to organometallic chemistry. Introduction to nuclear and radiochemistry.
Prerequisites: a background in Chemical Bonding, e.g. Chemistry 211* or 218* or 231
2 lectures, for two terms (full-year course)

350* Spectroscopy and Molecular Structure
Introduction to concepts and applications of microwave, Raman, IR, electronic and resonance spectroscopy with respect to molecular parameters.
Prerequisite: Chemistry 252*
2 lectures, Fall and Spring terms

351* Statistical Thermodynamics
Ensembles, postulates of statistical mechanics; Boltzmann, Fermi-Dirac, and Bose-Einstein Statistics; microcanonical, canonical and grand canonical ensembles; Equilibrium statistical mechanics and statistical thermodynamics; application to ideal gases.
Prerequisites: Chemistry 240*, 250*
2 lectures, Fall and Spring terms

352* Chemical Kinetics
Introduction to kinetics and mechanism of elementary chemical processes in homogeneous systems; reversible, consecutive and simultaneous reactions, interpretation of kinetic data. Collision theory, absolute reaction rate theory.
Prerequisite: Chemistry 351*
2 lectures, Winter term
353* Introduction to Polymer Science
Basic definitions and polymer nomenclature, molecular weight averages and distributions, polymer constitution, configuration and conformation, step-growth and free-radical chain-growth polymerization and copolymerization.
Prerequisites: Chemistry 250* and 260* or equivalent
2 lectures, Fall and Spring terms

354* Applied Kinetics
Introduction to kinetics and mechanism of elementary chemical processes in homogeneous systems, reversible, consecutive and simultaneous reactions, interpretation of kinetic data. Application to industrial processes, both batch and continuous.
Prerequisite: Chemistry 250* or 356*
2 lectures, Winter term

356* General Physical Chemistry 1
An introductory survey of the thermodynamics of ideal systems; the application of thermodynamic principles to the study of solutions, phase equilibria, chemical equilibrium and the properties of electrolytes.
Prerequisites: Chemistry 122* and Math 130
2 lectures, 3 hours laboratory, Fall term

357* General Physical Chemistry 2
An introductory survey of the concepts and principles of quantum mechanics; the application of these principles to the study of atomic and molecular structure and spectra, and to photo-mechanical phenomena. Chemical kinetics.
Prerequisites: Chemistry 356*
2 lectures, 3 hours laboratory, Winter term

360* Organic Chemistry 3
Stereochemistry of organic compounds; conformational isomers, geometrical (cis-trans) isomers, optical isomers and diastereomers. Introductory carbohydrate chemistry.
Prerequisite: Chemistry 261*
2 lectures, Fall term

Note A 3 hour laboratory will be given for Honours Biology and Chemistry students.

361* Organic Chemistry 4
Acidity and basicity of organic compounds. Formation and reactions of enolate anions with emphasis on their synthetic utility. Cycloaddition reactions.
Prerequisite: Chemistry 360* or 261*
2 lectures, Winter term

Note A 3 hour laboratory will be given for Honours Biology and Chemistry students.

362* Theoretical Organic Chemistry
A number of topics in physical and organic chemistry treated from a semi-empirical consideration of molecular structure (e.g. MO theory and reactivity).
Prerequisite: Chemistry 240*, 261*
2 lectures, Winter term
363* Applied Organic Chemistry

The organic chemistry involved in selected industrial processes will be discussed. Petroleum chemistry, synthesis of dyestuffs, pharmaceuticals, pesticides, organic polymers, etc.

Prerequisite: Chemistry 261*

2 lectures, Fall and Spring terms

366* Structural and Synthetic Organic Chemistry

Stereochemistry of organic molecules; synthesis of selected organic compounds examined in detail with emphasis on cycloaddition reactions and condensation reactions.

Prerequisites: Chemistry 261* or 267*

2 lectures, 3 hours laboratory, Fall term

367* Selected Topics in Chemistry

Some of the following topics will be discussed: photochemistry, organometallic compounds, organic compounds of commercial interest, natural products.

Prerequisites: Chemistry 360* or 366*

2 lectures, Winter term

390* Advanced Laboratory 1

Selected experiments to accompany lecture work of year 3 Honours and Applied Chemistry.

Prerequisite: Chemistry 291*

9 hours laboratory, Fall and Spring terms

391* Advanced Laboratory 2

Selected experiments to accompany lecture work of year 3 Honours and Applied Chemistry.

Prerequisite: Chemistry 291*

9 hours laboratory, Winter term

395* History of Chemistry

The development of chemistry will be traced from alchemy to the 20th century. The contributions of famous scientists to the concepts and models of modern chemistry will be emphasized.

2 lectures, Winter term

409* Solid State Chemistry


Prerequisite: Chemistry 211*, or 218*

2 lectures, Fall term

411* Organometallic Chemistry


Prerequisite: Chemistry 310* or equivalent

2 lectures, Fall term

414* Kinetics of Inorganic Reactions

Mechanisms of substitution reaction in solution. Hydrolysis, aquation, anation, fast reactions of transition metal complexes. Octahedral, square planar and tetrahedral systems will be treated in detail. Experimental techniques.

Prerequisite: Chemistry 310*

2 lectures, Winter term
416* Applied Inorganic Chemistry
The chemistry of inorganic compounds and processes of industrial importance will be discussed. Inorganic polymers; catalysis by inorganic systems including nitrogen fixation, hydrogenation, and hydroformylation. Synthesis and purification of metals.
Prerequisites: Chemistry 210*, 211*
2 lectures, Fall term

417* Synthesis and Structure of Inorganic Compounds
The chemistry of selected groups of important inorganic compounds will be discussed to emphasize synthetic methods, structure and reactivity.
Prerequisite: Chemistry 310*
2 lectures, Winter term

419* Biological Aspects of Inorganic Chemistry
Survey of metal binding groups in enzymes, proteins, amino acids and other molecules of biological importance. Role of metals in biological processes. Oxygen transport, electron transfer, enzyme catalysis, nitrogen fixation. Specific groups of important metal complexes to be discussed will include: heme proteins, ferredoxins, vitamin B12 coenzymes, carboxypeptidase, xanthine oxidase, etc. Poisoning and blocking of active sites by complexation; mercury pollution. Design and use of model systems.
Prerequisite: Chemistry 310* or 316*
2 lectures, Winter term

420* Analytical Chemistry
Selected topics in modern analysis of inorganic materials such as rocks, ores, ceramics, metals and alloys. Atmospheric flame spectroscopic methods, analytical X-ray techniques, methods for ultra-pure materials, trace and micro determinations.
Prerequisite: Chemistry 220* (with 221* recommended) or 227*
2 lectures, Fall term

421* Spectrometric Analysis
The techniques and fundamental principles of infrared, mass spectrometry and NMR as applied to the qualitative identification of chemical compounds.
Prerequisite: Chemistry 220* (with 221* recommended) or 227*
2 lectures, Winter term

427* Chemical Measurements for Biologists 1
Practical and theoretical topics required for understanding, selecting and applying basic methods of quantitative analysis. Primarily for students in upper years of Honours Biology.
Prerequisite: a first year chemistry course
2 lectures, 3 hours laboratory, Fall term

428* Chemical Measurements for Biologists 2
Extension and refinement of measuring techniques by proper choice and use of instruments, emphasizing topics related to modern biological studies. Primarily for students in upper years of Honours Biology.
Prerequisite: Chemistry 427* or consent of instructor
2 lectures, 3 hours laboratory, Winter term

432* Biochemistry 3
Kinetics, stereospecificity, structure and function of enzymes, bio-energetics, oxidative phosphorylation.
Prerequisite: Chemistry 333*
2 lectures, Fall term
433* Biochemistry 4 Chemistry and biosynthesis of porphyrins. Metabolism of amino acids, purines and pyrimidines. Role of vitamins in biological transformations. Respiration, muscular contraction.  
Prerequisite: Chemistry 432*  
2 lectures, Winter term

Note Honours Biology and Chemistry students will take a 3-hour laboratory with Chemistry 432* and 433*.

434* Applied Biochemistry Chemistry and function of antibiotics; blood coagulation and related topics. Immuno-chemistry. Nutritional aspects of food.  
Prerequisite: Chemistry 333*  
2 lectures, Winter term

437 Biochemistry 2 Selected topics and techniques in modern biochemistry; energy transfer, transport across membranes, comparative aspects of metabolism, mechanism and kinetics of enzyme activity, structural macromolecules.  
Prerequisite: Chemistry 337  
2 lectures  
(Full-year course for correspondence students, equivalent to 432*-433*)

450* Group Theory Basic group theory, irreducible representations, molecular symmetry groups, character tables, reduction of representations. These various concepts will be illustrated by application to specific examples.  
Prerequisite: Chemistry 252*  
2 lectures, Fall term

451* Statistical Mechanics Applications of statistical mechanics to systems of interacting molecules: imperfect gases, liquids, solids, surfaces and solutions.  
Prerequisite: Chemistry 351*  
2 lectures, Fall term

452* Quantum Chemistry 2 Selected topics in quantum chemistry. Such topics may include: fundamental problems in quantum chemistry, physical nature of the chemical bond, stationary and nonstationary state problems, applications of quantum mechanics to systems of chemical interest.  
Prerequisite: Chemistry 252*  
2 lectures, Winter term

453* Polymer Properties and Polymerization Polymerization reactions; control of polymer structure and properties.  
Prerequisite: Chemistry 353* or equivalent  
2 lectures, Fall term

454* Surface Chemistry An introduction to the physical chemistry of surfaces. Qualitative and quantitative descriptions of surfaces and interfaces and the development of relevant techniques and theories. Application to surface tension, spreading, wetting, adsorption, and other interfacial phenomena.  
Prerequisites: Chemistry 250*, 251*  
2 lectures, Fall term
455* Electrochemistry
Electrolytic conductance and transport, thermodynamics of electrolytic cells. Reversible and irreversible electrode processes, metallic corrosion; study of selected industrial electrochemical processes.
Prerequisites: Chemistry 250* or 356*
2 lectures, Fall term

456* Catalysis
An introduction to heterogeneous catalysis. Examination of the physical manifestations of catalysis and the development of experimental techniques and theoretical methods for the measurement and elucidation of catalytic phenomena.
Prerequisite: Chemistry 454*
2 lectures, Winter term

457* Experimental Aspects
of Polymer Science
Selected experiments to describe properties of polymers and polymerization processes.
Prerequisite: Chemistry 353* or equivalent
1 lecture, 3 hours laboratory, Winter term

460* Spectroscopy in
Organic Chemistry
Elucidation and identification of organic structures by contemporary spectroscopic techniques.
Prerequisites: Chemistry 260*, 350*
2 lectures, Fall term

461* Special Topics in
Organic Chemistry
One half of the semester will be devoted to principles of organic synthesis. For the second half of the semester students can opt for one of the following topics (a) Molecular rearrangements (b) Photochemistry (c) Organometallics (d) Heterocyclic compounds.
Prerequisite: Chemistry 361*
2 lectures, Winter term

490* Advanced Laboratory
9 hours laboratory
Fall term

491* Advanced Laboratory
9 hours laboratory
Winter term
Department of Civil Engineering

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

Professor, Dean of Engineering
W. A. McLaughlin, B.Eng.(Saskatchewan), M.S., Ph.D.(Purdue)

Professor, Associate Chairman of Graduate Studies
H. H. E. Leipholz, Dipl.Eng., Dr. Ing., Docent Habilit Stuttgart

Professor, Associate Chairman of Undergraduate Studies
R. C. G. Haas, B.Sc., M.Sc.(Alberta), Ph.D.(Waterloo)

Professors
S. T. Ariaratnam, B.Sc. (Eng.)(Ceylon), M.Sc.(London), Ph.D. (Cambridge)
M. Z. Cohn, C.Sc.(Bucharest)
W. R. Drynan, B.A.Sc.(Toronto), M.Sc., Ph.D.(Texas)
G. M. L. Gladwell, B.Sc., Ph.D., D.Sc.(London)
V. K. Handa, B.Sc.(Calcutta), B.Sc. (Eng.)(London), M.Sc. (Queen's), M.A.Sc., Ph.D.(Waterloo)
B. G. Hutchinson, B.E.(Sydney), M.Sc.(Queen's), Ph.D.(Waterloo)
N. C. Lind, M.Sc.(Tech. Univ. of Denmark), Ph.D.(Illinois)
J. T. Piu, D. of Tech. Sciences(Warsaw), Docent Habilit, (Cracow)
T. Prasad, B.Sc., M.Sc.(Banaras Hindu Univ.), Ph.D.(Cambridge)
J. T. Pindera, Dr. of Tech. Sciences(Warsaw), Docent Habilit, (Cracow)
T. E. Unny, B.E.(Madras), M.Tech.(Karagpur), Dr. Ing. (Dresden)

Associate Professors
E. F. P. Burnett, B.Sc.(Capetown), D.I.C., M.S., Ph.D.(London)
R. W. Cockfield, B.Sc., M.Sc.(Queen's), Ph.D.(Waterloo)
G. J. Farquhar, B.A.Sc., M.A.Sc.(Waterloo), Ph.D.(Wisconsin)
R. Green, B.Sc. (Eng.)(London), M.Sc.(Queen's), M.Sc(Waterloo) Ph.D(Texas)
D. E. Grierson, B.A.Sc., M.A.Sc., Ph.D.(Waterloo)
B. LeLievre, B.Eng(West Australia), M.A.Sc., Ph.D.(Waterloo)
W. C. Lennox, B.A.Sc., M.Sc.(Waterloo), Ph.D.(Lehigh)
E. L. Matyas, B.A.Sc.(Toronto), D.I.C., Ph.D.(London)
G. M. McNeice, B.A.Sc.(Waterloo), Ph.D.(London)
J. Roorda, B.A.Sc(Waterloo), Ph.D.(London)
J. Schroeder, B.Eng., M.Eng.(McMaster), Ph.D.(Waterloo)
J. Shortreed, B.Eng. Sc.(Western), M.Sc.(Queen's), Ph.D. (Northwestern)
K. N. Smith, B.A.Sc.(Toronto), M.S.(Illinois), Ph.D.(Waterloo)
S. I. Solomon, Civ. Hyd. Eng.(Bucharest)
O. L. White, B.Sc.,(Melbourne), M.A.Sc.(Toronto), Ph.D.(Illinois)

Assistant Professors
N. Kouwen, B.A.Sc., Ph.D.(Waterloo)
J. C. Thompson, B.A.Sc.(Toronto), M.S., Ph.D.(Illinois)
S. Yagar, B.A.Sc., M.A.Sc.(Toronto), Ph.D.(California)

Adjunct Professors
P. Allen
D. G. Havard, B.Sc.(London), M.A.Sc., Ph.D.(Waterloo)
N. W. McLeod, B.Sc.(Alberta), M.Sc.(Saskatchewan), Ph.D. (Michigan)
Undergraduate Course Descriptions

200 Civil Engineering

Project 1 Preliminary designs of standard civil engineering structures.
The creation and evaluation of alternative locational and spatial configurations in accordance with user socio-economic and technological requirements. Informational content of previous courses is augmented with case studies of typical civil engineering problems and solutions.

203 Statics An analytic treatment of static equilibrium of particles and rigid and deformable bodies. Internal forces in straight beams and columns, diagrams of axial force, shear force and bending moment.

204 Dynamics An introduction to the Kinematics and Kinetics of particles and rigid bodies. Kinematics of particles; Kinetics of particles: Newton's Second Law, energy and momentum, impulsive motions; systems of particles. Kinematics of rigid bodies; plane motion of rigid bodies: equations of motion, energy and momentum, impulsive motions.

205 Mechanics of Deformable Solids 1 Introduction of the concepts of stress and strain. Stress-strain relations for linearly elastic and other materials; analysis of the response of prismatic members to axial, shearing, flexural or torsional loads.

206 Mechanics of Deformable An extension of CE205. Combined stress and strain states, Mohr's circle yield and failure criteria, energy methods, virtual work buckling of columns, and an introduction to simple statically indeterminate structures.

221 Calculus A continuation of Math 12. Infinite series and power series, partial derivatives, multiple integration with applications, vector analysis, theorems of Green and Gauss, line integrals and Fourier analysis.


224 Probability and Statistics A course in aspects of probability and statistics. Sample spaces, calculus of events, probability, conditional probability, independence, permutations and combinations, random variables, discrete and continuous distributions, mean and variance, Chebychev's inequality, joint distributions, random sampling, the normal distribution, law of large numbers, central limit theorem, parameter and interval estimation, hypothesis testing, regression, analysis of variance.
265 Structure and Properties of Materials
Structure of Materials – Topics include: crystalline and non-crystalline arrangements, bonding forces, structural defects, phase equilibria, non-equilibrium transformations, heat treatment of metals, deformation resistance; elasticity, anelasticity, plasticity and creep, fracture properties; brittle and ductile fracture, fatigue, embrittlement fractures, mechanical properties of plain concrete and polymers.

280 Fluid Mechanics
An introductory course in fluid mechanics. Unit and dimension, fluid statics, fundamentals of fluid flow, viscous effects, closed conduit flow, pipe network analysis.

291 Survey Camp
A one-week course in surveying. Introduction to surveying, length measurements, levelling, transit surveys. Approximate cost to each student $50.

292 Socio-Economic Aspects of Civil Engineering
An overview of the man-environment interaction. General economic concepts of human welfare and resource allocation, engineering economic decisions, breakeven and minimum cost analysis, engineering methods of resource allocation, scheduling of resource allocation, concepts of interest, time evaluation of tactical and strategical alternatives.

298, 299 Seminar
The engineer in society. Principles, methods and practice of Civil Engineering. Informal lectures.

300 Civil Engineering Project 2
The detailed design of comprehensive projects by student teams. Each team member is assigned a portion of a project which he is to design. Each of the individual designs are integrated to produce a complete design in the form of a report containing all appropriate calculations and drawings. Particular emphasis is placed on the utilization and integration of knowledge acquired in the more specialized courses.

303 Structural Analysis 1
An introduction to structural analysis. Degree of internal indeterminacy and stability of structural systems; analysis and construction of influence lines for beams, frames, arches and trusses, calculation of displacements; energy principles.

304 Structural Analysis 2

315 Structural Design 1
An introductory course in structural design intended to acquaint the student with the behaviour of typical engineering materials. The behaviour of sections under various loading conditions, the design of connections in steel and concrete structures, design of beams and columns.

342 Urban Transport Planning 1
An introduction to the analytical tools of transport planning. Urban transport planning process, trip generation, modal split analysis, trip distribution, traffic assignment. Economic evaluation of transport systems. Transport technology. Transport plan development and urban planning principles.

Prerequisites: CE224, CE292, or equivalents
343 Urban Transport Planning 2
Applications of the analysis methods of CE342 to actual transport planning problems in Canadian urban areas. Objectives of system planning; land use and travel surveys; census data; synthesis of alternative road and public transport plans; testing and evaluation of plans.

353 Geology and Soil Mechanics
An introductory course in geology and rock mechanics with emphasis on topics related to civil engineering. Mineralogy and petrology, structural geology, geomorphology (especially glacial geology), aggregates, soil classification, permeability and groundwater flow. Approximate cost of field trips to each student $10.

354 Soil Mechanics and Foundations
A study of theories of soil mechanics and their use in soil engineering. Introduction to engineering properties of soils. Procedures for the design of earth structures and shallow foundations.

375 Sanitary Engineering
An introductory course in sanitary engineering. Fundamentals of microbiology and chemistry, water treatment; water quality criteria, clarification, filtration, disinfection, removal of dissolved materials, waste water treatment, characteristics of waste water, disposal of water, primary treatment, secondary treatment, sludge handling, tertiary treatment, industrial wastes.

381 Hydraulics
An introductory course in hydraulics. Open channel flow, hydro-meteorological concepts, statistical hydrology, reservoir operation, dimensional analysis, hydraulic structures, hydro electric power.

393 Environmental Engineering
An introduction to environmental, urban and municipal engineering. Characteristics of urbanization, measuring demands for municipal services, developing and testing plans, implementation considerations, performance and measurement consideration.

398, 399 Seminar
The engineer in society. Principles, methods and practice of Civil Engineering. Informal lectures.

400 Civil Engineering Project 3
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.

413 Structural Steel Design
A concise presentation of basic features of the behaviour and design of steel structures. Materials, applications, Types of construction; elastic and plastic action; design of tension members, beams, columns, bolted and welded connections, plate girders, composite construction, light gauge members.

414 Structural Concrete Design
A concise presentation of the basic features of the behaviour and design of structural concrete. Physical and mechanical properties of concrete, reinforcing steel, reinforced concrete; generalized flexural behaviour, shear, bond, combined axial and bending applied to singly and doubly reinforced and flanged sections. Structural design and design criteria for continuous beams; yield line analysis for slabs.
415 Structural Design 2 A continuation of CE 413 and 414. Loadings, layout, components, assemblage and economics of various building systems; design of one and two-way floor systems; effects of temperature, creep, shrinkage, concentrated loads, etc; industrial and multistory framed structures; bridges. A CE 500 project must be done in conjunction with this course.

441 Transportation Economics A course in public enterprise economics with emphasis on spatial or transportation related effects in economics. Topics include welfare economics, costing, pricing theory, project evaluation and practical application problems.

454 Foundation Engineering A continuation of CE 354. Engineering properties of soils, special problems and techniques in the design of foundations, earth structures and excavations, shallow and deep foundations, case studies.

481 Engineering Law General introduction to law and the Common Law legal systems; formation of contracts, effect of mistakes 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.

493 Engineering in the Canadian North A course designed to provide an introduction to the technical, ecological and sociological problems associated with construction in the Canadian North. Special engineering problems concerning transportation, water supply, foundations, structures, etc., in the northern environment are discussed. Students will be doing engineering and feasibility studies in such areas as railways, pipelines, natural resource explorations, vehicle development and marine anchorages.


500 Special Project An independent piece of engineering work, design or research, under the direction of a faculty member.

501 Approximate Analysis of Structures Simple alternative methods of structural engineering that provide independent checks on more complex analyses or designs are surveyed. Such methods are becoming necessary with the growing automation of structural computations. A deliberate development of understanding of structural behaviour ('structural intuition') is attempted. The role of approximation is discussed at all levels, ranging from accepted standard approximations in so-called exact structural mechanics to more intuitive proportioning of structures. Approximate equivalence of continuous and discrete systems: cantilever method, equivalent beams, plates and shells, trusses and grids. Finite element methods; Newmark's analysis and further simplifications. Moment balancing, load balancing and related methods of pragmatic design. Methods of negligible redundants: portal method, area method in shells.
504 Structural Analysis 3  Flexibility and stiffness procedures for the analysis of indeterminate structures; matrix methods applied to planar and three-dimensional frames; computer applications; problem formulation and solution.


508 Structural Dynamics and Stability  An introduction to the analysis of the dynamics and stability of civil engineering structures. Vibrations of single and multi-degree of freedom lumped-mass systems for imposed forces or support motions; vibrations beam-girder, plates and slabs; approximate design methods; stability of columns, buckling of continuous beams, buckling of frames, plates and plate-type structures; lateral and torsional buckling problems; approximate methods of analysis.

518 Plates and Shells  A simultaneous development of the elementary methods of analysis and design of plates and shells. Types, uses, typical materials and methods of construction; membrane theory for shells, derivation and solution of governing equation for various cases; elementary bending theory for plates and shells, derivation of governing equations, methods of solution (analytic, tables, codes, series, finite difference, finite elements); limitations of methods, solutions.

520 Advanced Computer Programming for Engineers  An advanced level study of the capabilities of the digital computer and the effective planning of large programmes. Use of functions, subroutines, object decks, load modules, programme libraries, overlay programmes; comparison of different compilers and various systems (FORTRAN, ICES, STRUDL, CPS, WITS, ICETRAN, PL/I); techniques for large systems of equations. Prerequisite: GE 121 or the equivalent.

522 Engineering Analysis  An introduction to the analysis of lumped parameter problems in engineering. Examinations of equilibrium, eigenvalue and propagation problems associated with the formulation techniques, mathematical properties and the various exact and approximate methods of solution; engineering applications: suitability of techniques for machine computation.

524 Probability, Statistics and Decision Theory  An extension of CE 224: objective, subjective and axiomatic probabilities; classical inference; Bayesian decision theory, terminal and pre-posterior analysis; game theory, zero and non-zero sum games, bargaining models; decisions under uncertainty; multiple regression analysis, principal components. Introduction to stochastic processes.
526 Continuum Mechanics
An introduction to the analysis of continuum. Vectors, Cartesian tensors; tensors of stress, strain and strain rate for a continuum; laws of motion-conservation of mass, momentum integral, kinetic equation of state, first and second laws of thermodynamics; linear elasticity – equations of equilibrium and compatibility, superposition principle, extension and flexure of beams, plane elasticity; plasticity – idealized behaviour, yield conditions and surfaces, plastic potential theory, hardening hypothesis, Hencky’s theory, slip line theory; linear viscoelasticity; viscoelastic models, creep, hereditary integrals.

534 Model Analysis of Engineering Structures
A lecture-laboratory study of the use of mechanical models to predict the response to loads of civil engineering structures. Advantages, limitations of model aided, analytic and code-based designs; principles of model similarity and behaviour of geometrically similar structures; investigation of limits of common design procedures; experimental evaluation of static and dynamic load response of models of structures not amenable to analytical solutions; transfer of data to geometrically similar structures; design, construction and test failure of reduced models of simple structures.

536 Model-Aided Design of Engineering Structure
A lecture-project course requiring the model-aided design of civil engineering structures not amenable to design by analytic techniques. Students will design, construct, test and analyse the response of reduced models of structures required to satisfy specified criteria; evaluation of design will be made with recommendations for modification and optimization of original design. Lectures will include: case studies of model-aided optimization of structures and structural components, introduction to theory, principles and design of experiments, measuring systems and transducers.

540 Highway Design
A course in geometric design, highway organization and highway information systems. Freeway design, interchange design, interchange spacing, flexibility of freeways, transportation systems in metropolitan areas, freeway networks, safety.

541 Traffic
A course in traffic analysis and design. Car following theories, delays at street intersections, deterministic and stochastic traffic patterns, computer simulation of traffic behaviour.

542 Pavement Structural Design
A course in pavement design. Soil identification, subgrade design, base courses, flexible pavement design, dense to graded hot mix asphaltic concrete, surface treatments.

543 Land Use Models
An introduction to analytical models for forecasting urban land use patterns. Urban development in Canada, available urban development models, population forecasting, economic activity forecasting, the Lowry model.

544 Systems Analysis
A course in systems analysis technique, linear programming, dynamic programming, networks, decision theory.
545 Transportation Planning Practice

The aim of this course is to expose students to the practice of transportation planning used in several areas of transportation. Case studies will be used to illustrate current practice. Illustrative problems will be drawn from the following areas: airport and air terminal planning; urban rapid transit planning and design; urban and rural freeway and road design; planning and operation of public transport systems for medium and smaller sized cities; planning demand scheduled bus systems. Students will be required to complete a planning and design problem in one area.

551 Engineering Terrain Analysis

An introduction to engineering terrain analysis. Use of geologic and pedologic information and aerial photo interpretation principles and techniques in the prediction of engineering properties of soils and the planning of engineering soil surveys; geotechnical aspects of permafrost and organic terrain (muskeg); principles and geotechnical applications of other remote sensing systems; terrain evaluation systems.

558 Soil Engineering (Case Histories)

A study of the application of procedures of design and construction of foundations and earth structures through consideration of case histories.

Prerequisite: CE 454

560 Mechanical Behaviour of Materials

A review of crystalline and non-crystalline structures. Elastic and inelastic properties, imperfection and plasticity in crystals; plastic deformation and creep; brittle, ductile and fatigue fracture. Plasticity in ceramics and polymers. Cyclic deformation.

572 Topics in Wastewater Treatment


573 Pollution in the Aquatic Environment

A waste management course involving characteristics of receiving waters. Diffusion, biological responses to nutrients, self purification, thermal discharge, limnological aspects.

580 Elements of Water Resources Management

An introduction course in water resources management. Uses of water, institutional characteristics, multi-use of water, water quality management, systems analysis, comprehensive water resources planning.

583 Water Distribution and Collection Systems

A municipal hydraulics and hydrology course. Water and wastewater estimates, water supply and distribution systems, urban hydrology, wastewater collection, hydraulics of treatment works.

586 Hydrology

A course in hydrology following CE 381. Hydrologic cycle, river basin characteristics, climatology, evaporation, probability in hydrology, hydrographs, time series, data banks, models, floods, groundwater.

589 Open Channel Flow

A course in open channel flow. Classification of open channel flow, energy and momentum principles, critical flow, uniform flow, design of channels, gradually and rapidly varied flows, flood routing.
Note Courses numbered within 500 series are considered to be undergraduate courses but are intended to form a transition from the undergraduate to the graduate programme in certain areas of Civil Engineering. They serve two major functions: 1) to provide electives for the undergraduate so that he may specialize in a particular area. 2) to provide background information for the graduate student when such is lacking. Courses of this series may be credited toward a graduate degree.
Department of Classics and Romance Languages

Professor and Chairman of the Department

R.L. Myers

Classics Faculty

Assistant Professor, Deputy Chairman (Classics)

P. Forsyth, A.B.(Mount Holyoke), M.A. Ph.D.(Toronto)

Chairman

Professors

P. Keresztes, M.A.(Toronto), Ph.D.(Graz)

D.C. Mackenzie, B.A., M.A., Ph.D.(Princeton)

Assistant Professors

S.B.P. Haag, B.A., M.A.(Queen's), M.Phil.(Toronto)

R.L. Porter, B.A.(McMaster), M.A., Ph.D.(Princeton)

French Faculty

Associate Professor; Chairman (Classics)

J.R. Dugan, B.A., M.A.(Toronto), Ph.D. (Yale)

Associate Chairman; Deputy Chairman (French)

Professors

A. Ages, B.A.(Carleton), M.A., Ph.D. (Ohio State)

J.R. Finn, C.R., B.A.(Western), M.A.(Toronto), Ph.D.(Illinois)

R.L. Myers, B.A.(Western), M.A., Ph.D.(Johns Hopkins)

Associate Professors

J.J. Binamé, L. en Phil. rom., Agrégé (Brussels)

J. Lafrance, B.Paed., M.A., Ph.D.(Laval)

C. Racine, B.A.(Joliette), Lic. en Péd., Lic. ès Lettres, D.E.S. (Montréal), Doctorat ès Lettres (Nice)

W.D. Wilson, M.A., Ph.D.(Trinity College, Dublin)

Assistant Professors

P.H. Dubé, B.A., M.A.(Toronto), Ph.D.(Ohio State)

R.J. Fournier, B.A., M.A., Ph.D.(Western)

Lecturers (part-time)

P. Aplevich, B.A. M.A.(Waterloo)

H.S. Fournier, B.A.(Toronto), M.A.(Western)

M. Henning, B.A.(Western), M.A.(Waterloo)

P. Socken, R.A.(Toronto), M.A.(Iowa)

Spanish Faculty

Professor, Deputy Chairman (Spanish)

J.C. McKegney, B.A.(Western), M.A.(Oregon), Ph.D.(Washington)

Diploma (Santander)

Assistant Professors

C.M. Fernandez, Lic. en Arq.(Madrid), M.A.(Tulane), D.Ilit. et Phil. Universitas Complutensis (Madrid)

B.C. Thalman, B.A.(DePauw), M.A., Ph.D.(Ohio State)

Italian Faculty

Assistant Professors

J E. Evans, Laurea in pedagogia (Padua)

J A. Gualtieri, B.A.(Toronto), M.A.(Colorado)
General Remarks
1) The number of lectures per week shown after certain course descriptions is an attempt to indicate the "normal". The instructor will determine how often his particular class will meet.
2) In choosing his course each year, the student should always bear in mind the requirements of the profession he intends to enter after graduation. The members of the department are at all times willing to advise the student if he so wishes.
3) Students entering their second year will require the following number of departmental courses in order to graduate with major or honours standing in French, Spanish or Classics:
a) Major in 3 year programme-6 courses, except Classics-5 courses
b) Double honours programme-8 courses (except French and Political Science-7 courses)
c) Single honours programme-10 courses

Undergraduate Courses

Classics

Classical Civilization (Courses in Translation)

201* Ancient Greek Society
A survey of several aspects of the civilization of Classical Greece. Topics studied, based on primary (in English translation) and secondary sources, will include the individual, the city, institutions and amusements.
Three lectures, Fall term

202* Ancient Roman Society
A course similar to 201* above, but dealing with Classical Rome.
Three lectures, Winter term

Note With regard to the following two courses, Classical Civilization 251*-Classical Civilization 252*, the Classics Division will accept History 255 as an alternative for Classics credit. But a student may not take both History 255 and Classical Civilization 251*-Classical Civilization 252*.

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.
This course is acceptable for credit by the History department.
Three lectures, Fall term

252* Roman History
A military, political, social, economic survey of Rome from earliest times to the Empire's fall.
This course is acceptable for credit by the History department.
Three lectures, Winter term

255* Mediaeval Civilization
A study of mediaeval literature, art, architecture, music and other expressive forms. The period from late antiquity to the High Middle Ages will be studied.
Three lectures, Fall term. Not offered in 1974-75
256* Mediaeval Civilization
A study of mediaeval literature, art, architecture, music and other expressive forms. The period from the High Middle Ages to Renaissance and Reformation will be studied.
Three lectures, Winter term. Not offered in 1974-75

265* Classical Verse in Greek and Roman Epic and Early Tragedy
A study of the evolution of ancient epic from Homer to Vergil. The beginnings of the art of tragic drama will be studied through the plays of Aeschylus.
Three lectures, Fall term

266* Classical Verse in Tragedy, Comedy and Other Verse Forms
A study of classical Greek tragic drama featuring the plays of Sophocles and Euripides. The art of comedy will be examined through the plays of Aristophanes and Plautus. Other verse forms will be studied as time permits.
Three lectures, Winter term

270 Mythology and Religion
A general survey of Graeco-Roman mythology. Attention will also be devoted to such topics as the state cults, Oriental mystery religions in the Mediterranean area, and the Ruler Cult and worship of the Roman Emperor.
Three lectures, Year course

321* Forms of Classical and Neo-Classical Satire
A study (in translation) of the major classical writers of satire and of their influence on English writers of the Renaissance and Neo-Classical periods. Forms such as formal verse satire, epigram and Menippean satire will be studied in both Classical and English writers, including Horace, Juvenal, Donne, Pope, Martial, Jonson, Petronius, Lucian, More and Swift. This course may be taken for English credit and will be taught jointly by instructors from the two departments. (same as English 355*). Fall term

322* Pastoral and Mythological Aspects of Classical and Neo-Classical Poetry
A study (in translation) of significant Classical writers using pastoral and mythological elements in their works, and of their influence on English writers of the Renaissance and Neo-Classical periods. Writers such as Ovid, Shakespeare, Theocritus, Vergil, Spenser, Milton, Marvell and Pope will be studied. This course is offered for credit in either the Classics and Romance Languages or English Departments and will be taught jointly by two instructors from the respective departments. (same as English 356*). Winter term. Not offered in 1974-75

351* Greek Art and Architecture
A survey of the art and architecture of the ancient Greek world from the Minoan to the Hellenistic periods. (same as Fine Arts 310*)
Three lectures, Fall term

352* Roman Art and Architecture
A survey of the art and architecture of the Roman world from Etruscan to Imperial times. (same as Fine Arts 311*)
Three lectures, Winter term

365* Problems in Greek History 1
A detailed study of a selection of problems in Greek History. This course is acceptable for credit by the history department. Prerequisite: Class. Civ. 251* or History 255
Fall term. Not offered in 1974-75
366* Problems in Greek History 2
A detailed study of a selection of problems in Greek History. This course is acceptable for credit by the history department. Prerequisite: Class. Civ. 251* or History 255 Winter term. Not offered in 1974-75

371* Christianity and the Roman Empire 1
A study of the relationship between Christianity and the Roman Empire from the earliest beginning to 200 A.D. This course includes topics such as the trial of Christ; the trials of Paul before governors of the Empire; the burning of Rome in 64 A.D. and the subsequent outlawing of Christianity; the suppression of the Bacchanals; legislation governing the persecution of Christians, and other topics. Fall term

372* Christianity and the Roman Empire 2
A continuation of the course above. Topics included are the persecutions by the Emperors Decius and Valerian, the 'Great Persecution' and finally the triumph of Christianity under the Emperor Constantine. Winter term

375* Problems in Roman History 1
A detailed study of a selection of problems in Roman History. History 345* is acceptable for Classics credit in lieu of this course. Prerequisite: Class. 252* or History 255. Fall term. Not offered in 1974-75

376* Problems in Roman History 2
A detailed study of a section of problems in Roman History. History 346* is acceptable for Classics credit in lieu of this course. Prerequisite: Class. Civ. 252* or History 255. Winter term. Not offered in 1974-75

381* From Diocletian to Constantine
The political collapse of the empire and its subsequent division to protect its frontiers and secure an unchallenged succession; economic collapse and measures to bring about recovery; the introduction of oriental ideas of the ruler as the vice-regent of heavenly authority; attempts to revive orthodox paganism and the long persecution of the Christian Church. Not offered in 1974-75

382* Constantine the Great
His early career and rise to imperial power; his victories over Maxentius and Licinius; the sole ruler of the Roman Empire; his measures to secure the empire and restore the economy; his close relationship with the Christian Church and his efforts to secure its unity; the problems of his conversion to Christianity and the establishment of 'new Rome'. Fall term

386* Classical Prose in Translation
A study of the major prose writers of antiquity in the fields of history and philosophy. Included are Herodotus and Thucydides (Greek history), Plato (Greek philosophy), Livy and Tacitus (Roman History), and Seneca (Roman philosophy). Other authors may be read as time allows. Winter term
490 Roman Civilization and History
Senior seminar. An in-depth study of various problems and aspects of Roman Civilization and History. (same as History 400)
Not offered in 1974-75

492*-498* Senior Tutorials
By arrangement with the Department, an individual student or a small group of students will follow a course of study under the supervision of a faculty member.

Greek

Note All courses in Greek include prose composition assignments.

100 Introductory Greek
A course designed for students beginning the study of Greek or who have not yet reached the level expected in Greek 190. The aim is to attain as rapidly as possible the ability to read simple prose. The emphasis is on forms and structure; reading of connected passages will begin early in the first term.
Year course

200 Epic and Philosophy
Reading in the Fall term centre on the last days of Socrates, with selections from Plato's account of the trial, self-defence, and execution of the teacher-philosopher. In the Winter term selections from Homer's Iliad will be read in Greek, and considered in their relation to the epic as a whole.
Prerequisite: Grade 13 Greek, Greek 100 or instructor's permission
Year course

Note Of the following list of courses only those with the higher enrolments will be offered. Consult the Department for further information.

265* History and Historiography
Selection from Herodotus.
Fall term

266* Tragedy
Euripides, Medea and other selections.
Winter term

365* The Greeks at War
Selections from Thucydides' history of the struggle between Athens and Sparta.
Fall term

366* Lyric and Elegiac Poetry
Selection from Lyric and Elegiac Poets.
Winter term

375* Drama 1
Selections from Aeschylus.
Fall term

376* Drama 2
Sophocles and Aristophanes. An analysis of the female tragic figure in the Antigone of Sophocles, and of the female comic figure in the Lysistrata of Aristophanes.

395*-399* Senior Tutorials
By arrangement with the Department, an individual student or a small group of students will follow a course of study under the supervision of a faculty member.
Latin

100 Introductory Latin
A course designed for students beginning the study of Latin or who have not yet reached the level expected in Latin 190. The aim is to attain as rapidly as possible the ability to read simple prose. The emphasis is on forms and structure: reading of connected passages will begin early in the first term.
Year course.

190 Literature of the Republic
Selections from Plautus, Catullus and Cicero.
Prerequisite: Grade 13 Latin, Latin 100 or instructor's permission
Year course. Not offered in 1974-75.

251* Language Study
Composition, translation, basic grammar with intensive analysis of selected works.
Winter term

265* Letters
Selections from the letters of Cicero and Pliny.
Fall term. Open to students with Grade 13 Latin

266* Epic
A study of three books of Vergil's Aeneid in Latin. The other books will be read in English. The aim is to reach some understanding of Vergil's language, thought and feeling.
Winter term. Open to students with Grade 13 Latin

352* Language Study
Composition, translation, basic grammar, with intensive analysis of selected works.
Fall term. Not offered in 1974-75

365* History and Historiography
Livy, 21, 22; Res Gestae.
Fall term. Not offered in 1974-75

366* Cicero
Selected orations, Caesar De Bello Civili.
Winter term. Not offered in 1974-75

375* Lyric Poetry
Catullus and Horace.
Fall term. Not offered in 1974-75

376* Elegiac Poetry
Selections from Tibullus, Propertius and Ovid.
Winter term. Not offered in 1974-75

395* Mediaeval Latin Literature
From Gregory of Tours to Abelard. Selected readings in various genres such as drama and the Cambridge Songs.
Fall term

396* Mediaeval Latin Literature
From the twelfth century to the Renaissance. Selected readings in various genres such as the chroniclers and the Goliardic Songs.
Winter term. Not offered in 1974-75

465* Philosophy
Lucretius, De Rerum Natura, 1, 3, 5 (selections); Cicero, De Officiis (Selections).
Fall term. Not offered in 1974-75
466* Horace the Satirist Selections from the non-lyric poetry of Horace, particularly the Satires and Epistles Book 1. The poet's survival in both imitations and translations will be briefly considered.

Winter term

475* Comedy Plautus, Rudens; Terence, Phormio.

Fall term

476* Historiography and Literary Criticism Tacitus, Annals 11-16 (selections); Quintilian 10.

Winter term. Not offered in 1974-75

485* Roman Life in the Empire 1 Juvenal; Petronius, Cena.

Fall term

486* Roman Life in the Empire 2 Tacitus, Agricola; Suetonius, Nero; Seneca, Apocolocyntosis.

Winter term. Not offered in 1974-75

490*-496* Senior Tutorials By arrangement with the Department, an individual student or a small group of students will follow a course of study under the supervision of a faculty member.

Romance Languages

French

101* French for Beginners 1 Introduction to basic French grammar and acquisition of reading skills. Computer drills.

No prerequisite. 3 hours in classroom, 1 hour in computer laboratory

102* French for Beginners 2 A continuation of French 101*.

Prerequisite: French 101* or permission of the Department

3 hours in classroom, 1 hour in computer laboratory.

105* French Language 1 Intensive oral and aural training in the classroom as well as in the language laboratory, exercises in comprehension and conversation.

Prerequisite: Grade 13 French or permission of the Department.

Note This course is open only to non-Arts students in Co-operative programmes and will be offered only when enrolment is sufficient. Contact the Department for further information.

106* French Language 2 A continuation of French 105*.

Prerequisite: French 105* or permission of the Department

Note This course is open only to non-Arts students in Co-operative programmes and will be offered only when enrolment is sufficient. Contact the Department for further information.

151* Intermediate French 1 A comprehensive approach to language study. Involves reading, writing and speaking French.

Prerequisite: French 102* or permission of the Department

3 hours in classroom, 1 hour in language laboratory

Fall term
152* Intermediate French 2
A continuation of French 151*.
Prerequisite: French 151* or permission of the Department.
3 hours in classroom, 1 hour in language laboratory
Winter term

190 French Language
This course is designed for students entering with Grade 13 French, or the equivalent. It comprises two different groups, as follows:

French 190: Group A: French Language
Students will receive a training in both written and spoken French.
Prerequisite: Grade 13 French or permission of the Department.
5 hours per week, including language laboratory.
Year course

This group is considered the normal choice of students intending to major or honour in French. Students will receive a training in both written and spoken French, as in Group A, but two of the class hours will be devoted also to the study of French and French-Canadian civilization.
Prerequisite: Grade 13 French or permission of the Department.
5 hours per week, including language laboratory, Year course.

200 French Literature
A survey in French designed to introduce the student to the whole historical perspective of French literature, to develop skills in reading works of various types, and to introduce the major problems and methods of literary study.
Prerequisite: French 190 or permission of the Department.
3 hours in classroom, Year course
Instructor: W.D. Wilson

250 French Language
Continued training in spoken and written French, with a concentration on more difficult problems of the language.
Prerequisite: French 190 or French 106* or permission of the Department.
4 hours per week, including language laboratory, Year course

251* French Language
Part 1 of French 250: see note below.

252* French Language
Part 2 of French 250: see note below.

Note These half-courses are available only to students in the Co-operative System or with the permission of the Department.

271* Poetry and Song in Quebec
An initiation to Quebec poetry through a study of the phenomenon of French-Canadian song and its principal themes. The course will analyse the works of the principal chansonniers such as: Félix Leclerc; Gilles Vigneault; Raymond Lévesque; Claude Léveillé, Marie Savard; Monique Miville-Deschênes; Georges Dor; Sylvain Lelièvre; J. P. Ferland; Robert Charlebois; Jacques Michel.
Fall term
Instructor: C. Racine
272* Introduction to the French-Canadian Novel
A study of some representative works of the 19th and 20th centuries.
Winter term
Instructor: J. LaFrance

291* French and French-Canadian Civilization 1
This course traces the cultural development of France and Quebec from their origins to the beginning of the Napoleonic Empire. Emphasis is given to the study of music, art, architecture, literature, ideas and "daily life" in their historical context.
No prerequisite. Three hours in classroom.
Fall term
Instructor: P.H. Dubé

Note This course will be taught in English, except in the Correspondence programme, where lectures are in French. It is open to Arts students in second year and higher, and to others in any year. Open to students majoring or honouring in French only with the permission of the Department.

292* French and French-Canadian Civilization 2
This course completes the study of the cultural development of France and French Canada to 1900. After that the course emphasizes a study of life in these two areas today. Considerable attention will be paid to popular music, art, politics, industry, etc.
Prerequisite: French 291* is recommended
Three hours in classroom. Winter term
Instructor: P.H. Dubé

Note See note under French 291*

300 French Language
Advanced grammar and composition, including translation; oral practice and corrective phonetics.
Prerequisite: French 250 or permission of the Department.
4 hours per week, including language laboratory. Year course

301* French Language
Part 1 of French 300. See note below.

302* French Language
Part 2 of French 300: See note below.

Note These half-courses are available only to students in the Cooperative System or with the permission of the Department.

Note 1 The Department recommends that General B.A. students majoring in French take at least one-half credit in as many as possible of the following areas, whether at the 300 or 400 level: 17th century literature, 18th century literature, 19th century literature, 20th century literature. French Canadian literature.
Honours French students are advised to take before graduating at least one-half credit, and preferably one full credit in each of the following areas: Medieval literature. Renaissance literature, 17th century literature, 18th century literature, 19th century literature, 20th century literature, French Canadian Literature.

Note 2 In the following series of courses, five areas are included. These are indicated by the following ranges of course numbers:
330-339 – 17th century literature
340-349 – 18th century literature
350-359 – 19th century literature
360-369 – 20th century literature
370-379 – French Canadian literature
Courses in these ranges will vary from year to year and numbers will be adjusted accordingly. Although there are no firm pre-requisites, it is recommended that the student have completed a course on the second-year level.

331* Le Grand Siècle
A study of those major authors of the seventeenth century who, by influence or by reaction, provide the foundations of many future literary works.
Fall term
Instructor: R.J. Fournier

341* Eighteenth Century
Reading in the novel, drama and poetry, and criticism of the eighteenth century.
Fall term
Instructor: A. Ages

351* Romanticism
A study of the French novel from 1800-1850. Selected authors will include Chateaubriand, Constant, Balzac, Stendhal, Hugo and Mérimée.
Three hours in classroom, Winter term
Instructor: P.H. Dubé

352* Realism and Naturalism
A study of the French novel from 1850-1900. Authors studied will include Flaubert, Maupassant, Zola and Huysmans.
Three hours per week in classroom, Fall term
Instructor: J.R. Dugan

361* Contemporary French Literature
A study of selected texts by authors such as Sartre, Camus, Ionesco, Prévert, Robbe-Grillet.
Fall term
Instructor: W.D. Wilson

362* French Literature, 1900-1939
A study of selected texts by authors such as Alain-Fournier, Gide, Apollinaire, the Surrealists, Malraux.
Winter term
Instructor: W.D. Wilson

375* Contemporary French-Canadian Novel
A study of a limited number of texts by authors such as Gabrielle Roy; Anne Hébert; Jacques Godbout; André Langevin; Hubert Aquin; Gérard Bessette.
Prerequisite: French 200 or permission of the Department
Fall term

376* The “essai” in French Canada
An analysis of the French-Canadian cultural phenomenon since 1950, through the works of the principal “essayistes”. The word “cultural” is taken in the wider sense, implying literature, culture, politics, art, etc.
Prerequisite: French 200 or permission of the Department.
Not offered in 1974-75
385* Knowledge and Reality
A philosophy course taught in French, and using French philosophical texts. A 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. (same as Philosophy 250*).
Winter term
Instructor: J. Huertas-Jourda

401* Advanced Language Study
Consult the Department for further details of this course.
Prerequisite: French 300 or French 350
Fall term

402* Advanced Language Study 2
Consult the Department for further details of this course.
Prerequisite: French 300 or French 350
Winter term

Note: In the following series of courses seven areas are included. These are indicated by the following range of course numbers:
410-419 – Medieval language and literature
420-429 – Renaissance literature
430-439 – 17th century literature
440-449 – 18th century literature
450-459 – 19th century literature
460-469 – 20th century literature
470-479 – French Canadian literature
Courses in these ranges may vary from year to year and numbers will be adjusted accordingly.

409* Medieval French Language
An introduction to the early development of French.
Fall term
Instructor: J. R. Finn

411* Medieval Literature
A study of the great works of Medieval literature with the aid of modern French translations, including selected works from the four great Medieval genres: the epic, the romance, the drama and lyric poetry.
Winter term
Not offered in 1974-75

421* French Prose of the Renaissance
Readings in sixteenth century literature: Rabelais, Montaigne, etc.
Winter term
Instructor: H. Fournier

422* French Poetry of the Renaissance
Readings in sixteenth century poetry: Marot, the Pléiade, the baroque poets, etc.
Winter term
Instructor: H. Fournier
Not offered in 1974-75.

431* Classical French Tragedy
The rise and decline of classical French tragedy from Corneille to Voltaire.
Winter term
Instructor: R. L. Myers
441* "The Philosophes": French Prose Writers of the Eighteenth Century
Selected texts from Voltaire, Rousseau, Diderot, etc.
Fall term
Instructor: A. Ages
Not offered in 1974-75.

451* Movements and Themes in Nineteenth Century Poetry
A survey of lyric poetry in the nineteenth century.
Fall term
Instructors: J. R. Dugan and P. H. Dubé
Not offered in 1974-75.

461* The Evolution of the Novel in Twentieth Century France
A study of a limited number of key texts by writers such as Proust, Gide, Camus, Butor.
Fall term
Instructor: W. D. Wilson

471* French-Canadian Poetry
A study of its evolution from Octave Crémazie to Anne Hébert.
Not offered in 1974-75.

472* Contemporary Quebec Theatre
A study of the themes, structures and evolution of Contemporary Quebec theatre, based on the principal plays of authors such as: Gratien Gélinas; Marcel Dubé; Yves Thériault; Françoise Loranger; Anne Hébert; Jacques Ferron; Jacques Langirand; Michel Tremblay.
Winter term
Instructor: C. Racine

490*-498* Senior Tutorials
By arrangement with the Department, an individual student or a small group of students follows a course of study under the supervision of a faculty member.

The following courses are administered by St. Jerome's College.

110J Introduction to Italian
An intensive study of the fundamentals of grammar and conversation. The language laboratory will be used. In the first year of Italian, emphasis will be placed on the fundamentals of grammar and speech. In addition, liberal use will be made of the language laboratory where the student will hear and be able to imitate authentic pronunciation and intonation of the language as spoken by natives of sunny Italy. Simple readings in Italian literature will give the student an opportunity to become familiar with vocabulary and style, as well as idiomatic expressions that make up such a great part of the language.
3 lectures and laboratory
Instructor: A. Gualtieri

210J Intermediate Italian
Advanced study of grammar, intensive study of one novel. Some finer points of grammar will be studied but will actually be a secondary aspect. A survey course in Italian literature of the Risorgimento (19th century) will be offered, giving special emphasis to the major writers of this period. Further familiarization with the spoken work will be afforded through use of the language laboratory.
Prerequisite: Italian 110 or permission of the Instructor
3 lectures and language laboratory
Year course
**230J Italian Culture**  This course, given in English, aims at giving the student a well-balanced view of Italy and her culture, through the study of her Geography, History, Religion, Literature, Art, Music and her contribution to the world and to North America in particular.  
*Prerequisite: Second Year standing*  
3 lectures  
*Instructor: E. Evans*

**310J Italian Literature**  Continued survey of Italian literature with selected readings in prose and poetry, including one novel. One semester devoted to the *Divina Commedia: Inferno*.  
In the third year the student will complete a survey course of Italian literature of the 19th and 20th centuries. Stress will be placed on the major authors and one play and novel will be studied intensively.  
*Prerequisite: Italian 210J*  
3 lectures  
*Year course*

**320J Classical Literature**  An anthology of Italian classics will be studied. A number of book reports and Italian essays are required. Two texts will be studied intensively: *Divina Comedia: Il Purgatorio*, and a modern novel.  
*Prerequisite: Italian 210J. Three lectures. Year course*

### Spanish

**101* Introduction to Spanish**  Intensive drill in the fundamentals of grammar, composition and oral skills. The language laboratory is used as an integral part of the course.  
*Fall term. 3 hours class. 2 hours language lab.  
Instructors: C. Fernandez, B. Thalman*

**102* Introduction to Spanish**  A continuation of Spanish 101*.  
*Prerequisite: Spanish 101* or permission of the Department.  
*Winter term. 3 hours class. 2 hours language lab.*

**191* Intermediate Spanish**  For students with some knowledge of Spanish. The course will work towards some measure of fluency in reading, writing, speaking and understanding the language. The language laboratory is used regularly.  
*Prerequisite: Spanish 101*-102* or Grade 13 Spanish.  
*Fall term. 3 hours class. 1 hour language lab.*

**192* Intermediate Spanish**  A continuation of Spanish 191*.  
*Prerequisite: Spanish 191* or permission of the Department.  
*Winter term. 3 hours class. 1 hour language lab.*

**210 Spanish Civilization**  A study in English of the main historical and cultural currents in Spain and Spanish America. No knowledge of Spanish is required.  
*Year course. 3 hours.  
Instructor: J. C. McKegney*
251* Composition and Conversation
Intensive language study based on literary texts, including grammar, comprehension, oral discussion and essay writing. 
Prerequisites: Spanish 191*-192*.
Fall term

252* Composition and Conversation
A continuation of Spanish 251*.
Prerequisite: Spanish 251*.
Winter term

255* Survey of Spanish Literature
A brief survey of Peninsular Spanish literature since the Poema Del Mío Cid.
Prerequisite: Spanish 191*-192*.
Fall term
Instructor: J. C. McKegney

256* Survey of Spanish American Literature
A survey of literary trends and most significant works from the Conquest to the present.
Prerequisite: Spanish 191*-192*.
Winter term

265* The Spanish Short Story
Selected stories from outstanding writers of the 19th and 20th centuries in Spain.
Fall term
Instructor: B. Thalman

266* The Spanish American Short Story
Selected stories from outstanding writers of the 19th and 20th centuries in Spanish America.
Winter term

315* Lyric Poetry of the Golden Age
A view of Spanish poetry, particularly the sonnet, from Garcilaso to Quevedo.
Fall term. Not offered in 1974-75.

316* The Theatre of the Golden Age
Dramatic theory and practice from Lope de Vega to Calderón.

325* Don Quijote
An in-depth study of the Quijote.
Fall term.
Instructor: B. Thalman

326* The Picaresque Novel
Intensive study of the major picaresque novels from Lazarillo de Tormes to El Buscón.
Winter term
Instructor: C. Fernandez

331* The Spanish Novel in Translation
An in-depth study of the peninsular novel, including the Picaresque, Don Quijote, the 19th-Century Realistic Novel, the Generation of 1898, and the Post-Civil War. Taught in English

Note No Spanish Credit for majors and honours students. It is not acceptable as fulfilling the A(ii) requirement.
Fall term.
Instructor: B. Thalman
344* Romantic Drama and Poetry in Spain
A study of the most important dramatists and poets of the
Romantic literature of the 19th century.
_Fall term. Not offered in 1974-75._
_Instructor: C. Fernandez_

345* The Novel of the Nineteenth Century
A study of the literary currents of the past century in Spain
such as the costumbrista movements, realism and naturalism.
_Winter term. Not offered in 1974-75._
_Instructor: B. Thalman_

346* Galdos
Intensive study of three representative novels of Galdós.
_Winter term._
_Instructor: B. Thalman_

351* Advanced Composition and Conversation
Writing of essays and discussion based on selected themes or
topics relating to Spain or Spanish America. Formal grammar
and translation are also included.
_Prequisitie: Spanish 251*-252*. 
_Fall term_

352* Advanced Composition and Translation
A continuation of Spanish 351*.
_Prequisitie: Spanish 351*. 
_Winter term_

375* The Enlightenment in Spanish Literature
A study of the works of Luzán, Feijoo, Jovellanos and Cadalso.
_Fall term. Not offered in 1974-75._

385* Spanish American Poetry from the Conquest to Modernism
A study of the texts of poets representing the major developments
of colonial and nineteenth-century poetry.
_Fall term_

386* Modern Spanish American Poetry
A study in depth of major poets and movements since Modernismo.
_Fall term_

395* Spanish American Prose
A critical study of Spanish American prose from the Cortés
letters to the works of Sarmiento.
_Fall term_
_Instructor: J. C. McKegney_

396* Recent Spanish American Prose
A critical study of masterpieces in prose from Sarmiento to the
present.
_Winter term.
_Instructor: J. C. McKegney_

415* The Prose of the Generation of '98
A study of selected prose with emphasis on the novel and the
philosophical essay.
_Fall term._
_Instructor: B. Thalman_

416* Drama and Poetry of the Generation of '98
Spanish poetry and drama from Antonio Machado to Juan Ramón Jiménez.
_Winter term._
_Instructor: C. Fernandez_
435* Modern Spanish Literature to the Civil War
A study of selected figures, most of whom wrote between the Generation of 1898 and the outbreak of the Civil War in 1936.
Fall term

436* Contemporary Spanish Literature since the Civil War
The artist under the Franco regime; a non-political view of selected dramatists, poets and novelists whose major work has continued or commenced since 1940.
Winter term.

440 Mediaeval Spanish Literature and Linguistics
Readings in texts from the beginning to the end of the fifteenth century. The jarchas, the Cid, Gonzalo de Berceo, Libro de Buen Amor, Romancero and La Celestina.
Year course.
Instructor: B. Thalman

451* Senior Spanish Composition and Conversation
Intensive practice in written and spoken Spanish on the advanced level.
Fall term.

452* Senior Spanish Composition and Conversation
A continuation of Spanish 451*.
Winter term

490*-494* Senior Tutorials
By arrangement with the Department, an individual student or a small group of students will follow a course of study under the supervision of a faculty member.

495* The Novel in Mexico
Principal stress will be placed on novels dealing with the Mexican Revolution.
Winter term.
Instructor: J. C. McKegney

496* The Novel in the Andean Countries
The works of selected novelists from Colombia, Ecuador, Peru and Bolivia, principally from the 20th century.
Fall term
Programme of Studies

Students will enroll at the University of Waterloo in the Faculty of their choice. Those enrolled in general degree programmes at the University may elect communication studies as a major area of study. Students enrolled in honours programmes may elect communication studies as a minor area of study. In each case, a total of five communication course credits must be taken to qualify for the appropriate degree recognition.

The Communication Studies Programme consists of a set of introductory core courses and three theme areas. The core segment provides a distinct focus while at the same time contributes to an interdependent set of studies. The courses included in the core segment are:

Arts 100 Communications

An examination of the origins, evolution, and future dimensions of communications media designed to facilitate an understanding of the adequacies and inadequacies of media, to relate them to the purposes of human awareness, and to explore needs and means of maintaining accountable controls over the media. The course seeks to assist students in discovering the range of informational, research and exploratory resources open to them; in gaining some preliminary experience in utilizing such sources; and in applying a critical judgment of material secured. (Arts 100 is a multi-media course offered in part on Channel 19 TV.)

Instructor: D. Gordon

General Engineering 062A-B
Introduction to Human Communication Systems

Describing and analyzing the range of human communication behaviours. The course will focus upon a variety of communication systems including man-man, man-machine, and machine-machine communication systems. Various models of communication systems will be examined. Using a systems approach, such concepts as redundancy, entropy, feedback, openness-closedness, equifinality, nonsummativity, relationships, determinism, homeostasis, stability, uncertainty and process will be examined.

Various art forms such as films and computer graphics will be considered.

3 hours per week, lectures and seminars.

Instructor: M. L. Constant

Sociology 270*
Communications

This course undertakes an analysis of the role of language and other symbol systems in social interaction; the interplay between communication and the social system; the formulation of attitudes through language; social and individual disorders as caused by, and reflected in, the breakdown of the communication process.

Prerequisite: Soc. 101*

2 lectures, Fall term

Instructor: N. High
Philosophy 341* Decision and Value Theory
A systematic study of the basic concepts in decision-making theories and their associated value theories. Special emphasis will be devoted to the definition and measurement of utility functions and to the various criteria employed in models of decision-making under uncertainty and under risk. Extensive use will be made of literature from Economics, Political Science, Psychology, and Mathematical Statistics.
Prerequisite: Consent of instructor.
3 hours
Instructor: J. S. Minas

The student is required to elect three of the core courses, two of which must be taken in the first year.

Communication Theme Areas
In addition to the introductory core courses, students will continue their communication studies in one or more of three theme areas, representing a more specific area of study.

A) Mass Media Systems

1) Arts 200G* Issues in Mass Communication
The emphasis of the course is on the role of the mass media in national and international communications and covers such topics as truth and deception, propaganda, legal controls, economic and political factors, government information systems, language and stereotypes, and mass media systems.
3 lectures. Winter term.
Instructor: F. Epp

2) IFS 300 Media Writing Exposition
An examination of the terms and forms of expression characteristic of non-fiction presentations in the media of print, radio and television. Lectures, seminars and workshops will be combined to seek to establish basic criteria for media expositions, to assess them and apply them to individual student projects.
Offered only if enrollment exceeds 15.
3 hours

3) Mass Communication and the Rule of Law
Beginning with the proposition that any mass medium is by its nature essentially incompatible with any system of rule of law, the course will explore selected areas of mass media responsibility, for both publicly and privately owned systems, and the ways in which such responsibilities conflict with the law. The "right" of publics to know and the legal basis for the control of information will be examined.
Not offered 1974-75.

4) Communication Systems Administration
The course will examine the organizational and financial structure of media systems, ownership, and control patterns, the organization and operation of information, acquisition, internal processing, and dissemination. The course will examine mass media operations in Canada, the United Kingdom and the United States.
Not offered 1974-75.
B) Communication Systems

1) SD 371 Introduction to Human Communication Systems

The course focuses upon a variety of communication systems including man-man, man-machine and machine-machine systems. Various models of communication systems will be examined paying particular attention to the assumptions and situational factors upon which the models are based. Using a systems approach such concepts as redundancy, entropy, feedback, openness-closedness, equi-finality, nonsummativity, homeostasis and stability, etc., will be examined.

Instructor: M. L. Constant

2) SD 471 Communication Media

The course encompasses the tools of communication and the nature and use of communication media. There will be a particular emphasis on those media containing a large technological component; machine-mediated human communication systems, e.g., computer graphics, film, T.V., etc.

Instructor: M. L. Constant

3) SD 473 Inter-Cultural Communication

The problems of designing a human communication system where more than one culture is involved. Anthropological, sociological, psychological, political, economic and technological aspects of such design. Environmental perception, value systems, social forms, etc.

Instructor: M. L. Constant

4) SD 475 Man-Machine Communication Systems

The nature and design of machine-mediated human communication systems. Consideration will be given to displays, computer graphics, computer-aided instruction and mass communication media (film, T.V., radio, print). The design of new media innovation. A systems approach will be adopted with special attention to the socio-economic effects of such systems.

Instructor: M. L. Constant

C) Communication and Environmental Studies

1) M-Env 240* Small Groups and the Environment

This course will focus on the ways small groups of people function. The emphasis will be on analyzing and understanding how the various groups concerned with environmental issues operate and how they might be made more effective.

No prerequisite.

3 hours, Fall term

Instructor: W. Shalinsky

2) M-Env. 260(Y) Visual Perception and Communication

An exploration of images, symbols and ideas which constitute the basis of evolution in the perceptual and communication processes. Special emphasis will be placed on films and some of the major movements in art and architecture.

Prerequisite: Consent of the instructor.

5 hours.

Instructor: S. K. Gupta
3) M-Env. 262* Environments of the Future

An imaginary look at the Future, both in terms of extrapolating from the present and postulating new, unforeseen and unforeseeable forces that may be at work in the future.

*Prerequisite: Consent of the instructor

5 hours, Winter term

Instructor: S. K. Gupta

4) M-Env. 360 Science, Technology, Art and Environment

An interdisciplinary exploration of concepts and themes which unify many aspects of nature and human artifacts. Such themes as Nature of Time as expressed in films, poetry, art, science fiction, psychology and nature are discussed.

*Prerequisite: Consent of the instructor

5 hours

Instructor: S. K. Gupta

5) M-Env. 361* Contemporary Media of Communication and Human Environment

A study of “heroes” and “anti-heroes” of the “counter-culture”, with special emphasis on the “new wave” movements in cinema, theatre, art and literature.

*Prerequisite: Serious pupils only, with the consent of the instructor.

5 hours, Winter term

Instructor: S. K. Gupta

6) M-Env. 440 Honours seminar: Environmental Communication and Education

A study of communication, innovation and educational processes in the context of environmental issues. Approaches to environmental education and communication for primary and secondary school programmes and adult education.

2 hours seminar

Not offered in 1974-75

Instructor: R. Keith
Drama and Theatre Arts Group

Professor and Director  P. O'Shaughnessy

Associate Professors  W.R. Chadwick, B.A., M.A.(Toronto), Ph.D.(London)
G. McDougall, B.A., M.A.(Cantab)

Assistant Professors  C.S. Hedges, B.A.(Northeastern, Okla), M.F.A.(Art Institute of Chicago)
K.J.R. Wylie, B.A.(U.B.C.), M.F.A.(Hawaii)

Lecturer  M. Graham, A.O.C.A.(Ontario College of Art)

Associated Theatre Arts Staff

Director, Humanities Theatre  P. O'Shaughnessy
Director, Cultural Programme Centre, Bookings Manager  P. Berg
Creative Arts Resident Director  M. Evans
Technical Supervisor  A. Ouwehand
Assistant Technical Supervisor  R. Gaskell, B.A.(Waterloo)
House Manager  E. Stieler

General Programme Requirements

A total of fifteen full courses including Faculty of Arts Group A and B courses required with an overall cumulative average of at least C - and a cumulative major average of C.
1) Six of the student's courses must be in Drama and Theatre Arts
2) Drama 101* and 102* are the required pre-requisites for most Drama and Theatre Arts courses.
3) Each student must satisfy the following requirements:
   A) Drama 329 (History of the Theatre)
   B) Drama 430* (Theatre Criticism)
   C) One full course from each of two of the following categories:
      1) Performance: Drama 225, 226*, 227*, 325
      2) Production: Drama 228*, 229* 242* 326*, 327*, 330, 426*, 427*, 442
      3) Other Drama and Theatre Arts courses including Drama 301*, 302*, 316*, 421, 422, 429*, 490*A-E, 491*A-E, or approved Inter-Disciplinary courses in Fine Arts, Dance, Classics, English or other related departments
   D) One and one-half courses from Dramatic Literature to be chosen from: Drama 201*, 202*, English 361*, 362*, 363*, 364* or other approved courses in dramatic literature
**Undergraduate Courses**

**First Year**  
Introduction to the Theatre 1 and 2 (Drama 101* and 102*) are recommended as first year courses and are prerequisite to most Drama and Theatre Arts courses. Students planning to major in Drama and Theatre Arts should confer with the Undergraduate Adviser for the Division before registering.

**Note**  
The normal number of lectures per week in each course is three; however, each instructor determines how often his particular class will meet. Laboratory sessions and rehearsal periods may be added to any course at the discretion of the instructor.

**101* Introduction to the Theatre 1**  
The role of theatre as a major art. Contributions of playwright, actor, director, designer and technician to the theatrical production. Analysis and interpretation of selected plays.  
*Class meets three hours per week.*

**102* Introduction to the Theatre 2**  
An extension of the studies described in 101*.  
*Prerequisite: Drama 101*.

**201* A survey of dramatic literature from classical times to the early Renaissance. The course will concentrate on the Greek and Roman periods.**

**202* A survey of dramatic literature from the Renaissance to 1850, including neo-classicism and romanticism.**  
A survey of dramatic literature from 1850 to the present. This course will include Ibsen, Chekhov, Strindberg, Brecht, O'Neill, Synge, Beckett, Ionesco and Pinter.

**225 Fundamentals of Acting**  
An introduction to the basic techniques of acting. Laboratory experience in movement, voice, improvisation, characterization, and scene study. Laboratory and production participation required.  
*Class meets 4 hours per week.  
Prerequisite Drama 101* and 102*, and Consent of Instructor*

**226* Seminar in Techniques 1**  
A series of workshop seminars by visiting lecturers dealing with stage movement and vocal production for the actor, with special study in stage fighting, mime, and makeup. Class meets as arranged. May be taken concurrently with 225 or 425.  
*Prerequisite: Drama 101*, 102* and Consent of Instructor*

**227* Seminar in Techniques 2**  
An extension of the studies described above in 226*.  
*Prerequisite: Drama 101*, 226* and Consent of Instructor*

**228* Design for the Theatre 1**  
Design as a theatrical medium. A study of the aesthetics and creation of performance environments. A study also of the evolving stage and relationship between changes in stage structure and varieties of social background.  
*Class meets 2 hours lecture and 4 hours lab per week.  
Prerequisite: Drama 101*, 102* and Consent of Instructor*
229* Design for the Theatre 2
An extension of the studies described above in 228*.
Prerequisite: Drama 101*, 102*, 228* and Consent of Instructor

242 Introduction to Technical Production
Involves theory and practice in building, painting, rigging, and shifting scenery; construction and use of properties; familiarity with lighting instruments, sound equipment and their control systems.
Prerequisite: Drama 101*, 102* and Consent of Instructor

301* Script Interpretation 1
Advanced study and analysis of plays in the process of production covering selected periods and types of play writing, for example: Renaissance tragedy, Restoration comedy, modern realism, the theatre of the absurd. Teaching will follow the contours of drama productions planned in the year.
Course meets 3 hours per week with study lab sessions by arrangement
Prerequisite: Drama 101*, 102*, 201*, 202* or equivalent

302* Script Interpretation 2
An extension of the studies described above in 301*,
Prerequisite: Drama 101*, 102*, 201*, 202* or equivalent, and 301*

325 Directing 1
Analysis of production and performance problems from the director's point of view. Planning the interpretative concept of a production. Study in the principles of stage direction. Special projects in directing, including the production of a Workshop production. Students may be required to attend rehearsals, assist a director and comment in writing on plays as they have unfolded in the process of production.
Class meets 3 hours per week with rehearsal lab sessions by arrangement
Prerequisite: Drama 101*, 102*, 201*, 202* or equivalent, and Consent of Instructor

326* (a,b,c) Special Studies in Theatre Production 1
Production participation and the study of selected problems of theatrical production.
Classes meet 3 hours per night, 5 nights per week for 8 weeks during production rehearsals.
Prerequisite: Consent of Production Director for Fall term

327* (a,b,c) Special Studies in Theatre Production 2
Production participation and the study of selected problems of theatrical production.
Classes meet 3 hours per night, 5 nights per week for 8 weeks during production rehearsals
Prerequisite: Consent of Production Director for Winter term

329 History of the Theatre
A survey of theatre history from ancient to modern times with attention to the development of theatre architecture and its relationship to the acting, directing, design, and literature growing out of the various periods and cultures.
Class meets 3 hours per week
Prerequisite: Drama 101*, 102*, 201*, 202* or equivalents
330 Costuming  Design and practice in the construction of costume for the stage. Research into the historical styles of costumes from antiquity to the present and the adaptation of these styles to stage use. Laboratory and production participation required. 

Class meets 2 hours lecture and 4 hours lab per week
Prerequisite: Drama 101*, 102*, 201*, 202* or equivalents

422 Directing 2  Consideration of problems involved in the directing of a production with exercises in production and staging of specific scenes. Each student in the course will be required to form his own production company and mount a play.

Course meets 4 hours per week with labs by special arrangement
Prerequisite: Drama 101* 102*, 201*, 202* or equivalent, 325 and consent of Instructor

425 Acting 2  Advanced work in acting including further work in improvisation and non-scripted materials as well as character development and scene study; course involves individual and ensemble work in selections from specific plays with attention given to various periods and styles in acting.

Course meets 4 hours per week.
Prerequisite: Drama 101*, 102*, 225 and Consent of Instructor

426* Theatre Workshop 1  Participation in stage production for advanced students.

427* Theatre Workshop 2  Participation in stage production for advanced students.
Prerequisite: 101*, 102*, 201*, 202* or equivalent. Permission of play Director.

429* History of Dramatic Criticism  A study of dramatic criticism from antiquity to the present.
Class meets 3 hours per week
Prerequisite: 101*, 102*, 201*, 202* or equivalent

430* Theatre Criticism  A study of the criticism of theatre production and performance.
Class meets 3 hours per week
Prerequisite: Drama 101*, 102*, 201*, 202* or equivalent.

442 Theatre Technology  Advanced study and practice in the various aspects of the technology of the theatre: theatre architecture and equipment, scenery shop practice: methods and materials of construction and painting, furniture and properties; lighting: theory of light and theatre lighting, equipment and control systems, preparation of plots and production operation; sound: theatre acoustics, reinforcement systems, and preparation of effects. Production participation which involves 3 hours per night for 5 nights a week for 2 ½ weeks in either the Fall or Winter term is required.
Class meets 2 hours lecture and 3 hours lab per week
Prerequisite: Drama 101*, 102*, 201*, 202* or equivalent Consent of Instructor

490* A-E Seminar in Drama and Theatre  A seminar in special areas of drama and theatre.
Prerequisite: Drama 101*, 102*, 201*, 202* or equivalents
491* A-E Selected Seminars in Drama and Theatre Arts

A continuation of 490*A-E of selected seminars in special areas of study in drama and theatre arts.

Prerequisite: Drama 101*, 102*, and Consent of Instructor

499 Senior Seminar

Designed to give the theatre arts major an opportunity to complete a comprehensive presentation project in his major area of concentration during his senior year. This presentation may take the form of an exhibit, a production thesis, or a recital. In some cases the student may elect to do a research thesis and a comprehensive examination. During the first term plans for the project will be completed.

During the second term the major project is brought to completion and students meet with the entire faculty for an intensive discussion of the presentation.

Class meets 2 hours lecture per week with lab sessions by arrangement.

Note: This course is required of all Honours Theatre Arts majors and open only to students in their fourth year.
Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found in Chapter 15.

Earth Sciences 130, or the consent of the instructor, is prerequisite for all later courses in Earth Sciences. However, Science 100* may be substituted for Earth Sciences 130 as prerequisite for Earth Sciences 235*, 236* and 336*. Second and third year courses usually involve field trips in the fall. All those majoring in Earth Sciences are required to take a two-week field camp at the end of third year and attend a week-long field excursion at the start of third year. (Expenses in excess of $100 are to be anticipated.) Earth Sciences students are encouraged to seek geological employment in the summers.

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

Students who are taking, or have taken Science 100* may not take Earth Sciences 130 for credit because of overlapping material.
**231* Mineralogy**

*2 lectures, 3 hours laboratory. Fall term*

**232* Petrography**
The classification and identification of sedimentary, igneous, and metamorphic rocks. The study of rocks in thin sections. Laboratory study of petrographic methods and problems.

*Prerequisite: Earth Sciences 231*

*2 lectures, 3 hours laboratory. Winter term*

**235* Stratigraphy**
The principles of stratigraphy, and an introduction to the structural framework of North America.

*2 lectures, 2 hours laboratory. Fall term*

**236* Principles of Paleontology**
The principles of paleontology with particular stress on the species concept and evolution; examples will be drawn primarily from the fossil record of plants and vertebrates. Laboratory work will include projects and reference to field trip collections.

*2 lectures, 2 hours laboratory. Fall term*

**241* Optical Mineralogy and Crystallography**
Principles of optical crystallography and the optical identification of minerals. Crystallography and stereographic projection.

*Prerequisite: Earth Science 231*

*2 lectures, 3 hours laboratory. Winter term*

**260* Introductory Structural Geology**
An introduction to the deformation of rocks, the effect of stress on rock materials, the application of experimental and theoretical data to naturally deformed rocks (tectonites); elementary rock mechanics; the results of deformation, the types of structures produced; the analysis of simple structures.

*2 lectures, 2 hours laboratory. Winter term*

**331* Igneous Petrology**
The principles and theories of igneous rock genesis. Silicate phase equilibria in magnetic systems. Magmatic differentiation; distribution and occurrence of magma types.

*Prerequisites: Earth Sciences 231*, 241*

*2 lectures, 3 hours laboratory. Fall term*

**332* Metamorphic Petrology**

*Prerequisites: Earth Sciences 231*, 241*

*2 lectures, 3 hours laboratory. Winter term*

**333* Sedimentology 1**

*2 lectures, 3 hours laboratory. Winter term*
336* Paleontology  Advanced paleontology emphasizing morphology, classification, evolution, paleoecology and stratigraphic value of fossil invertebrates. Field trips and laboratory study of fossil collections.

Prerequisites: Earth Sciences 236*

2 lectures, 2 hours laboratory, Fall term


2 lectures, 3 hours laboratory, Fall term

345* Historical Geology  A systematic review of the geological history of North America from the Precambrian to Recent, exemplified by regional geology. Laboratory work will include study of rock and fossil regional suites and geological maps.

Prerequisite: Earth Sciences 235*

2 lectures, 2 hours laboratory, Winter term

355* Mathematical Geology  Introduction to the principles of probability and statistics and their application in the Earth Sciences. Evaluation of quantitative data; statistical models.

Prerequisites: Mathematics 130 and an introductory course in computer programming.

3 lectures, Fall term

360* Introduction to Applied Geophysics  An introduction to applied geophysics, covering seismic, gravity, electric, electromagnetic, magnetic, radiometric and borehole logging methods.

Prerequisite: Physics 101*-102* or consent of instructor

3 lectures, 2 hours laboratory, Fall term


Prerequisite: Mathematics 130, Physics 121*-122* or equivalent

2 lectures, Fall term

369* Geophysics 2  The geology of the ocean basins. Topics in physical oceanography. Physical properties of ocean water, heat budget of the world oceans. Oceanic circulation, Coriolis effects. Some idealized current regimes. (Identical to Physics 369*).

Prerequisite: Earth Sciences 368*

2 lectures, Winter term

370* Geology of Non-renewable Primary Resources  The occurrence and geological setting of metallic, non-metallic minerals and construction materials. Energy resources. Special emphasis on Canada's resource industry. The laboratory will involve sampling methods, ore calculation and property evaluation.

Prerequisites: Earth Sciences 231*, 241*

3 lectures, 2 hours laboratory, Winter term
421* Geochemistry  An introduction to geochemical processes in the Earth’s crust with special emphasis on low temperature environments. Fundamental principles are reviewed and applied to the understanding of sedimentary rocks, the hydrosphere and hydrothermal systems. 
Prerequisite: First year Chemistry
3 lectures, 2 hour laboratory, Fall term

427* Crustal Evolution  Continental drift, sea-floor spreading, plate tectonics, Paleoclimes and paleogeography with particular reference to the Phanerozoic record.
2 lectures, 2 hours seminars, Winter term

432* Precambrian Geology  The geology, tectonics, stratigraphy and history of the Canadian Precambrian Shield. The Precambrian time scale and problems of geochronology. Life, climate and physical conditions in Precambrian time.
2 lectures, 2 hours laboratory, Winter term

Prerequisite: Earth Sciences 333*
2 lectures, 3 hours laboratory, Winter term

434* Biostratigraphy  Methods of using paleontological data to solve stratigraphic problems. Faunal provinces in space and time. Effects of continental drift and climatic change on biogeography through the Phanerozoic.
Prerequisite: Earth Sciences 236* or 336*
2 lectures, 2 hours laboratory/seminar, Fall term

435* Advanced Structural Geology  The geometry, kinematics and dynamics of structural geology. The relationship of structures from the microscopic to the macroscopic scale; statistical studies of structural elements.
Prerequisite: Earth Sciences 260*
3 lectures, 2 hours laboratory, Fall term

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.

438* Engineering Geology  The application of geology to civil engineering problems. Introductory soil and rock mechanics. Urban and environmental geology.
2 lectures, 1 hour problems, Winter term

439* Groundwater Geology  Groundwater hydrology. The location, exploitation, and conservation of groundwater resources, physical and chemical interaction of water with subsurface geologic materials, relations between groundwater and surface water regimes.
3 lectures, Fall term
440* Quaternary Geology  Stratigraphy and history of Quaternary Period with emphasis on glaciation. Laboratory studies on glacial deposits. Field trips. A previous course in geomorphology is recommended.
2 lectures, 3 hours laboratory, Fall term

456* Mathematical Geology  Boundary value problems in geophysics and hydrogeology.
2 Mathematical modelling of geological systems; simulation.
Prerequisites: Earth Sciences 355*, Mathematics 130
3 lectures, Winter term

461* Applied Geophysics  Physical and mathematical foundations of applied geophysics, advanced methods of treatment of geophysical data, with emphasis on problems from geophysical exploration.
Prerequisite: Earth Sciences 360*
2 lectures, 2 hours laboratory, Winter term

470* Metallic Mineral Deposits  The petrology and genesis of metalliferous ore deposits. The description of classic deposits; the stability of ore minerals; ore minerals in aqueous systems. The laboratory will include instruction and practise in ore microscopy.
Prerequisites: Earth Sciences 231*, 241*, 370*
3 lectures, 2 hours laboratory, Fall term
Department of Economics

Professor, Chairman of the Department
R. A. Mundell, B.A.(U.B.C.), Ph.D.(M.I.T.)

Associate Professor, Deputy Chairman
R. Blackhurst, B.S.(California), Ph.D.(Chicago)

Professors
S. N. Afriat, M.A.(Cambridge), D.Phil.(Oxford)
J.H. Hotson, B.A.(Colorado College), M.A., Ph.D.(Pennsylvania)
V. C. Walsh, B.A., M.A., Ph.D.(Trinity College)

Associate Professors
L. P. Fletcher, B.Comm.(Mount Allison), A.M., Ph.D.(Brown)
S. K. Ghosh, B.S., M.S.(Calcutta), M.A. Ph.D. (Wisconsin)
R.R. Kerton, B.Comm.(Toronto), M.A.(Carleton), Ph.D.(Duke),
J N. E. Lavigne, C.R., B.A., (Western), M.Comm.(Ottawa),
M.B.A. (Detroit)
G. Lermer, B.Sc.(M.I.T.), M.A., Ph.D. (McGill)
W. R. Needham, B.Comm.(Carleton), M.A., Ph.D. (Queen's)

Assistant Professors
K.M.H. Bennett, B.A., M.A. (Queen's)
S.G. Clarke, B.A., M.A., Ph.D.(Queen's)
S.W. Kardasz, B.A.(Loyola)
E. Milne, B.A.,Windsor, M.A.(Northwestern)
F. Miiller, M.A.(Berlin), Ph.D.(Bochum, Germany)
A. Olsen, B.Comm.(Sir George Williams), M.B.A.(Western Ontario)

Lecturers
R. Chand, M.A.(Toronto)
H.N. Gram, B.A.(U.B.C.)
T. Williams, B.A.(Northwestern), M.A.(Chicago)

(part-time)
R. Kilimnik, B.A.(Waterloo), M.B.A.(McMaster)

Associated Faculty

Professors
G. Berman, Ph.D.(Toronto), Chairman Department of Combinatorics and Optimization
D.A. Sprott, Ph.D.(Toronto), Chairman, Department of Statistics

Associate Professor
D.W. Conrath, B.A.,M.S.(Stanford), M.A.,Ph.D.(U.C. at Berkeley)

Department of Management Sciences

Undergraduate Courses

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. Students proceeding to a General Arts degree with a major in Economics are required to take as part of their programme Economics 201*, 202*, 231*plus either 211* or 221*. It should be noted that some of the 400 level courses are open to third year students who have the necessary prerequisites (this also holds for second year students vis-a-vis 300 level courses).

The number of courses offered in a particular year will not necessarily include all of those listed below.
Department of Economics

Some Economics courses do not have a “term offered” indicated. This information will be available at pre-registration and students can confirm the “term offered” with their Departmental advisor.

The “normal” number of lectures per week in each course is three; however, each instructor determines how often his particular class will meet.

101* Introduction to Microeconomics

An introduction to the central problems of economic society, the functioning of a mixed capitalistic enterprise system, the economic role of government, the composition and pricing of national output, pricing of productive factors, and income distribution.

The student can pursue his studies through either of the following approaches:

101A) The economics of public and private decision processes with emphasis on general principles of economic analysis. (Also offered at St. Jerome’s)

101M) Similar to 101A except for a somewhat greater emphasis on presenting the material in a mathematical framework.

Fall and Winter Terms

102* Introduction to Macroeconomics

Determination of national income; the banking system; government fiscal and monetary policy; international trade and finance; and current economic problems.

102A*: Continuation of 101A*

102M*: Continuation of 101M*

Fall and Winter terms

Students are encouraged to select a section on the basis of the approach they are likely to enjoy the most, rather than on the basis of assumed prior preparation (for example, some students from the Math Faculty may prefer to take the A section).

Both the A and the M sections serve as prerequisites for further courses in Economics.

191* Introduction to Financial Accounting 1

Recording transactions; measuring income; preparation and analysis of financial statements; accounting for assets, liabilities, and owner equity.

2 lectures, 2 hours laboratory

Fall and Winter terms

192* Introduction to Financial Accounting 2

Analysis of accounting principles; preparation of statements of sources and uses of working capital; cash flow analysis; basic concepts associated with manufacturing and responsibility accounting and budgeting.

Prerequisite: Economics 191*

2 lectures, 2 hours laboratory

Fall and Winter terms
<table>
<thead>
<tr>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>4th Year</th>
<th>Subject Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>102 Intro. Macroeconomics</td>
<td>202 Macroeconomic Theory</td>
<td>302 Monetary Theory and Banking</td>
<td>402 Economic Cycles and Stabilisation Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>303 Economic Thought</td>
<td>403 Econ. Analysis, Forecasting, and Public Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>221 Statistics for Economists</td>
<td>321 Intro. Econometrics</td>
<td></td>
</tr>
<tr>
<td>231 Intro. International Economics</td>
<td>331 International Trade Theory</td>
<td>411 Mathematical Economics</td>
<td>413 Economic Growth Theory</td>
<td></td>
</tr>
<tr>
<td>233 Regional Economics</td>
<td>332 International Monetary Theory</td>
<td>333 Interregional Economics</td>
<td>421 Econometrics 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>334 Economic Development</td>
<td>335 Economic Development</td>
<td>422 Econometrics 2</td>
<td></td>
</tr>
<tr>
<td>341 Public Finance</td>
<td>413 International Economic Policy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>343 Urban Economics</td>
<td>431 Advanced International Economics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>345 Industrial Organisation</td>
<td>432 International and Interregional Economics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>347 Economics of Transportation and Communication</td>
<td>441 Economics of the Public Sector 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>442 Economics of the Public Sector 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Year</td>
<td>2nd Year</td>
<td>3rd Year</td>
<td>4th Year</td>
<td>Subject Areas</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>241 Cost Benefit and Project Evaluation</td>
<td>351 Labour Economics</td>
<td>Advanced Topics in Economics of Energy, Land and Labour Resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>353 Population Economics</td>
<td>355 Energy and Natural Resources</td>
<td>Economics of Energy, Land and Labour Resources</td>
</tr>
<tr>
<td></td>
<td></td>
<td>357 Environmental Economics</td>
<td>451 Advanced Topics in Resource Economics</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>261 World Economic History</td>
<td>361 North American Economic History</td>
<td>Comparative Economic Systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>263 Canadian Economic History</td>
<td>363 Contemporary Economic Systems</td>
<td>Economic History and Contemporary Problems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>291 Intermed. Fin. Accounting 1</td>
<td>391 Cost and Management Accounting 1</td>
<td>Advanced Accounting 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>292 Intermed. Fin. Accounting 2</td>
<td>392 Cost and Management Accounting 2</td>
<td>Advanced Accounting 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>293 Auditing</td>
<td>393 Corporate Finance 1</td>
<td>493 Taxation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>191 Intro. Financial Accounting 1</td>
<td>394 Corporate Finance 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>192 Intro. Financial Accounting 2</td>
<td>481-489 Special Studies</td>
<td>Special Topics and Studies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>193 Economics and the Administrator 1</td>
<td>491 Advanced Accounting 1</td>
<td>Accounting and Administration Economics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>194 Economics and the Administrator 2</td>
<td>492 Advanced Accounting 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>291 Intermed. Fin. Accounting 1</td>
<td>493 Taxation</td>
<td></td>
</tr>
</tbody>
</table>
193*/194* Economics and The Administrator 1, 2 The course is designed to present an opportunity to examine and discuss a broad range of situations where analysis and decision making are required. Emphasis is placed on developing an understanding of the factors and attitudes involved in administration. The course divides into five parts: financial function, personnel administration, production/services function, information and marketing function, and general administration in business, non-profit organizations, and the government sector. Fall and Winter terms

201* Microeconomic Theory Theory of consumer demand; production theory; market structure; resource pricing and allocation under perfect and imperfect competition.
Prerequisite: Economics 101*
Fall and Winter terms

202* Macroeconomic Theory Theory of the determination of the level of national income, employment and the price level.
Prerequisite: Economics 102*
Fall and Winter terms

211* Mathematics for Economists Application of elementary mathematics to problems in economic theory. Topics include the graphing of functions, elementary analytical geometry, derivation, exponential and logarithmic functions, and differentiation – all developed within the context of economic theory. No previous training in algebra or calculus is presumed.
Prerequisites: Economics 101*, 102*
Fall and Winter terms

221* Statistics for Economists An introduction to the underlying logic of statistical procedures most commonly employed by economists. No mathematical training beyond high school algebra is presumed. Emphasis is given to solving problems as a way of learning statistical theory.
Prerequisites: Economics 101*, 102*
Fall and Winter terms

231* Introduction to International Economics Theory of comparative advantage and the gains from trade; tariff theory; concepts and measurement of balance of payments; exchange rate systems; reform of international monetary system.
Prerequisites: Economics 101*, 102*
Fall and Winter terms

233* Regional Economics Application of economic theory to the analysis of regional economic problems, including, for example, the problem of chroniclally depressed areas, and of regions whose economic activity is concentrated in one or two major industries.
Prerequisite: Economics 201*
Winter term

Prerequisite: Economics 201*
Winter term
261* World Economic History

Selected topics in the economic development of various areas of the world. Emphasis is given to the nature and origin of the forces which gave rise to particular methods of economic organization and institutions.
Prerequisites: Economics 101*, 102*
Fall term

263* Economic History of Canada

The course concentrates first on Mercantilist theory and practice vis-a-vis Canadian development, then turns to Innis' "Staples Theory". Finally, modern economic theory is used to analyse a number of controversies in Canadian economic history, in particular the rejection of the staples model by Chambers and Gordon and the dispute regarding the economic impact of the Reciprocity Treaty of 1854. The relation between these historical controversies and current concern about Canadians "selling-off their heritage" will conclude the course.
Prerequisites: Economics 101*, 102*
Winter term

291*/292 Intermediate Financial Accounting 1, 2

An in-depth analysis of accounting procedures. A study is made of the reporting process, matching of costs and revenues, money value items, capital determination and presentation, and accounting for internal management.
Prerequisites: Economics 191*, 192*
Fall and Winter term

293* Auditing

Internal and external auditing, its effects and uses. A study is made of budgeting, centralized and decentralized control, internal audit, performance measurement, the role of an external auditor, the techniques used by an external auditor, services available from a Public Accounting firm and the evaluation of the services provided.
Prerequisites: Economics 191*, 192*

301* Intermediate Micro-economics

Distribution theory; production, consumption and general equilibrium analysis; welfare economics.
Prerequisite: Economics 201*, 231*
Fall term

302* Monetary Theory and Banking

Monetary theory and banking in an open economy; national policies for achieving full employment, price stability, and equilibrium in the balance of payments.
Prerequisites: Economics 202*, 231*
Winter term

303* Economic Thought

A critical survey of the development of economic thought from Adam Smith through J.M. Keynes.
Prerequisites: Economics 201*, 202*, 231*

311* Introduction to Mathematical Economics

Mathematical treatment of some micro – and macro – partial and general equilibrium models; programming and game theoretic techniques; stability analysis; simple growth models.
Prerequisites: Economics 201*, 202*, 211* (or Math 130)
321* Introduction to Econometrics
Introductory level course in econometrics; includes economic model building and testing, regression and correlation analysis, and price indices.
Prerequisite: Economics 221

331* International Trade Theory
An examination of the modern theory of international trade. Topics include comparative advantage and the gains from trade, tariff theory, economic integration, and the interaction between international trade and economic growth.
Prerequisites: Economics 201*, 231*
Fall term

332* International Monetary Theory
The monetary aspect of international economic relations. Topics include analyses of the foreign exchange and international capital markets, the theory of balance of payments policy, monetary integration, and reform of the international monetary system.
Prerequisites: Economics 202*, 231*
Winter term

333* Interregional Economics
Application of economic theory to the analysis of interregional economic problems. Emphasis is on the use of elementary models of international trade to analyse interregional economic relations.
Prerequisites: Economics 201*, 231*. (Economics 233* is recommended)

335* Economic Development
The nature of the problem of economic development; theories of economic development; major policy issues in economic development.
Prerequisites: Economics 201*, 202*, 231*

341* Public Finance
The economic rationale of governmental activity; alternative measures of fiscal operations; the structure and economic effects of government revenues and expenditures; the role of fiscal policy in economic stabilization and growth.
Prerequisite: Economics 201*

343* Urban Economics
Application of economic analysis to location decisions of firms and households; discussion of policy problems, for example, urban renewal and housing.
Prerequisite: Economics 101* (Economics 201* is recommended)

345* Industrial Organization
An analysis of the characteristics of industrial structure, behaviour and performance with special reference to Canada. Competition and "rationalization" policy in Canada and other selected countries.
Prerequisite: Economics 201*

347* Economics of Transportation and Communication
Application of economic analysis to problems in the area of transportation and communication; critical review of policies and programmes designed to deal with problems in this area.
Prerequisite: Economics 201*

351* Labour Economics
Wage theory; training and mobility theory; economics of information in Canadian labour markets; other investments in human capital; manpower policies.
Prerequisite: Economics 201*
353* Population Economics  
Demographic techniques; economic interrelationships with fertility, mortality, morbidity; theory of an optimum population.  
*Prerequisite: Economics 201*

355* Economics of Energy and Natural Resources  
An analysis of the economics of conservation, especially the adequacy of the market mechanism as an allocator of resource use over time. The political economy of the world's supply of and demand for energy resources and major issues in Canadian energy policy will be considered.  
*Prerequisite: Economics 201* (Economics 241* is recommended)

357* Environmental Economics  
Application of economic theory to problems of the environment, in particular, air, water, and land pollution. Emphasis is on the theory of the management of common property resources.  
*Prerequisite: Economics 201*

361* North American Economic History  
An advanced level treatment of the economic development of North America with particular emphasis given to various facets of the economic inter-relationship between Canada and the United States.  
*Prerequisite: Economics 201*

363*/364* Contemporary Canadian Problems 1, 2  
A "topic oriented" seminar course. The class agrees to study a Canadian problem selected from a list that includes poverty, unemployment, industrial policy, and so forth. The format assists the student in gaining analytical skill through work on the selected topic.  
*Prerequisite: Economics 201*, 202*  
Fall and Winter terms

381*-389* Special Topics  
One or more special half courses will be offered at different times as announced by the Department.  
*Prerequisite: Consent of Instructor*

391*/392* Cost and Management Accounting 1, 2  
Conventional methods of accounting, summarizing, and interpreting costs: job order and process costing. Budgetary control with standard costs; profit analysis for decision-making purposes.  
*Prerequisite: Economics 192*  
Fall and Winter term

393*/394* Corporate Finance 1, 2  
The general problem of financing business activities; the financial organization and control of corporations, liquidations and reorganization; the operation of capital markets.  
*Prerequisite: Economics 101*, 102*, 191*, 192*  
Fall and Winter term

401* Advanced Economic Theory  
Pure theory of exchange, production and consumption theory, the core of an economy, capital theory, general equilibrium analysis of multiple markets, and related theoretical issues.  
*Prerequisite: Economics 301*, 302*, fourth-year standing  
Fall term

402* Economic Cycles and Stabilization Policy  
Theory of economic policy, business cycles, inflation and unemployment problems, and balance of payments analysis.  
*Prerequisites: Economics 301*, 302*, Fourth-year standing  
Winter term
403* Economic Analysis, Forecasting, and Public Policy
The course focuses on the problems of forecasting economic activity (as measured by the principal macroeconomic variables), and of designing and implementing policies to control those variables; topics covered include a critical review of current forecasting models, problems associated with lags in the impact of policies, and so forth.
Prerequisites: Economics 301*, 302*

411* Mathematical Economics
Mathematical formulation of economic theory; solutions to systems of simultaneous difference and differential equations; introduction to dynamic models; analysis of stability conditions; introduction to linear and nonlinear programming, input-output analysis, game theory.
Prerequisites: Economics 301*, 302* 311* Fall term

413* Economic Growth Theory
Classical, neoclassical, and Cambridge theories of growth; study of production, technical progress, and consumption; aggregate and two-sector models of growth; growth theory in an open economy.
Prerequisites: Economics 301*, 302*, 311*
Winter term

421*/422* Econometrics 1, 2
Review of linear algebra, and development of basic statistical inference; formulation, identification, estimation, and tests of single equation and simultaneous equation regression models of micro- and macroeconomics; empirical models.
Prerequisites: Economics 201*, 202*, 211*, 221*, 321* Fall and Winter terms

431* Advanced International Economics
Analysis of selected topics such as the theory of trade blocs and systems of customs unions, economic integration, devaluation theory, theory of dominant currencies, international transmission of inflation, gold/bimetallic/dollar standard theories and optimum currency areas.
Prerequisites: Economics 301*, 302*, 331*, 332* Fall term

432* International Economic Policy
Analysis of selected policy problems, such as monetary and fiscal policy mix in open economies, optimum tariff policy, trade and environmental policies, trade in public goods and bads, international monetary reform, control of international capital flows, the multi-national firm, and so forth.
Prerequisites: Economics 301*, 302*, 331*, 332* Winter term

441*Economics of the Public Sector 1
An overview of fiscal functions and institutions; the theory of social goods; expenditure and revenue structures; fiscal incidence.
Prerequisites: Economics 231*, 301*, 302*, 341* Fall term

442* Economics of the Public Sector 2
Fiscal stabilization, fiscal federalism, public pricing, international public finance, social security and other contemporary policy issues.
Prerequisite: Economics 441* Winter term
451* Advanced Topics in Resource Economics
Advanced analysis of selected topics in the area of energy, land, and labour resources.
Prerequisites: Economics 201*, 202*, 231*, 355*

461* Comparative Economic Systems
An analysis of the government's role in the planning and management of the economy under capitalism, socialism, fascism, communism, worker management, and other forms of economic organization.
Prerequisites: Economics 201*, 202*

481*-489* Special Studies
Research and reading courses under the direction of individual instructors.
Admission by consent of instructor

491* Advanced Accounting 1
The accounting treatment of business combinations, consolidations, pooling of interests, reorganizations, valuation of business enterprises, foreign branches, specialized types of operations such as mutual funds, banks, trust companies, insurance companies, municipalities, non-profit institutions.
Prerequisites: Economics 391*, 392*

492* Advanced Accounting 2
Prerequisite: Economics 491*

493* Taxation
The prime purpose of the course is to gain a broad understanding of the Canadian tax system in its economic, legal, and accounting settings. Fundamental legal and economic concepts will be studied as well as specific provisions and problems that commonly arise. The second purpose of the course is to relate the provisions of the taxing statutes to frequent business problems with emphasis on tax planning.
Prerequisite: Economics 292*
Department of Electrical Engineering

Professor and Chairman of Professor and Associate Chairman (Graduate Studies)
K.D. Srivastava, B.Sc., B.E.(Hons.) (Roorkee), Ph.D.(Glasgow)
R.H. MacPhie, B.A.Sc.(Toronto), M.S., Ph.D.(Illinois)

Associate Professor and Associate Chairman (Undergraduate Studies)
J.V. Hanson, B.A.Sc.(Toronto), M.Sc., Ph.D.(Imperial College, London)

Professor and Dean of Graduate Studies
L.A.K. Watt, B.Sc.(Manitoba), M.S.(Chicago), Ph.D. (Minnesota)

Professors
I.H. Anderson, B.Sc.(Leeds), M.Sc., Ph.D.(Manchester)
R.G. Anthes, B.A.Sc., M.A.Sc.(Toronto)
P.R. Bryant, M.Sc.(London), M.A., Ph.D.(Cambridge)
E.L. Heasell, B.Sc., Ph.D.(Imperial College, London)
S.N. Kalra, B.Sc.(Punjab), M.S., Ph.D.(Illinois)
H.C. Ratz, B.A.Sc.(Toronto), S.M.(M.I.T.), Ph.D.(Saskatchewan)
J. Reeve, B.Sc., M.Sc., Ph.D.(Manchester)
D.I. Roulston, B.Sc.(Belfast), Ph.D.(Imperial College, London)
J. Vlach, Dipl. Ing., C.Sc.(Technical Univ. of Prague)
L.Y. Wei, B.S.(National Northwestern College, China), M.Sc., Ph.D.(Illinois)

Associate Professors
I.F. Blake, B.Sc., M.Sc.(Queen's), M.A., Ph.D.(Princeton)
S.G. Chamberlain, M.Sc., Ph.D.(Southampton)
Y.L. Chow, B.Eng.(McGill), M.A.Sc., Ph.D.(Toronto)
J.D. Cross, B.Sc.(Cardiff), M.Sc., Ph.D.(Carleton)
G.J. Dufault, B.A.(Ottawa), B.Sc.(Carleton)
J.A. Field, B.E.(Saskatchewan), M.A.Sc., Ph.D.(Toronto)
J.S. Keeler, B.A.Sc., M.A.Sc.(Toronto)
W.D. Little, B.A.Sc., M.A.Sc., Ph.D.(U.B.C.)
J.W. Mark, B.A.Sc.(Toronto), M.Eng., Ph.D.(McMaster)
W.N. Meikle, B.A.Sc., M.A.Sc.(Toronto)
R.S. Ramshaw, B.Sc., Ph.D (Nottingham)

Assistant Professors
J.D. Aplevich, B.E.(Saskatchewan), Ph.D.(Imperial College, London)
T. Kameda, B.S., M.S.(Tokyo), Ph.D.(Princeton)
Y.F. Lam, B.S.E.E., M.S.E.E., Ph.D.(Purdue)
J.C. Majithia, B.Sc.,(London), M.Eng., Ph.D.(McMaster)
V.H. Quintana, I.I.E.(Chile), M.Sc.(Wisconsin), Ph.D.(Toronto)
P.A. Vuorinen, B.A.Sc.(Toronto), Ph.D.(London)
W.J. Wilson, B.E., M.Sc.(Saskatchewan), Ph.D.(Cambridge)

Research Assistant Professors
B.Y. Woo, B.Sc.(Taiwan), M.A.Sc., Ph.D.(Waterloo)
Undergraduate Programme

Details of the undergraduate programme in Electrical Engineering may be found on page 162. Each course extends over one term only.

Undergraduate Course Descriptions

14 Electromagnetics  Kirchoff's Laws, mesh current and node voltage equations, superposition theorem, maximum power theorem, time domain analysis of RC, RL and RLC circuits, phasors, measuring instruments, power factor and its correction, magnetic circuits, transformers, electromechanical energy transducers, introduction to d.c. and a.c. motors and generators, polyphase circuits.

Prerequisites: GEI22, Math 12, Math 21, or equivalent

32 Electronic Instruments  Introduction to the principles of instrumentation: transducers, amplifiers and readouts. Realization of these with emphasis on solid state electronic devices and circuits. The control of electric power with semiconductor devices.

Prerequisites: EE14 or equivalent

201 Seminar  General Seminar.

202 Seminar  General Seminar.

203 Concepts of Electrical Engineering  A series of lectures by the E.E. Faculty and invited speakers covering the areas of networks, devices, electronics, communications, computers, power, control, antennas, microwaves.

205 (Math25) Advanced Calculus for Electrical Engineers 1  Differential calculus of functions of several variables. Differential equations. Multiple integrals. Applications to Electrical Engineering will be stressed.

206 (Math 35) Advanced Calculus for Electrical Engineers 2  Fourier series, partial differential equations, separation of variables, wave equations, heat equation and Laplace's equation, Fourier integral, properties of complex analytic functions, complex integration. Applications to Electrical Engineering problems will be stressed.

Department of Electrical Engineering

233 Physical Electronics  Electromagnetic radiation, photoelectric effect, Compton effect; Wave aspects of particles; Structures of hydrogen atom; many electron atoms; Solid State Physics, semiconductors, effective mass, doping n-type, p-type, Fermi level, mass action law, charge neutrality, conductivity, mobility, diffusion; Introduction to p-n junction, built-in potential.

241 Electrical Networks 1  Introduction to network variables and laws; resistors, sources and simple circuits; resistance networks; capacitors and inductors; first order circuits; sinusoidal steady state analysis. 
Prerequisites: GE122, M12, GE121

Prerequisites: EE241, EE271, or equivalent

271 Electric and Magnetic Fields  Vector analysis; Coulomb's law and electric field intensity; electric flux density; Gauss' law and divergence; energy and potential; conductors, dielectrics, capacitance; experimental mapping methods; Poisson's and Laplace's equations; the steady magnetic field; magnetic forces, materials and inductance; time varying fields and Maxwell's equations. 
Prerequisites: GE122 or equivalent

293 Measurement and Instrumentation 1  Safety in the laboratory, measurement errors, accuracy. The oscilloscope, d'Arsonval meters, rms and mean values, ac measurements, electrodynamometer instruments, bridges, the decibel, signal sources, transducers. Laboratory experiments.

294 Measurement and Instrumentation 2  A continuation of EE293; to include topics from: digital instruments, sampling oscilloscope, spectrum analysis, design of experiments, data handling, experimental technique; laboratory experiments.

301 Seminar  General Seminar.

302 Seminar  General Seminar.

316 Probability and Statistics  Basic notions of probability; conditional probability and independence; Bayes' Theorem; random variables; functions of random variables; and distribution functions; applications to reliability and failure rates; two dimensional random variables; marginal and conditional distributions and transformation of variables; correlation and applications to regression and statistical testing. 
Prerequisites: EE205 (Math 25) or equivalent
324 Introduction to Digital Circuits and Computers
Number systems and representation of digital information. Binary arithmetic in various number representations.
Boolean Algebra and its application to switching circuits.
Analysis and simplification of combinational switching functions.
Prerequisites: EE221 or equivalent

342 Electric Networks 2
Review of sinusoidal steady state, node and mesh analysis; source transformations, Laplace transforms and applications; network functions; network theorems; two-ports; network graphs and Tellegen's theorem; state equations.
Prerequisites: EE241 or equivalent

351 Electronics 1
Review of doped semiconductors charge neutrality, mass action law, equilibrium conditions. Boltzman relations; derivation of p-n junction, d.c. and a.c. characteristics; charge storage effects; the bipolar transistor; derivation of d.c. and a.c. terminal characteristics, small and large signal models. Temperature effects. Introduction to the insulated gate field effect transistor. (MOSFET).
Prerequisites: EE233 or equivalent

352 Electronics 2
Large signal amplifiers; biasing networks and stability; single and multi-stage small-signal amplifiers; use of the hybrid-pi model; high and low cut-off effects; feedback amplifiers; stability; oscillators; noise in electronic circuits; modulation and detection systems.
Prerequisites: EE351 or equivalent

362 Dynamic Energy Conversion
Energy conversion by use of dynamic magnetic circuits. Translational and rotational transducers used in the electrical-mechanical energy conversion process.
Prerequisites: EE261 or equivalent

372 Transmission Lines and Electromagnetic Fields
Transmission lines; distributed parameters; telegrapher's equations; sinusoidal waves; terminated lines, matching with the Smith Chart; Electromagnetic Fields; Maxwell's equations; plane waves; reflection and refraction, Poynting vector; waveguides.
Prerequisites: EE271 or equivalent

380 Introduction to Systems and Control
Mathematical modelling of systems and components; introduction to simulation; feedback systems; system stability and analysis using amplitude and phase plots and methods of Nyquist; Nichols and the Root Locus.

401 Seminar
General Seminar.

402 Seminar
General Seminar.

Prerequisites: GE121, EE205 (Math 25) or equivalent

425 System Simulation  A study of computer simulation techniques; principles of analog computation; models, scaling and procedures; digital simulation languages, computer simulation and investigation of continuous systems; differential equations, transfer functions, boundary value problems, system design; elements and application of hybrid computers.

426 Software Engineering  Programming techniques, including subroutines, recursive programs etc. Arrays, lists, pushdown stacks. Searching and sorting methods. Assemblers, compilers and interpreters. Operating system, resource management, time-sharing. Communication between computers.

Prerequisites: EE324 or equivalent


Prerequisites EE324, EE454 or equivalent

428 Signal Analysis and Frequency Domain Methods  Introduction to Fourier Series and Transforms and their use in the analysis of deterministic signals in linear systems; bandwidth, distortion and filter characteristics; input output relationships in linear filters; linear modulation such as AM, SSB, VSB and demodulation techniques; sources of noise in a communication system including channel and receiver noise.

Prerequisites: EE205, M25 or equivalent

429 Communication Systems  Probability theory and the description of random processes, the analysis of analog and digital communication systems including phase and frequency modulation of analog waveforms and pulse amplitude modulation, pulse code modulation for digital signals; the investigation of the performance of these systems in the presence of noise using various criteria, including probability of error and signal to noise ratios.

Prerequisites: EE316, EE428 or equivalent

434 Quantum Electronics and Magnetics  Laser principle, solid state lasers, semiconductor injection lasers, gas lasers, laser applications, holography, ferromagnetism, spin waves, magnetic domains, diamagnetism and paramagnetism, electronic spin resonance, magnetic memories, bubble devices.

Prerequisites: EE271, EE351 or equivalent
435 Semiconductor Devices 1
Review of p-n junction theory; Selected topics from the following: Photocells, photodiode and photodetectors, the Solar cell, the Silicon Control Rectifier (SCR) IMPATT microwave devices, Light emitting devices, JFET, Schottky diodes, varactor diodes, MIS, Charge coupled devices. Dielectric relaxation time, scattering mechanisms, ionization rates, breakdown mechanisms, avalanche and zener breakdown devices. Shockley-Read recombination model.
Prerequisites: EE351 or equivalent

436 Semiconductor Devices 2
Prerequisite: EE352 or equivalent

443 Electric Networks 3
Topics from the following: general passive network functions; passive driving point functions; reactance functions and reactance networks; scattering parameters, reactive passive filters; active networks and active filters, digital filters.
Prerequisites: EE342 or equivalent
Continuous and discrete linear systems; linear transformations; finite field theory; polynomials over finite fields; matrix algebra, system decomposition.
Prerequisite: EE380 or equivalent

453 General Electronic Circuits
Selected topics from the following: Applications of the MOST and JFET to modern circuits. Bipolar IC's. Design of operational amplifiers, IC's temperature compensation. Power supplies, narrow and wideband amplifiers, the cascade amplifier. Differential, low noise amplifiers, frequency response, power amplifiers. Modulators, mixers, detector circuits, receiver front end design.
Prerequisites: EE325 or equivalent

454 Pulse and Switching Circuits
Selected topics from the following: switching characteristics of semiconductor devices, non-sinusoidal wave generation and shaping, voltage and current sweeps, binary circuits, NAND, NOR, AND, OR gates and compatibility requirements, digital integrated circuits, DTL, DCTL, ECL, and T²L; the blocking oscillator.
Prerequisite: EE351, EE352 or equivalent

459 Sound, Noise and Electroacoustics
An interdisciplinary study of acoustical physics, human response to sound and audio engineering. Main topics include: the physics of sound, electroacoustical systems, human audiology, acoustical measurements, and audio electronics.
Prerequisite: Knowledge of the basic techniques for measurement and analysis of simple linear systems is required. Familiarity with simple electronic devices would be helpful.
463 Energy Conversion and Power Applications
The steady state control of electrical machines; thyristors for power applications; steady state control of apparatus by power electronics; transient response of electromechanical translational transducers; introduction to dynamic circuit theory for the transient analysis of individual rotating transducers; protection of plant, power generation, hydro, steam, tidal, nuclear, etc., superconductivity and power applications.
Prerequisite: EE261, EE362 or equivalent

464 High Voltage and Insulation Engineering
Nature and origin of high voltage surges encountered on power systems travelling waves on transmission systems; insulation engineering: electrostatic fields in High voltage apparatus, insulation failure; corona; insulation testing; circuit breakers and surge protection devices; insulation coordination.
Prerequisite: EE463 or equivalent

465 Power Systems
Introduction to system concepts of power plants; coordinate systems including symmetrical components; sequence impedances and transmission line constants; analysis of unbalanced systems and fault calculations; per-unit systems; protection techniques and fault analysis appropriate to protection; voltage and reactive power control; power transfer and system stability; load flow; introduction to computer methods for power system analysis; transient response of power systems; introduction to HVdc transmission; economic considerations.

473 Microwave Engineering
Rectangular and circular waveguides; simple waveguide discontinuity; periodic transmission systems; microwave scattering theory; ferrite components; klystrons; travelling wave amplifiers; backward-wave oscillator, magnetron; solid-state microwave devices.
Prerequisite: EE372 or equivalent

474 Antenna and Propagation Engineering
An introduction to the theory of radiation and of antenna and propagation engineering; linear antennas, linear arrays; aperture antennas, frequency independent antennas, measurement theory ground wave propagation, ionospheric propagation, plasmas.
Prerequisites: EE372 or equivalent

481 Control Systems
Performance specification, synthesis of single-input single out-put system; state variable representation for continuous and discrete time systems; analysis of multivariable systems.
Prerequisites: EE380 or equivalent

482 Control Systems 2

499A, 499B Project
An engineering assignment requiring the student to demonstrate initiative and assume responsibility. The student will select a project at the end of the 3B term from an approved list prepared by the Department. A short progress report at the end of the 4A term and a full report at the end of the 4B term are required.
Department of English

Professor and Chairman of the Department

W.U. Ober, B.A.(Washington and Lee), Ph.D.(Indiana)

Professors

J. Gold, B.A.(Birmingham), Ph.D.(Wisconsin)
I.C. Gray, B.A.(Washington State), M.A.(Connecticut), Ph.D. (Syracuse)
G.R. Hibbard, B.A., M.A.(London)
K. Ledbetter, A.B.(Central College, Mo.), M.A., Ph.D.(Illinois)
C.F. MacRae, B.A.(Western), M.A.(McMaster), Ph.D.(Toronto)
W.R. Martin, M.A., DeLitt. et Phil. (South Africa)
W.K. Thomas, M.A., Ph.D.(Toronto)

Associate Professors

A.I. Dust, M.A., Ph.D.(Illinois)
B.N. Honeyford, B.A., Ph.D.(Toronto)
H.E. Haworth (Mrs.), B.A.(Rollins), M.A., Ph.D.(Illinois)
N.C. Hultin, B.A.(Concordia), M.A.(Chicago), Ph.D.(Johns Hopkins)
J.R.M. Levitsky (Mrs.), B.S.Ed.(Central Missouri S.C.), M.S.Ed. (Illinois Normal), Ph.D.(Missouri)
H.M. Logan, A.B.(Franklin and Marshall, Ph.D.(Pennsylvania)
E.F. Shields (Miss), B.A.(Chestnut Hill), M.A.(Villanova), Ph.D. (Illinois)
J.S. Stone, M.A.(British Columbia)
R.H. Tuyn, M.A.(Utrecht and Oxon.) Docteur de l'Université de Paris

Assistant Professors

P.O. Beam, B.A.(Waterloo), M.A.(McMaster), Ph.D.(Toronto)
R.R. Dubinski, B.A., M.A.(Western), Ph.D.(Toronto)
R.N. Gösselin, B.A.(Kansas), M.A., Ph.D.(Colorado)
J.L. Hinchcliffe, B.A.(British Columbia), M.A., Ph.D.(Toronto)
J.D.S. Keppel-Jones, B.A.(Natal), M.A., Ph.D.(Queen's)
R. Lister, B.A., M.A., Ph.D.(Toronto)
W.R. Macnaughton, B.A.(Toronto), M.A., Ph.D.(Wisconsin)
J.E.P. McCormack, M.A.(Glasgow), Ph.D.(Manitoba)
J.S. North, B.A., M.A.(British Columbia), Ph.D.(Alberta)

Lecturers

Sister M. Leon, S.S.N.D., B.A.(Toronto), M.A.(Detroit)
J.D.R. Letson, B.A.(Waterloo), M.A.(McMaster), Ph.D.(Toronto)
G.E. Slethaug, B.A.(Pacific Lutheran), M.A., Ph.D.(Nebraska)
M.G. Thyssell, M.A.(Montana), Ph.D.(Iowa)

For programmes and courses in Drama, see Drama and Theatre Arts Group in this Chapter.

English Honours Programmes

For programmes in Honours English and dual Honours programmes involving English, see pages, 126, 127.
English General Programme

To fulfill the requirements for a general degree in English, a student must take six courses in English consisting of: 101 or equivalent, 251, one full course equivalent from 310, 350, 362*, 363*; one full course equivalent from 305, 330, 373, 375, 410, 430, 451; two other approved English credits.

First year English 101 and 102 are the recommended first-year courses. However, a first year student may - without formal permission from the Department - take courses from the following list instead of either 101 or 102: English 108*, 190*, 211*-212*, and 230*-231*. All other English courses are open to first year students, but only with the permission of the Chairman of the English Department and the instructor of the course. Students may use only one full course equivalent in English from the 100-level to fulfill the minimum English requirements.

Upper years English 251 is strongly recommended for second year. With the consent of the Department upper year courses may be taken at any time during the upper years without regard to course number or "level."

Restrictions English 109*, 140*-141*, 209*, 210*, 335 may not be included as approved English courses in fulfilling the minimum course requirements for an English Programme, but may be chosen as non-English electives.

Note 1 W.K. Thomas's Correct Form in Essay Writing is the official style sheet for all undergraduate English courses.

Note 2 The "normal" number of lectures per week in each course is three; however, each instructor determines how often his particular class will meet.

Note 3 In all English courses, emphasis will be placed on student essays written in connection with the reading.

10 English as a Second Language (a non credit course) The course will aim at the improvement of both written and spoken English to bring about ease and facility of expression in assignments and oral discussion through a detailed study of basic patterns in Grammar and Idiom and their practical application in writing commentaries, essays or summaries.

101 The Living Tradition An examination of examples of the greatest literatures in English and its relation to the periods of its origin. Figures such as Chaucer, Shakespeare, Milton, Swift, Blake, Keats, Tennyson, Dickens, and T.S. Eliot will be examined. The precise list of readings will depend upon the individual instructor. The basic text will be the one-volume Norton Anthology of English Literature.

102 Poem, Play and Story A study of the forms that imaginative literature assumes. Examples of different kinds of literature will be explored in detail so as to discover how the shape of a literary work of art gives to its meaning. Students will for instance read ballad, lyric, and narrative poetry; classic tragedy and comedy and absurdist, existential and expressionist plays; novels and short stories.
An exploration of the great variety of literature through thematic perspectives. The following themes will be offered in the coming year:

108*A The Hero
A study of human excellence in thought and action, embodied in representative men and women, as seen through works of literature.

108*B Utopia and Anti-Utopia
The purpose of this course will be to acquaint the student with various forms of the literary artist's moral vision of man as it appears in "Utopian" writings. It will involve an examination of the role of the imagination in helping to inform and embody the cultural ideals of four periods: the Renaissance, the Eighteenth Century, the Romantic Age and the Modern Age.

108*C Literature and Morality
Works in English literature from its beginnings are selected for their bearings on questions of morality. The relationships include: (1) the moral values assumed by the writer and his culture; (2) the means by which moral values and ideals are clarified and promoted; (3) the consideration of true and false moral principles; (4) images of reward, nemesis, guilt, and redemption. Some attention will be given to the traditional categories of morality, especially the Deadly Sins and the Cardinal Virtues.

108*E Women in Literature
A study of the nature and role of women in British, Canadian, and American literature from Chaucer to the present. Works by both men and women writers will be studied in which women are seen in such forms as earth mothers, people, sex objects, and bitches.

108*F The Rebel
A study of various works of literature in which the protagonist is a rebel, a non-conformist to the standardized, existing norms of life and living. It will examine a number of rebel types and concepts, moral implications, final outcomes either in successful realization or in tragic defeat.

108*H Isolation and Alienation
This course includes the study of a variety of works of literature centering on the theme of man in crisis, the stress being on the individual at variance with his inner self, his fellow man, his world. The inner struggle isolates him from society and alienates him from his fellow man. The course will discuss the process in which wisdom and maturity are gained as the ultimate product of suffering.

109* Basic Writing Skills
This course is designed for students who wish to develop basic writing skills. It teaches such elements of composition as focus of theme and development of central idea, use of supporting material, and organization; it stresses as well proper mechanics and good diction. In carefully graduated steps, the course takes the student from the paragraph to the essay, and from exposition to argumentation. It shows the student how to tailor his writing to meet special needs. Students enrolling in the course should understand that, while the essays written will not be lengthy, they will be frequent.
140* The Use of English 1 The use and abuse of spoken and written English. The study and evaluation of language as it is used for various purposes (e.g., colloquial, scientific, legal, political, commercial, journalistic, literary) in order to increase critical awareness and help students to write clearly and effectively themselves.

141* The Use of English 2 A continuation of English 140*. The study of factual, emotive, scientific and imaginative writing; relevance, context; meaning, tone, feeling and intention. Prerequisite: English 140*

190* Shakespeare Designed for students in all programmes and faculties, the course examines some of Shakespeare's comedies, history plays, and tragedies selected from his early, middle, and late periods. In addition, the full range of Shakespeare's variety and flexibility in developing characters and dramatic structures is stressed as are such significant and recurring themes as identity and self-knowledge; the use and abuse of words; the interplay of the real and the ideal; the function of the imagination; kingship; the problem of deception and evil; the relationship of deeds to words, and so forth. No previous work in Shakespeare is required

201* The Short Story (formerly English 105*) Examples are the stories of Hemingway, Faulkner, James, D.H. Lawrence, and modern Canadian Writers.

202* The Bible and Literature The study of the major themes, stories, myths, and characters of the Old and New Testaments of the King James Bible, and their influence on other English literature.

203* Introduction to Folklore 1 An introduction to the scope and aims of folklore, together with a survey of the major types of folklore in the English tradition from earliest times to the present and from the various nations of the English-speaking world. Topics such as the following will be discussed: Oral literature and traditional cultures of the English world; problems in the creation, transmission, and alteration of oral literature; myth, legend, tale, and märchen.

204* Introduction to Folklore 2 Similar to 203* but dealing with folk-drama, ballads, songs, riddles, chants, proverbs, and charms. Prerequisite: English 203* or consent of instructor

205R* The Canadian Short Story Exploration of the Canadian short story, from its beginnings – in the bush, in the north, on the land, in the small towns – through the struggles of an urbanizing society to the present. A course in the "fashions" of Canadian short story writing tracing changing modes and reference points. Students will be expected to work in some depth with individual authors. Note R courses are those administered by Renison College

206* The Art of the Essay Essays of current and recurrent interest will be read both for the ideas presented and for the artistry involved in the presentation.
208* Literary Genres and Themes

208A* Forms of Fantasy
This course will deal with the history and forms of fantasy written for an adult reading audience. In considering fantasy as a genre, related forms like the romance, the fairy tale, the fable, and the gothic horror story will be discussed. Authors such as Morris, C.S. Lewis, Tolkien, Williams, and White will be studied in depth.

208B* Science Fiction
A survey of the history and evolution of the genre known as "science fiction." The works studied deal with such themes as the status of the artist in the future, the concept of perfect equality, utopia, the aftermath of war, immortality, and the end of the world. Authors such as Doyle, Verne, Hawthorne, Poe, Asimov, Bradbury, Heinlein, and Vonnegut will be considered at length.

208C* Studies in Children's Literature
This course will deal with classic works of children's literature, including fantasy written primarily for children. Selections by such authors as Thackeray, Emily Bronte, Hawthorne, Kipling, Woolf, C.S. Lewis, George MacDonald, Kenneth Grahame, Welty, Thurber, and Langston Hughes will be studied.

208D* Modern Satire
The mode of satire in the fiction, drama, poetry, and discourse of the 20th century. Particular attention to the literary works of Waugh, Huxley, Orwell, Parker, Heller, Hiebert, and a dramatist of the absurd, but also attention to satiric cartoons and nightclub satire.

208E* Women Writers of the 20th-Century
A study of such major 20th-century women writers as Woolf, Hellman, Murdoch, McCarthy, Lessing, Laurence, Plath and Atwood. The emphasis of this course will be on the specific concerns of these writers with the situations and roles of women in the modern world, their search for new meanings and their innovations in literary forms.

208F* Themes in Canadian Literature
The course will explore a theme which is significant in the understanding of the Canadian literary mind. Examples of themes which may be considered will include: the impact of the landscape, rural-urban conflict, isolation, social conservatism, regional reality. Novels, poetry, drama, essays and biography drawn from both 19th-century and 20th-century sources may be used.

209* The Art of Writing Well
The course outlines the key principles of rhetoric and gives the student opportunities to apply them in the various forms of descriptive, expository, argumentative, and persuasive writing. Examples from newspapers, magazines, government reports, advertising, briefs, etc., are analyzed for their rhetorical effectiveness. There is one weekly lecture and a weekly workshop where student writing is discussed. Students entering the course should understand that six to eight essays will be required of them. There are no examinations; the student is graded on his writing improvement.

210* Report Writing
The role of the report as a key tool in modern communications is examined as are its various forms and techniques. The student will practice writing many different kinds of reports.
211*/212* The Novel
The novel, by its nature, constitutes an attempt to formulate, to interpret, to reach for the significance of, the bewildering human experience. This course, in turn, undertakes an exploration of the various forms and manifestations that that attempt can take. The course aims to provide aid in reading a novel intelligently and with perception and appreciation; to give an idea of the range and scope of the novel as written in English; and to provide an understanding of what has gone into making the novel what it now is. British, Canadian, and American novels will be studied. The two halves of the course may be taken independently.

211* The Novel 1
A study of the novel in English from its beginnings to the late 19th century.

212* The Novel 2
A study of the novel in English from the later 19th century to the present.

230*/231* Poetry
A study of the major forms of poetry in the English language. Each half may be taken independently.

230* Narrative Poetry
A study of the major narrative forms in English poetry, including the ballad, epic, mock epic, and dramatic monologue.

231* Lyric and other Poetry
A study of the development of various lyric forms (e.g., erotic, religious), the ode, elegy, meditative-descriptive verse, and perhaps other forms.

232* The Development of Drama to 1660
A study of the origins and development of English drama, with special concentration on 16th-century non-Shakespearian drama.

233* 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.

236* Literature of Ideas 1
This course is designed to stimulate oral and written controversy about such problems as idealism versus realism, the individual versus society, and rebellion versus revolution. Texts include classics such as Machiavelli's *The Prince*, More's *Utopia*, Marx's *Communist Manifesto*, and Mill's *On Liberty*, as well as 20th-century prose counterparts of these earlier expressions of political concern.

237* Literature of Ideas 2
Similar to English 236*, but dealing with moral implications of philosophical and scientific ideas and discoveries that have profoundly affected 20th-century society.

245R Form and Function
The uses of literacy and the functions of language as acquired in English 140*/141*. These will be applied to the more advanced form of the literary and critical assignment essay, involving comparison, evaluation and exposition.

251 The Theory and Practice of Criticism
A study of the elements of criticism and their application to a variety of literary texts and contexts. Much of the work of this course consists of analysis and discussion of literary problems by the students themselves.
290* American Literature

The meaning of America – the myth, the dream, and the reality – as experienced through its major literary works. Sin, guilt, madness, mysticism, and grace: the search for fulfilment and peace by such writers as Poe, Thoreau, Whitman, Twain, and Crane.

291* Modern American Literature (formerly English 344*)

Approaches to reality amid the confusion and uncertainty of 20th-century America. Emphasis on such major writers as Faulkner, Miller, and Cummings.

Prerequisite: English 290*

305 Old English (formerly English 261)

An introduction to the literature and language of pre-conquest England. The principal literary methods, themes, and types of English literature up to the 12th century constitute the material of study in this course.

310 Middle English (formerly English 270)

A study of Middle English literature with special emphasis on the work of Chaucer.

312* Literature of the Commonwealth

A survey of Australian poetry and prose, with some consideration of the literatures, in English, from South Africa and the West Indies.

313* Canadian Literature to 1920

A study of Canadian prose and verse to 1920, with particular attention given to the poetry of the School of the Sixties and to the historical and idyllic novels of the 19th and early 20th centuries.

314* Canadian Poetry Since 1920


315* Canadian Prose Since 1920

The Canadian novel since the appearance of Morley Callaghan, with brief consideration of the essay, the short story, and drama during the period.

316* Canadian Drama

A study of several plays by such dramatists as Merrill Denison, Robertson Davies, Gratien Gélinas (in translation), James Reaney, John Coulter, George Ryga and Michel Tremblay (in translation). The background for 20th-century Canadian drama will be provided by means of lectures.

330 Elizabethan Literature (excluding Drama) (formerly English 280)

A study of the principal writers of prose and of lyric and narrative poetry in England during and immediately preceding the reign of Elizabeth 1. Native, classical, and Italianate influences are stressed in the erotic poetry of the period especially as manifested in the sonnet tradition and Ovidian poems of Marlowe and Shakespeare. Reserved for special attention is Spenser's epic poem glorifying Elizabeth 1 and England – The Faerie Queene.

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 manuscript as evidence of his ability to profit from the course.
339* Contemporary British Literature
A study of the major trends in British literature from World War II to the present. The course will examine the rise of the angry generation and social protest, the renaissance in drama, the return to tradition and the reaction against experimentation, and other topics related to the literary emergence of a new England.

345*(A-E) Studies in American Literature: Themes
345B* The Southern Myth
The Southern Myth: its origins in early literature, its flowering, testing, and shattering; as in the works of Twain, Faulkner, Grau, and O'Connor, as in the black literature of Wright, Ellison, Baldwin, and Jones.
Prerequisite: English 290* or consent of instructor.

347*(A-E) Studies in American Literature: Historical Periods
347A* Contemporary American Literature
A study of American literature from World War 2 to the present. Prerequisite: English 290* or consent of instructor.

350 Seventeenth Century Non-Dramatic Literature
A study of the non-dramatic literature of the late Renaissance in England. Special attention will be given to the rich lyric achievement of the poets of this period in both secular and religious themes. The poetry of Donne, Jonson, Herbert, Vaughan, and Marvell will be studied intensively. Developments in intellectual and cultural history and in prose style will be considered in the prose works of Jonson, Bacon, Burton, Browne, and Milton. Nearly all of Milton's English poetry will be examined in the context of the traditions and conventions of Renaissance literature as well as in the context of the revolutionary era of the English Civil War and Interregnum. Among topics studied will be Milton's treatment of God's Providence, man's freedom, man's temptation and fall, and man's regeneration.

355* Forms of Classical and Neo-Classical Satire
A study (in translation) of the major classical writers of satire and of their influence on English writers of the Renaissance and Neo-Classical periods. Forms such as formal verse satire, epigram and Menippean satire will be studied in both Classical and English writers, including Horace, Juvenal, Donne, Pope, Martial, Jonson, Petronius, Lucian, More and Swift. This course is offered for credit in either the Classics and Romance Languages or English Department and will be taught jointly by two instructors from the respective departments. (same as Classical Civilization 321*)

362* Shakespeare 1
A study of those plays of Shakespeare written up to 1600, including the early comedies, the histories, *Romeo and Juliet* and *Julius Caesar*.

363* Shakespeare 2
A study of those plays of Shakespeare written after 1600, including the late comedies and the major tragedies.

365*-66* Selected Studies
Designed to provide a study in depth of problems and/or authors selected by the instructor. Students interested in initiating such courses are encouraged to do so by bringing their ideas to the attention of individual instructors.
Prerequisite: consent of instructor
373 An Introduction to the History of English

The processes of linguistic change as exemplified in the development of the English language from its origins in Indo-European and Germanic through modern Canadian dialects and other forms of English in the 20th century (British and American dialects, Commonwealth dialects) form the subject of this study. Traditional, structural and generative approaches to historical linguistics will be employed in this survey.

375 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.

376R* Our Changing Language: Syntax and Semantics 1

An evaluation of modern systems of syntax from the learned European tradition to the computer grammar of today. The course will provide a thorough and practical grounding in the structure of language and will stress the growing need for semantic interpretation. (An extensive knowledge of syntax is not assumed.)

Prerequisites: English 141R* and 245R

377R* Our Changing Language: Syntax and Semantics 2

The failure of descriptive dogma and its replacement by the new semantic approach which explains language as the outcome of unconscious mental processes which formulate the rules. Meaning conditions syntactic form. An assessment of its practical significance in language teaching. Of interest to the modern language student and intending teachers of English as the native or as a second language.

Prerequisite: English 376R*

385R Twentieth Century Literature

A survey of writing in the age of anxiety from the psychoanalytic novel to the theatre of the absurd. The concept of the anti-hero in the various approaches. Satirical, emotional and intellectual writing as studied in novels and plays by Graham Greene, Aldous Huxley, D.H. Lawrence, Evelyn Waugh and Harold Pinter.

Note R courses are administered by Renison College

400 The Development of English Literature

Designed for senior students who have already acquired a considerable acquaintance with English literature, the course explores the origin, growth, and transformation of philosophical ideas and of literary themes, motifs, genres, forms, and movements from the beginning of English literature to the present. Each student will write research essays in areas he has not already studied, choosing individual topics in consultation with his instructor and reporting to him regularly.

Three hours a week: two hours of lectures and one of consultation on research essays.
410 The Augustan Age  
(formerly English 370) A study of English literature from 1660 to 1798, featuring the witty, bawdy comedy of the Restoration; the sophisticated satire of Dryden, Swift and Pope; the probing of mores and manners by Pope and Johnson; the emergence and flowering of the novel with Richardson, Fielding, and Sterne; the crystallizing of neo-classical criticism; the development of modern prose style with Addison; and the gradual transformation from classicism to romanticism.

430 The Romantic Movement  
(formerly English 380) An historical and critical study of the principles and practice of the English Romantic poets, Blake, Wordsworth, Coleridge, Byron, Shelley and Keats, with some attention to prose works of the period. In their explorations of the imagination, the feelings and emotions, and the depths of the human psyche, and in their concern with the alienation of man from himself and his society, the Romantics enunciated many of the major concerns of 20th-century culture, and revolutionized poetic theory and practice.

451 Literature of the Victorian Age An historical and critical study with emphasis on the major poets (Browning, Tennyson, Arnold), novelists (Dickens, Thackeray, Eliot), and essayists (Newman, Ruskin, Mill, Huxley). Prominent topics are relative morality, the role of the artist, freedom of speech, the idea of a university, and the effect of economic and social reform upon the human condition. Provision will be made for students who wish to study other writers such as Hopkins, Swinburne, Carroll, Morris or Pater.

460 Modern British Literature A study of the major writers in British literature from 1890 to World War 2, with special emphasis on such writers as Shaw, Yeats, Eliot, Conrad, Joyce, and Lawrence.

Note The following course is administered by St. Jerome's College:

480 J Senior Seminar Designed for fourth-year students in the Honours English or Combined Honours English programs, this course provides a study of the major works in those periods of English literature in which students have not taken courses. It also provides a study in depth of selected authors and topics. Individual syllabi are prescribed for each student, and the course is conducted on a seminar basis.

495 Supervision of Senior Honours Essay

496* Honours Examination Essay (open only to extramural students)
School of Architecture

Professor and Director

Associate Professor and Associate Director

Professor and Dean of Environmental Studies

Assistant Professor and Undergraduate Officer
O. Dutt, B.A.(Punjab), B.Sc.(London), M.S.(Wisconsin), Ph.D. (Waterloo), P.Eng.

Professors
T.E. Bjornstad, B.Arch.(Iowa State), Ph.D.(Liverpool), A.I.A., M.R.A.I.C.
L.A. Cummings, A.B.(Washington), A.M.(Missouri), Ph.D. (Washington)

Associate Professors
A. Banerji, B.Arch.(Calcutta), M.Arch.(North Dakota State)
D.B. McIntyre, B.Arch.(Toronto)

Assistant Professors
M. Elmitt, Dipl. in Art and Design(High Wycombe)
E.M. Pallett, B.S., M.Music(Oregon), Ph.D.(Michigan State)
J.C. Somfay, B.Arch.(N.S.W. Sydney), M.Arch.(Toronto)
F. Thompson, B.Arch., M.Arch.(Toronto), M.R.A.I.C.
R. Wiljer, B.A.(Waterloo), M.A.(Ottawa)
J. Zvilna

Faculty members holding cross and/or joint appointments as shown
1 Architecture and English
2 Man-Environment and Architecture
3 Architecture, Geography, Man-Environment, and Urban and Regional Planning

Undergraduate Architecture Courses

Courses for Bachelor of Environmental Studies

Systems and Measures
Preparation leading to the application of mathematics, statistics and computer science as tools for analyzing quantitative and behavioral problems as prerequisites for ensuing studies; to deliberately develop an understanding of the qualities of materials and structural behaviour; to propose alternatives in structural engineering; and to perform independent mathematical checks on simple, statically determinate and indeterminate structures.

102* Mathematics

Calculus and Vector Geometry
Elementary differential and integral calculus, applications to problems involving rates of change, areas, volumes, centroids, moments of inertia; introductory vector geometry in two and three dimensions.
Prerequisite: none
4 hours per week, Fall term
103* Statistics  Descriptive statistics, sampling, curve fitting, regression and correlation; elementary queuing models; emphasis on the description of environmental processes through observational data.  
Prerequisite: Arch 102* or Math 130*  
3 hours lectures/labs per week, Winter term  
Instructor: Lawless

112* & 113* Computer Science  Introduction to Programming  
This course is essentially the same as Math 132. However, efforts are made to spend more time on an overview of computer systems and on solving architectural problems.  
The Programming language applied is Fortran with Watfiv. A machine language simulation “Spectre” is also taught for a better understanding of the way computers operate.  
Prerequisite: none  
3 hours per week, Fall and Winter terms  
Instructor: Best

163* Statics  Basic concepts, forces, moments, moment of force and system of forces, resolution of forces, transformation of couples; resultant of concurrent and non-concurrent force systems; centre of gravity of a system of forces and moments, of a body or mass of composite bodies; equilibrium, free body diagrams; calculation of reactions, shears, moments, bar forces in simple trusses; friction; moment of inertia.  
Prerequisite: Arch 102* or Math 130*  
4 hours per week including laboratory session, Winter term  
Instructors: Dutt, Schuster

212* Computer Science Simulation  Purpose: To understand how to simulate interacting time/space event by use of computer, and to apply such simulation techniques to the solution of architectural problems.  
Content: Simulation programming will be developed in Fortran so as to build up meaningful architectural simulation concepts necessary in architectural planning. Specific simulation languages such as G.P.S.S. will be introduced.  
Prerequisite: none  
3 hours per week, Winter term  
Instructor: Linders

213* Computer Generated Design  Architectural Design 1  
An overview of design logic and computer system requirement currently used for architectural design.  
Prerequisite: Arch 212* or consent of instructor  
4 hours per week, Spring term  
Instructor: Bjornstad

262* Strength of Materials  Concept of simple stress and strain; statically indeterminate axially loaded members; thermal stresses, torsion; shear and bending moments in simple beam systems; shear and moment diagrams, qualitative deflected shapes, flexural and shearing stresses, deflection calculations; combined stresses, beams of different materials, compression members, Euler's formula.  
Prerequisite: Arch 163*  
4 hours per week including laboratory session, Fall term  
Instructors: Dutt, Schuster
263* Theory of Structure 1  
Historic review of building structures; live and dead loading, wind, snow, earthquake, reactions, stability, determinacy and indeterminacy of structural systems; shears, moments and qualitative deflected shapes; bar forces in pin-connected frameworks; approximate methods of analysis for high rise building frames; deflection calculations by the moment area method, moment diagrams by parts; influence lines, introduction to arches.  
*Prerequisite: Arch. 262*.  
4 hours per week including laboratory session, Spring term  
Instructors: Dutt, Schuster

265* Structural Morphogenesis  
Exploration of new structural forms. Basic physical principles and laws governing these forms. Study of membrane surfaces, Arrangements of forms for structural efficiency, minimum surfaces and modular developments (close packing and hierarchies). Use of modular symmetry to create optimum structural systems.  
*Prerequisite: Architecture students should have completed first year; other students require consent of instructor*  
3 hours per week lecture/lab, Spring term  
Instructors: Dutt, Schuster, Zvilna

303* Economics  
Content: The economic structure of the urban environment; the function of the enterprise system in private, public and public-private sectors and its organizational patterns of shaping the environment.  
*Prerequisite: none*  
2 hours per week, Not offered in 1974-75

313* Computer Generated Architectural Design 2  
Input from various other courses is formulated into comprehensive data structures and simulated behaviour patterns; methods of synthesis problem-solving techniques, analysis of thought processes and protocol analyses. Project oriented course, where student chosen projects with instructor approval can be processed.  
*Prerequisite: Arch 213*  
4 hours per week, Fall or Winter term  
Instructor: Bjornstad

363* Theory of Structures 2  
Advantages, limitations and principles of indeterminate structures; analysis of continuous beams and rigid frames by consistent deformations, moment distribution, slope deflection; analysis of continuous beams having differential support settlement, of frames subjected to side-sway; analysis of pin-connected frameworks by virtual work; joint loading, thermal stresses; arches.  
*Prerequisite: Arch 263*  
4 hours per week including laboratory session, Fall term  
Instructors: Dutt, Schuster
372* Mechanical Systems 1 Plumbing and drainage; heating, ventilating and air conditioning systems; electrical distribution for power and light; illumination; acoustics, geometrics and materials; vertical transportation systems.

Prerequisite: Arch 293*, or consent of instructor

4 hours per week including laboratory session, Winter term

Instructor: Faculty

Ecology

Courses in this Theme Area prepare the student to understand the structure and function of Man in the pre-existing environment as an individual and as a social animal; to recognize and be critical of the human/physical complex and its management for desirable human goals and quality in the natural and man-made Environments.

Env St 195* Introduction to Environmental Problems A discussion of some major environmental problems and issues such as the population explosion, the impact of urbanization on man's environment, environmental pollution, resource management, conservation, and environmental planning.

Prerequisite: Not available to Man-Environment students

3 hours lecture and discussion, Fall and Winter terms

Instructors: Krueger, and E.S. Faculty

Students in the Faculty of Environmental Studies may take this course in their first or second year only.

Env St 200* Field Ecology Main concepts and principles of ecology as a basis for understanding the consequences of man-made changes in the natural environment. Cycling of elements, energetics and structural organization of major ecological systems; population dynamics; impact of natural resource management practices and urban and industrial development on the environment; incorporating environmental quality considerations into development activities; "designing with nature".

Prerequisite: 2nd, 3rd and 4th year students only

2 hours lecture, 2 hours lab, Fall and Winter terms

Instructors: Davies, George, Kitchen, Theberge

223* Human Ecology Social Behaviour as the Human/Physical Interface

The biological and psychological basis of perception and cognition of environments; factors affecting percepts, images and meanings; small groups and the social environment; the structure, functioning and change of neighbourhoods and communities.

Prerequisite: Env. Studies 195*

2 hours per week, Spring term

Env. St 252* Media Tools for Environmental Studies An introduction to the use of audio, slide, film and television formats for project presentation on environmental issues. Students will be involved in three major productions which will stress organization, content, technique and media responsibility.

Prerequisite: E.S. student only or consent of Instructor/Coordinators

3 hours per week, Fall and Winter terms

Instructor: De'Ath; Coordinators: Gough, Steele, van den Ouden
Env St 358* Environmental Pollution and its Control
Guest lecturers, expert in their respective fields, discuss air, water, soil pollution from waste products; biological, economic, political and legal aspects; technical and social control measures.

Prerequisite: none
3 hours, Fall and Winter terms
Coordinating Instructor: Farkas

Env St 380*/381* Environmental Studies Workshop
An interdisciplinary workshop focusing upon major environmental issues, with an emphasis upon problem solving processes; problem definition, obtaining the necessary data, analysis, alternative solution formulation and evaluation. Enrolment in the course is restricted.

Prerequisite: The course is open only to students in third and higher years
Coordinating Instructors: Thompson, Arch.; Mitchell, Geog.; Keith, Man-Env.; Martin, Planning.

Env St 400 Environmental Law
Conflict as the core of all aspects of environmental relationships. A review of several current conflicts in each of the three sections of the course: community planning law; ecological law; and natural resource law. As these conflicts are examined, we will isolate and define the legal tools available to the interests involved in such conflicts, and seek to understand both the effect and the limits of these tools under current legislation and practice.

Prerequisite: Third or Fourth Year Students
3 hours lecture and discussion, evening, Year
Instructors: Greenspan, Kennedy, Stuart

Design
The courses in design studio combine design fundamentals and design concepts, along with the opportunity to involve analysis and synthesis, professional and scientific insights, application of tools and methods for designing artifacts for man, and an awareness of the inherent physical characteristics and limitations of media and materials. The objectives of the studio are: (1) to guide the student in observing aspects of the physical and social environment; to find, categorize and associate the information into fundamental structures and patterns of relationships; (2) to apply theories generated in the lecture courses to situations in the physical environment, implementing by categorizing the courses into behaviour of materials, structures and mechanical systems, behaviour of man, and communications; (3) to provide the student with an opportunity to develop skill in using different “techniques” for analyzing and synthesizing problems in the physical environment; (4) to establish a relationship between faculty and students where all faculty members are consultants to the students; (5) to provide a vehicle for persons from faculties of different disciplines and from outside of the university to discuss with students their problems and projects from different points of view.
192 Design Fundamentals

*Design Fundamentals and Workshop*
Perceptual techniques and methods; principles of graphic communication, what "media" are and what are their best applications, the qualities of materials in construction and the qualitative, behavioural characteristics of structural forms and shapes; perspectives, and instrument and free-hand drawing.
Prerequisite: none
8 hours per week including lectures and workshop, Fall term
Instructors: Dutt, Elmitt, Somfray, Watts, Zvilna

193 Design Fundamentals and Studio

Space notation, serial vision; the sensory input and stimuli of the environment to man, pattern recognition; design exercises for the student to observe and communicate about action and reaction of materials in the environment, the individual responses physiologically and psychologically to objects in the environment, and the methods of communicating specific messages from man to man using graphic media.
Prerequisite: Arch. 192
14 hours per week including lectures and workshop, Winter term
Instructors: Elmitt, Somfay, Watts, Zvilna

194* Visual Interdisciplinary Language

Theory and practice of visual form based on formative processes and hierarchical structures. Propositions: form follows process, rotation is a universal form-generating process, symmetric form is a result of an asymmetric process and freedom is the single organizing principle.
Prerequisite: Consent of instructor
2 hours per week, Winter term
Instructor: Zvilna

252* Creative Problem Solving

Development of creative skills through group behaviour in problem solving sessions by: 1) developing a clear understanding of each participant's own creative thought processes; 2) increasing his ability to consciously and deliberately make use of his own creative potential; 3) engendering an awareness of the capacity to use himself and the people he works with to produce better solutions to the problems identified by the group.
Prerequisite: Consent of instructors
One 40 hour week, Winter
Instructors: Somfay, Thompson

284*, 285 Architectural Research

This offers a student an opportunity for independent research study into architectural problems not offered in the regular curriculum, guided exploration of specific architectural problem area, of appropriate complexity to the particular term.
Prerequisite: Approval of (in house) undergrad. Affairs Committee
Equivalent of 3 hours per week, Fall and Winter terms
Instructor: By arrangement
292 Design Concepts and Studio
To develop in each student the ability to design on a small, personal scale and explore design as a thinking process. Small space design exercises where the student is required to define and analyze a problem and generate an architectural solution. Solutions are refined through a series of evaluations. The finalized solution is presented and construction documents produced. 
Prerequisite: Arch 193
14 hours per week including lectures and workshops, Fall term
Instructor: Elmitt, Somfay, Zvilna

293 Design Concepts and Studio
Design involving problems of human perception and dimension in complex or large spaces, and to develop in each student the ability to generate solutions to architectural problems on a scale which involves “privacy and community”. Emphasis is placed on programming, analysis and solution evaluation. Problems of construction, servicing, and siting will be further explored. 
Prerequisite: Arch 292
14 hours per week including lectures and workshops, Spring term
Instructors: Banerji, Somfay

384*, 385* Architectural Research
This offers a student an opportunity for independent research study into architectural problems not offered in the regular curriculum. It allows guided exploration of specific architectural problem area, of appropriate complexity to the particular term. 
Prerequisite: Approval of (in house) Undergraduate Affairs Committee
Equivalent of 3 hours per week, Fall and Winter terms
Instructor: By arrangement

392 Design Concepts and Studio
Design of complex environments; the effect of legal and administrative controls on the design process and form; the influence of mechanical, structural and industrial building components on design process and architectural form. Projects will involve coordination of the design task with other disciplines involved in such projects. 
Prerequisite: Arch 293
21 Hours per week including lectures and workshops, Winter term
Instructors: Banerji, Somfay

393 Design Concepts and Studio
The analysis and exploration of relationships between physical, social, political and economic systems that influence the physical environment; techniques for defining systems that influence the physical environment; techniques for defining the patterns of interaction and predicting the influence on physical form involving other disciplines; projects to explore the techniques and design with others at the city or community scale. 
Prerequisite: Arch. 392
21 hours per week including lectures and workshop, Fall term
Instructors: Banerji, Thompson
School of Architecture

Culture

Courses in cultural history give the student a critical and creative understanding of the basic ingredients of all creative work, recognizing the seemingly unrelated forces for change in the cultural history of man, and comprehending the present as a part of the historical past. Open to any University student upon consent of instructor. No prerequisites are required for these courses except for Architecture students.

142* Iconography 1 Conventions
Selected schemes of order, such as fate, providence, natural law, the human will, as expressed in plays, poems, and fiction from various ages; selected conventions in literature, cinema, and the visual arts; the development of one or two archetypal symbols in literature and the visual arts; directed to lead into more detailed studies of symbolic patterns in Iconography 2.
Prerequisite: none
4 hours per week including laboratory session, Fall term
Instructors: Cummings, Wiljer

143* Iconography 2 A survey of the symbolic Nature of the Environment
A study centred on ancient life to initiate the student into the stream of cultural history and the complex problems of what the artist is, the quality of human existence, culture, environment, as well as the working of the icon from raw state of perceived image to its function as an expressive symbol in poetry, music, dance, architecture and other works of art; a study of modern work in comparison to ancient achievement.
Prerequisite: Arch. 142*
4 hours per week including laboratory session, Winter term
Instructors: Cummings, Wiljer

244* History of Gardens of Europe and Western Asia
To study the garden as a work of art reconciling man with his world and to examine gardens of Europe, Western Asia, Ancient Greece, the Roman Empire and the countries of Islam and mediaeval Europe, as specific responses of the age and the climate and landscape of the country in which they were formed.
Prerequisite: Arch. 142*, 143* and 246* for architecture students and completion of first year for others.
Two hours lectures in first half of the course and three hours discussions in second half of the course, Fall term
Instructor: Watts

245* Survey of Contemporary Architecture
Formative years in Europe, early North American scene, study of contemporary works in Architecture, analyses of important buildings of twentieth century. Philosophies of internationally known architects and designers. Study of the development of architectural styles, trends and schools of thought in North America and other countries.
Prerequisite: Students who have completed first year
Two hours lectures and one hour tutorial per week, Winter and Spring – depending on faculty resources available
Instructor: Banerji
246* Foundations of Europe  
Sense of Periods and Styles  
Recognition of patterns of life and concepts of order and conduct, models of the universe and other, moving metaphors and myths by means of study of the thoughts, acts, art, architecture, technology, literature, music and town design of the West from the break-up of the Roman Empire until the Renaissance.  
Prerequisite: Arch. 143*  
4 hours per week including laboratory session, Fall term  
Instructors: Cummings, Wiljer

247* Renaissance to Revolution  
Sense of Periods and Styles  
Analysis of the various styles emerging out of provincial and international Gothic, especially Italian use of classical models, the spread of this “renaissance” mode, leading to consideration of the Mannerist, the Baroque, the Rococo, the Neoclassical; investigation of the course of men’s attitudes from humanism, nationalism, and Reformation through the Enlightenment until the French Revolution and Hume’s dethronement of Reason.  
Prerequisite: Arch. 246*  
4 hours per week including laboratory session, Spring term  
Instructors: Cummings, Wiljer

346* Romanticism and 20th Century  
Sense of Periods and Styles  
Depiction of “modern” culture as one in which the notion of environmental order as the fulfilling of natural law is replaced by a notion of order as the creation of the autonomous human will through a study of selected works in philosophy, literature, art and architecture.  
Prerequisite: Arch 247* or consent of instructor  
4 hours per week including laboratory session, Winter term  
Instructors: Cummings, Wiljer

347* The Roots of Civilization  
The course attempts to establish a basis for the understanding of the functions of myth, ceremony and ritual, the structures of primitive and ancient built environments, man’s attitude towards nature, and his use of the resource environment, the development of classical culture, and the beginnings of science.  
Prerequisite: Arch 346* or consent of instructors  
4 hours per week including laboratory session, Fall term  
Instructors: Cummings, Wiljer

Courses for Bachelor of Architecture Programme

The courses for the Bachelor of Architecture Programme are intended to prepare the student to demonstrate professional skill in separating, organizing, and conceptualizing actual problems in the man-made environment in his role as an architect, alone and in a team; to synthesize mechanical, structural and functional systems into architectural expressions which adapt to social needs and aspirations of society, user, client and community, alone and with the help of others; to adapt his skills to (a) real world constraints, (b) to the evolution of social, economic and technological changes, and (c) to influence change both in constraints and evolution, alone and with the aid of others; to communicate skillfully, verbally and graphically, the solutions to environmental
problems and know the current methods and procedures in professional practice for defining and solving environmental problems; to organize patterns of behaviour which assure continuing development for professional competence and relevance at all times; and to pass the examination for registration as an architect if he aspires to become a practising professional.

423* Urban Planning
Introduction to urban theory to understand the forces of obsolescence and change and to critically analyze and define patterns of interaction in the urban scene, the changing ecological structure of the city and consideration of the technological, economic and social forces accounting for these changes; ecological and location theories; accelerated urbanization; large scale urban systems.
Prerequisite: none
2 hours per week, Fall term

452* Specifications
Architectural working drawings and specifications; bidding requirements; general conditions; general requirements trade divisions; reference and source material; assembly and reproduction; structural, mechanical and electrical consultants.
Prerequisite: B.E.S. standing
2 hours per week, Spring term
Instructor: Faculty

455* Management and Estimating
Exposure of the student to the administrative responsibilities of the practicing architect's work in the building industry, which includes: bidding, bid opening and analysis; contract award; administration of the contract, contractors organization; subcontractors; labour relations, estimating and cost control.
Prerequisite: B.E.S. standing
3 hours per week, Fall term
Instructor: Faculty

462* Structural Synthesis 1 Steel and Concrete Design
Design and behaviour of structural steel systems, application of current building specifications, proportioning structural elements based on pertinent design considerations; preliminary design of structural steel frames, connections, bolted and welded; criteria for choosing steel systems; introduction to plastic design.
Prerequisite B.E.S. standing
4 hours per week including laboratory session, Spring term
Instructors: Dutt, Schuster

463* Structural Synthesis 2 Concrete and Timber Designs
Design and behaviour of structural concrete systems, application of building specifications; analysis and design of concrete elements using ultimate strength principle; criteria for choosing structural concrete systems; introduction to prestressed concrete. Behaviour and design of modern wood structures; fasteners, ring connectors and their significance in timber construction; proportioning and design of sawed and laminated timber members.
Prerequisite: Arch. 462*
4 hours per week including laboratory session, Fall term
Instructors: Dutt, Schuster
472* Mechanical Systems 2
Heating, ventilating and air conditioning systems for buildings; plumbing and drainage; electrical distribution for power and light in buildings; illumination; acoustics, geometries and materials; and vertical transportation systems.
Prerequisite: Arch. 372*
3 hours per week including laboratory session, Spring term
Instructor: Faculty

484*, 485 Architectural Research
This offers a student an opportunity for independent research study into architectural problems not offered in the regular curriculum. It allows guided exploration of specific architectural problem area, of appropriate complexity to the particular term.
Prerequisite: Approval of (in house) Undergrad. Affairs Committee
Equivalent of 3 hours per week, Spring and Fall terms
Instructor: By Arrangement

554* Development and Financing
Introduction to the important determinants of the development, growth and re-planning of the various man environments, including development law, land use development, land use planning, appraisal, mortgage lending and accounting.
Prerequisite: Arch. 455*
3 hours per week, Fall term
Instructor: Faculty

555* Architectural Practice
The Profession
Discussion of the legal and ethical aspects of architectural practice in Canada and in Ontario in particular, contracts, bonds and insurance, mechanics liens, by-laws and regulations, architectural partnership. The legal background, client-architect relations, partial services, professional problems.
Prerequisites: B.E.S. standing
2 hours per week, Winter term
Instructor: Faculty

563* Suspended and Space Structures
State-of-the-art review of cable-suspended construction. Analysis of cable networks, basic equations. Effect of live loads on cables; dynamic considerations. Double cable systems; synclastic and anticlastic surfaces. Cable-stayed systems; analysis of space structures; space frames and roof systems; one and two-way design.
Prerequisite: 4B architecture standing or equivalent
3 hours per week, Winter term
Instructors: Dutt, Schuster

584*, 585* Architectural Research
This offers a student an opportunity for independent research study into architectural problems not offered in the regular curriculum. It allows guided exploration of specific architectural problem area, of appropriate complexity to the particular term.
Prerequisite: Approval of (in house) Undergrad. Affairs Committee
Equivalent of 3 hours per week, Fall and Winter terms
Instructor: By Arrangement
492, 493 Design Studio

The intent of the course is to develop skills and gain experience in architectural design through the application of design and analysis techniques to complex building types. This is approached through a series of design projects aimed at the exploration of generative factors in the definition of built form. Projects are closely related to existing contexts and parallel current practicing conditions. Both individual and group work are included.

Prerequisites: B.E.S. or its equivalent

21 hours per week in both 492 and 493, Spring and Fall terms

592, 593 Design Studio

The course provides an opportunity for the student to select an area of concentration for study and design in depth. A thesis topic is to be submitted and approved during term 8 (4b) and all research work completed by the end of the 8 month co-op work term 5. Terms 9 and 10 (5a and 5b) will be spent developing the thesis for presentation during term 10. The thesis is to be a vehicle for thinking and design at an innovative level. Thus considerable emphasis is placed on formulation of policy and development of design solutions from the knowledge gained during the research period.

Prerequisite: 492 and 493

32 hours per week in both 592 and 593, Winter and Spring terms

Electives

Students are permitted to study courses given by the University at large which are in the area of the student's individual interest. This will hopefully provide better orientation and more interdisciplinary communications relevant to the student's academic pursuits.

Electives are divided into the following two categories:

(TE) Theme Elective (B.E.S. Degree) courses within the Faculty of Environmental Studies which deal with ecological issues.

Theme Elective (B.Arch Degree) any course within the School of Urban and Regional Planning.

Each student pursuing a B.E.S. degree must have accumulated one and a half course credits in the theme area of Ecology by or before his 6th academic term.

Each student pursuing a B.Arch. degree must have one half course credit in the theme area of Planning by or before his 10th academic term.

(FE) Free Elective Courses selected by the student without restrictions as long as the course is approved by Senate. Departmental approval is suggested.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Class of</td>
<td>1A</td>
<td>1B</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
<td>1A</td>
</tr>
<tr>
<td>Terms</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
</tr>
</tbody>
</table>
# Recommended Core Programme for the Degree of Bachelor of Environmental Studies

<table>
<thead>
<tr>
<th>Theme Areas</th>
<th>Term 1 (1A) Fall</th>
<th>Term 2 (1B) Winter</th>
<th>Spring</th>
<th>Term 3 (2A) Fall</th>
<th>Winter</th>
<th>Term 4 (2B) Spring</th>
<th>Fall</th>
<th>Term 5 (3A) Winter</th>
<th>Spring</th>
<th>Term 6 (3B) Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Systems and Measures</strong></td>
<td></td>
<td></td>
<td>Off Term</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>½ Arch 102* Math</td>
<td>½ Arch 103* Stats</td>
<td></td>
<td>½ Arch 212* or FE Computer Science Simulation</td>
<td></td>
<td>½ Arch 213* or FE Computer Generated Design</td>
<td></td>
<td>½ Arch 303* or FE Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>½ Arch 112* Comp Sci</td>
<td>½ Arch 113* Comp Sci</td>
<td></td>
<td>½ Arch 262* Statics</td>
<td></td>
<td>½ Arch 263* Theory of Structures 1</td>
<td></td>
<td>½ Arch 313* or FE Computer Generated Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>½ Arch 163* Stats</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>½ Arch 372* Mechanical Systems 1</td>
<td></td>
<td>½ Arch 363* Theory of Structures 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>½ Arch 303* or FE Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ecology</strong></td>
<td>½ E.S. 195* Man and His Environment</td>
<td></td>
<td></td>
<td>½ E.S. 200* or TE Ecology and the Ecosystem</td>
<td></td>
<td>½ Arch 223* or TE Human Ecology</td>
<td></td>
<td>½ Arch 303* or FE Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>½ Arch 313* or FE Computer Generated Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Culture</strong></td>
<td>½ Arch 142* Iconography 1</td>
<td>½ Arch 143* Iconography 2</td>
<td></td>
<td>½ Arch 246* Foundations of Europe</td>
<td></td>
<td>½ Arch 247* Renaissance to Revolution</td>
<td></td>
<td>½ Arch 346* or FE Romanticism and 20th Century</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>½ Iconography 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>½ Arch 303* or FE Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td>1 Arch 192 Design Fundamentals</td>
<td>1½ Arch 193 Design Fundamentals and Studio</td>
<td></td>
<td>½ Arch 292 Design Concepts and Studio</td>
<td></td>
<td>½ Arch 293 Design Concepts and Studio</td>
<td></td>
<td>Arch 392 Design Concepts and Studio</td>
<td></td>
<td>2 Arch 393 Design Concepts and Studio</td>
</tr>
</tbody>
</table>

**Note**

- **Bold blocks** indicate elective courses: see section on electives.
- **(TE)** Theme elective in the same theme area with Department approval (see section on electives).
- **(FE)** Free elective with Department approval (see section on electives).
- † This indicates as shown in the small squares the credit value of the course.
Recommended Core Programme for the Degree of Bachelor of Architecture

<table>
<thead>
<tr>
<th>Winter</th>
<th>Theme Areas</th>
<th>Term 7 (4A) Spring</th>
<th>Term 8 (4B) Fall</th>
<th>Winter</th>
<th>Spring</th>
<th>Term 9 (5A) Fall</th>
<th>Term 10 (5B) Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-op Work Term 4</td>
<td>Systems and Measures</td>
<td>½ Arch 452* Specifications</td>
<td>½ Arch 455* or FE Management and Estimating</td>
<td>Co-op Work Term 5</td>
<td>½ Arch 554* or FE Development and Financing</td>
<td>½ Arch 555* Architectural Practice</td>
<td></td>
</tr>
<tr>
<td>Term 4</td>
<td>½ Arch 472* Mechanical Systems 2</td>
<td>½ Arch 462* Structural Synthesis 1</td>
<td>½ Arch 463* Structural Synthesis 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term 5</td>
<td>½ Arch 423* or 1E Urban Planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term 6</td>
<td>½ Arch 492 Design Studio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term 7</td>
<td>½ Arch 493 Design Studio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term 8</td>
<td>3 Arch 597 Design Studio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Term 9</td>
<td>3 Arch 593 Design Studio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note
- Bold blocks indicate elective courses; see section on electives.
- (TE) Theme elective in the same theme area with Department approval (see section on electives).
- (FE) Free elective with Department approval (see section on electives).
- † This indicates as shown in the small squares the credit value of the courses.
Department of Geography

Professor and Chairman of the Department
R. M. Irving, B.A., M.A.(Toronto), Ph.D. (Minnesota)

Professor and President of the University
B. C. Matthews, B.S.A.(Toronto), A.M.(Missouri), Ph.D.(Cornell)

Professor and Dean of Environmental Studies

Associate Professor and Associate Chairman
G. R. McBoyle, B.Sc., Ph.D.(Aberdeen)

Associate Professor and Associate Dean (Environmental Studies (Graduate Affairs))

Associate Professor and Associate Dean (Environmental Studies Undergraduate Affairs)
A. G. McLellan, B.Sc., Ph.D.(Glasgow), (on Sabbatical leave 1974-1975)

Associate Professor and Graduate Officer

Assistant Professor and Undergraduate Officer
C. R. Bryant, B.A., Ph.D.(London School of Economics)

Associate Professors
A. Diem, B.A.(Wayne State), M.A.(Clark), Ph.D.(Michigan)
D. K. Erb, B.Sc.(Western), M.A.(Toronto), Ph.D.(McGill)
R. R. Krueger, B.A., M.A.(Western), Ph.D.(Indiana)
R. E. Preston, B.A., M.A.(Washington), Ph.D.(Clark)
H. D. Steiner, M.Sc., Ph.D.(Zurich) (on Sabbatical leave 1974-1975)

Associate Professors
R. A. Bullock, B.A., M.A. (Belfast), Ph.D.(London)
J. S. Gardner, B.Sc.(Alberta), M.Sc., Ph.D. (McGill)
A. B. Kesik, M.A., Ph.D. (UMCS - Lublin, Poland)
G. G. Mulamoottil1, B.Sc.(Mysore), M.Sc.(Bombay), Ph.D. (Delhi)
G. B. Priddle2, B.A.(Western), M.A., Ph.D.(Clark) (on Sabbatical leave, Winter 1975)
L.H. Russwurm, B.A., M.A.(Western), Ph.D.(Illinois)

Assistant Professors
T. E. Bunting, B.A.(York), M.A.(Western)
B. Hyma4, B.S., M.S.(Madras), M.S.(Sheffield), Ph.D.(Pittsburgh)
C. M. Kitchen2, B.A.(Queen's), M.A.(Waterloo)
E. R. Officer, B.A.(U.B.C.), M.A.(Wisconsin)
R. A. Patrick, B.A., M.A.(Queen's), Ph.D.(London School of Economics)

Lecturer and Cartographer
A.E. Hildebrand, B.A.(Toronto)

Faculty members holding cross or joint appointments as shown:
1 Planning, Geography and Biology
2 Geography and Planning
3 Architecture, Geography, Man-Environment Studies, and Planning
4 Renison College and Geography
The following represents a grouping of the course offerings of the Department of Geography according to subject matter. This should act as an additional guide in selecting courses. The course descriptions themselves are found after this and are in numerical order.

### Human Geography

#### General/Introductory
- 101* Introduction to Human Geography
- 195* Introduction to Environmental Problems
- 202* Some Basic Topics of Economic and Urban Geography
- 203* Some Basic Topics of Cultural and Regional Geography

#### Cultural, Historical, Political
- 232* Geography of Population
- 330* Cultural Geography
- 331* Special Topics in Cultural Geography
- 332* Special Topic in the Geography of Population
- 341* Historical Geography of Canada 1
- 342* Historical Geography of Canada 2
- 345* Political Geography
- 445* Advanced Political Geography

#### Regional
- 125R* Introduction to the Developing World
- 126R* The Emerging "Third" World
- 225R* Urbanization in Newly Developing Countries
- 226R* Population Growth and Resource Development in "Third World" Countries
- 320 World Regional Geography
- 426-432 Different World Regions
- 127* Regional Problems of Europe
- 421 Europe and the Mediterranean
- 423 Central and Eastern Europe
- 321* Geographic Perspectives on Contemporary Problems of the American Society
- 322* Geographical Study of Canada
- 323* Geographical Study of a Selected Region
- 422* Canada
- 324* Soviet Geography
- 424* Soviet Geography
- 325* Africa
- 425* Africa

#### Resource Management
- 310* Advanced Economic Geography 1 Resources Management
- 357* Conservation and Resource Management
- 410* Recreation Geography
- 411* Resource Studies
- 413* Behavioural Studies
- 358* Environmental Pollution and its Control
- 380*/381* Environmental Studies Workshop
- 400* Environmental Law
- 414* Resources Management Workshop

#### Industrial
- 311* Advanced Economic Geography 2 Manufacturing and Transportation
- 412* Industrial Geography
Department of Geography

**Rural**
315* Agricultural Geography
452* Problems of Rural Land Use

**Urban**
251* Urban Areas in North America
350* Regional Urban Systems 1
450* Regional Urban Systems 2
349* The City as a System 1
440* The City as a System 2

**Miscellaneous**
475* Special Readings and Seminar on Selected Topics
476* Special Readings and Seminar on Selected Topics

**Physical Geography**

**General/Introductory**
102* Introduction to Physical Geography
200* Field Ecology
201* Some Basic Topics of Physical Geography

**Ecology**
451* Soils Geography
460* Land Dereliction and Rehabilitation

**Climatology**
301* Climatology
408* Special Topics in Climatology and Natural Hazards

**Geomorphology**
300* Geomorphology and the Southern Ontario Environment
302* Geomorphological Processes
303* Physical Basis and Geography of Water
400* Climatic and Periglacial Morphology and Geomorphological Surveying
401* Glacial Geomorphology and Some Contemporary Applications
402* Physical and Chemical Processes in Geomorphology
406* Tropical Geomorphology
407* Field and Lab Techniques in Geomorphology

**Techniques and Methodology**

**General**
270* Introduction to Cartography and Air Photo Interpretation
252* Media Tools for Environmental Studies

**Cartography**
260* Introduction to Cartography and Map Analysis
360* Preparation of Maps and Illustrations
403* Advanced Cartography 1
404* Advanced Cartography 2

**Remote Sensing**
275* Introductory Air Photo Analysis and Remote Sensing
375* Air Photo Interpretation and Remote Sensing 1
470* Air Photo Interpretation and Remote Sensing 2
471* Air Photo Interpretation and Remote Sensing 3
Quantitative Analysis
- 271* Introduction to Quantitative Research Methods
- 272* Computer Programming and Selected Terminal Systems
- 307* Social Survey Techniques
- 316* Multivariate Statistics
- 317* Nonparametric Statistics
- 318* Spatial Analysis
- 319* Regional Planning Techniques

Independent Research Oriented
- 110* Tutorial in Geography
- 391* Field Research
- 430 Field Research in Regional Geography
- 490 Senior Honours Research Essay

Nature and Philosophy of Geography
- 381* The Nature of Geography
- 480* Development of Geographic Thought
- 481* Frontiers in Geography

Note 1: Fields of interest with a small number of offerings are often augmented by offerings in other departments.

Note 2: There is obviously considerable overlap in terms of fields of interest between many of the above categories.

101* Introduction to Human Geography
An introduction to the nature of human geography through a survey of some of the central problems, concepts, methods, techniques and applications of contemporary geographic analysis of man's cultural environment. Two overriding themes are emphasized: the man-land theme, which focuses on the study of the impact of man through time on the landscape, and the locational analysis theme, which focuses on the study of spatial structure and dynamics of socio-economic systems.

No prerequisite.
2 hours lectures, 2 hours lab, Fall and Winter terms
Instructors: Patrick and other faculty

102* Introduction to Physical Geography
An ecosystem approach to physical geography is employed which emphasizes that man's natural environment is an integrated system of which man is a part. A systems approach is used to study selected aspects of weather and climate, soils, biogeography, and landforms. Stress is placed on the flows of energy, water and matter and the resultant effects on the subsystems of the natural environment.

No prerequisite.
2 hours lectures, 2 hours lab, Fall and Winter terms
Instructors: Gardner, Russwurm

110* Tutorial in Geography
A tutorial for first year geography majors designed to promote close contact with a faculty member. Students will follow a personalized programme within the realm of geography. Times and meetings will be arranged individually.

No prerequisite.
Fall and Winter terms
Instructors: Faculty
125R* Introduction to the Developing World
An introduction to problems of population growth, resource development, cultural diversity, and of industrial and urban growth in developing areas of the world. Contemporary problems of economic, cultural and demographic differences will be examined in selected regions of Asia and Africa.
No prerequisite.
3 hours, Fall term
Instructor: Hyma

126R* The Emerging "Third World"
The emergence of the "Third World" in international relationships. Background factors: the impact of occidental culture in colonial and post-colonial times; changes in technology, economic organization, rapid population growth, resource development problems, political unrest. The challenge to the wealthy, industrialized countries posed by the needs of the populations of Africa and Asia.
No prerequisite.
3 hours, Winter term
Instructor: Hyma

127* Regional Problems of Europe
An introduction to the geography of Europe which examines agricultural, industrial and urban problems. Lectures, discussions and visual presentations based on field experience of instructors.
One two hour seminar, Winter term
Instructor: Diem

Environmental Studies 195*
Introduction to Environmental Problems
A discussion of some major environmental problems and issues such as the population explosion, the impact of urbanization on man's environment, environmental pollution, resource management, conservation, and environmental planning.
Not available to Man-Environment students.
2 hours lecture, 1 hour lab, Fall and Winter terms
Instructors: Krueger, and E.S. Faculty

Note Students in the Faculty of Environmental Studies may take this course in their first or second year only.

Environmental Studies 200*
Field Ecology
To introduce the main concepts and principles of ecology as a basis for understanding the consequences of man-made changes of the natural environment. Cycling of elements, energies and structural organization of major ecological systems; population dynamics; impact of natural resource management practices and urban and industrial development on the environment; incorporating environmental quality considerations into development activities; "designing with nature".
Prerequisite, 2nd, 3rd, and 4th year students only
2 hours lecture, 2 hours lab, Fall and Winter terms
Instructors: Davies, Kitchen, Mulemoottil, Theberge

Note For 2nd, 3rd, and 4th year students only.
201* Some Basic Topics of Physical Geography
Further study of energy and matter flows in the atmosphere and on the land (begun in Geography 102*). Specific topics of study include global radiation balances, energy flux at the land-air interface, weather modification, urban climates, climate classification systems, the physical processes in the pollution of land, air and water, the dynamics and morphology of stream systems and glacial landform systems.
Prerequisite: Geography 102*
2 hours lectures, 2 hours lab, Fall term
Instructors: McBoyle, Russwurm

202* Some Basic Topics of Economic and Urban Geography
An analysis of the locational structure of economic activities. Basic concepts and tools are explained; these are used to analyse the location structure of primary, secondary and tertiary activities. Throughout, an attempt is made to evaluate the locational models under discussion by reference to case studies. The analysis is placed in the overall context of regional development.
Prerequisite: A first-year human geography course
2 hours lectures, 2 hours lab, Winter term
Instructors: Bryant, Preston

203* Some Basic Topics of Cultural and Regional Geography
The approach of the regional geography is illustrated by reference to one or more world regions. Political, social and historical processes are studied as they affect man’s perceptions of his environment and the identification of culture regions.
Prerequisite: A first-year human geography course
2 hours lectures, 2 hours lab, Winter term.
Instructors: Bater, Bullock

225R* Urbanization in Newly Developing Countries
An analysis of the factors behind the rapid urbanization of selected areas in Asia, Africa and Latin America, with an examination of related problems of urban planning and development control policies.
No prerequisite.
3 hours, Fall term
Instructor: Hyma

226R* Population Growth and Resource Development in "Third World" Countries
A discussion of some major problems of population explosion, food supply and economic development faced by the developing countries of the World. The course also covers technological and ecological aspects of international agricultural development. Emphasis will be placed on case studies of selected countries from Tropical Africa, Asia, Tropical South America and the Caribbean region.
No prerequisite.
3 hours, Winter term
Instructor: Hyma

232* Geography of Population
No prerequisite.
2 hours lectures, 1 hour lab, Fall term
Instructor: Hyma
251* Urban Areas in North America
An introduction to some basic concepts in urban studies emphasizing a systematic approach to processes and problems of urban development in North America, particularly in Canada. The course is staffed by faculty members from different departments and is designed to present an interdisciplinary perspective on urban systems.
No prerequisite.
3 hours lecture, Fall term
Instructor: Bunting

Environmental Studies 252*
An introduction to the use of audio, slide, film and television formats for project presentation on environmental issues. Three productions in the term will stress organization, content, technique and media responsibility.
Prerequisite: E.S. students only or consent of Instructor / Coordinators
3 hours per week, Fall and Winter terms.
Instructor: C. De'Ath;
Coordinators: Gough, Steele, van den Ouden

260* Introduction to Cartography and Map Analysis
Basic concepts involved in the analysis and use of existing types of cartographic products. Background theory of the production and reproduction of topographic and thematic maps, including historical development, collection of data and symbolization.
Prerequisite: Geography 102*
2 hours lectures, 2 hours lab, Fall term
Instructor: Hildebrand

270* Introduction to Cartography and Air Photo Interpretation
Principles of the presentation of the earth's surface on maps and air photographs. Basic techniques of map compilation and reproduction. Interpretation of air photographs primarily in the field of resource inventory.
No prerequisite.
2 hours lectures, 2 hours lab, Winter term
Instructors: Erb, Hildebrand

271* Introduction to Quantitative Research Methods
An introduction to scientific method; descriptive and inferential statistics; sampling design. The course emphasizes the methodological and interpretative problems involved in using selected quantitative methods to investigate selected environmental topics. This course is the same as Plan 271* and M.Env. 271*. The Department of Geography strongly recommends that students, who have not had Grade 13 Maths., take Math 85*.
Prerequisite: only for students in General or Honours Geography, Planning, Man-environment, or Architecture.
2 hours lecture, 1 hour lab, Fall and Winter terms
Instructors: Semple and other faculty

272* Computer Programming in Environmental Studies
The course emphasizes programming skills and applications in the context of environmental problems.
Cross listed.
Prerequisites: Geog./M.-Env./Plan 271*, or consent of instructor
3 hours, Winter term
Instructor: Semple
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisites</th>
<th>Credit Hours</th>
<th>Instructor(s)</th>
<th>Term(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>275*</td>
<td>Introductory Air Photo Analysis and Remote Sensing</td>
<td>Basic techniques of handling air photos, viewing them stereoscopically (in 3D), identifying and describing features, making measurements and in general, their use in the broad field of geographic and environmental studies. Introduction to specialized types of air photos, satellite imagery and remote sensing techniques.</td>
<td>Prerequisite: Geography 102* and a first-year human geography course.</td>
<td>2</td>
<td>Kesik</td>
<td>Fall and Winter terms</td>
</tr>
<tr>
<td>300*</td>
<td>Geomorphology and the Southern Ontario Environment</td>
<td>This course will emphasize field work and field trips designed to explore the evolution of S. Ontario landforms. The identification of landforms, landform assemblages and their relationships will be emphasized. A few techniques, e.g. surveying and levelling, particle size analysis, and till fabric analysis which help in the systematic collection and analysis of field data will be used. There will be a $15. charge per student for field trip expenses.</td>
<td>Prerequisite: Geography 201*, or Earth Sciences 130 or consent of instructor.</td>
<td>2</td>
<td>Kesik</td>
<td>Fall term</td>
</tr>
<tr>
<td>301*</td>
<td>Climatology</td>
<td>Advanced study of the elements and mechanics 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.</td>
<td>Prerequisite: Geography 201* or consent of instructor.</td>
<td>2</td>
<td>McBoyle</td>
<td>Winter term</td>
</tr>
<tr>
<td>302*</td>
<td>Geomorphological Processes</td>
<td>The impact of processes in landform development and modification will be analyzed. Techniques of measurement will be discussed particularly as they show the impact of changes over time. Special areas of concern will be mass movement, weathering and morphological changes under different climatic conditions and processes connected with glaciation and deglaciation, and collion, karst, coastal and fluvial landforms.</td>
<td>Prerequisite: Geography 201* or Earth Sciences 130 or consent of instructor.</td>
<td>2</td>
<td>Gardner</td>
<td>Fall term</td>
</tr>
</tbody>
</table>
303* Physical Basis and the Geography of Water

The geography of water, including the various forms of snow and ice, will be reviewed. In discussing the physical characteristics of water, the uniqueness and importance of the substance as an environmental element will be made apparent. Specific topics will include: the earth's water balance and cycle, the oceans, lakes and swamps, snow cover, ground ice, glacier ice and streams. Special attention will be directed to the impact of water on the earth's surface, the role of water in the workings of the earth's system, and water as a resource and hazard. Some field work will be involved.

Prerequisite: Geography 201* or consent of instructor. Enrollment limited to 25 students
2 hours lectures, 2 hours lab, Winter term
Instructor: Gardner

307* Social Survey Techniques

Social research and the planning process; interview and self administered surveys; questionnaire design; profile data; sampling; data processing; non-survey data collection techniques; practical applications. This course is the same as Plan. 307*.

Prerequisite: May be taken in 2nd or 3rd year
2 hours lectures, 1 hour practical or discussion, Fall and Winter terms
Instructor: to be arranged

310* Advanced Econ. Geog.
1 Resources Management

Theoretical and conceptual approaches to resources studies; evaluation of management practices in fisheries, forestry, petroleum, minerals and water; research techniques.

Prerequisite: Geography 202* or consent of instructor
3 hours, Fall term
Instructor: Mitchell

311* Advanced Econ. Geog.
2 Manufacturing and Transportation

Studies in the geography of manufacturing and transportation; further development of theory and empirical studies of Canada and the United Kingdom.

Prerequisite: Geography 202* or consent of instructor
3 hours, Fall term
Instructor: to be arranged

315* Agricultural Geography

The study of agriculture as a system, and an analysis of the geographical dimensions of agricultural systems. Using concepts developed in the first part of the course, a number of issues will be investigated, such as the diffusion of innovations and the regional evolution of agricultural structure. Finally, the discussion will focus on structural problems in agriculture through a comparative study of programs of government intervention in agriculture in Canada and Europe.

Prerequisite: Geography 202* or consent of instructor
3 hours, Fall term
Instructor: Bryant

316* Multivariate Statistics

The theory and application of multivariate statistics, with particular emphasis upon the computer. Same as Plan 316*.

Prerequisite: Geography 271* or consent of instructor
3 hours seminar and/or tutorial, Fall term
Instructor: to be arranged
317* Nonparametric Statistics
The theory and application of nonparametric statistics, with particular emphasis upon social science problems. Same as Plan 317*.
Prerequisite: Geography 271* or consent of instructor
2 hours lectures, 1 hour practical or discussion, Winter term
Instructor: Mitchell

318* Spatial Analysis
Advanced quantitative analysis applied to spatial patterns and interactions. The course will focus on a selection of techniques from gravity models, linear programming, nearest neighbour analysis, Markov chain analysis, graph theory, simulations, and trend surface analysis. This course is the same as Plan 318*.
Prerequisite: Geography 271* or consent of instructor
3 hours, Winter term
Instructor: to be arranged

319* Regional Planning Techniques
Discussion, appraisal and application at the regional level of selected economic techniques – specifically, cost-benefit analysis, planning-programming-budgeting systems and input-output analysis. This course is the same as Plan 319*.
Prerequisite: Economics 101* or consent of instructor
3 hours seminar and/or tutorial, term to be arranged
Instructor: to be arranged

320 World Regional Geography
Study in depth of selected areas of the world's climatic regions, emphasizing characteristic problems as well as their physical, cultural and economic interrelationships. Utilization of natural resources, the effects of increasing population density, the occupancy and utilization of urban and rural lands, and the effects of man's tools, techniques and institutions on the earth's surface.
No prerequisite
2 hours lectures, 2 hour lab, Year
Instructor: Diem

321* Geographic Perspectives on Contemporary Problems of the American Society
Focus on three critical problem areas of contemporary life in America: natural resources and environmental quality, regional economic disparities, management of large metropolitan systems. Student participation by means of collective project-seminar work. Liberal use of audio-visual materials to generate interest, to spark discussion and to serve as a substitute for the field experience.
Prerequisite: Any half course in human geography or consent of instructor
3 hours, Winter term
Instructor: to be arranged

322* Geographical Study of Canada
Geographical basis of Canada and Canadian issues. Selected problems relating to environmental quality, urbanization, regional and resource development. This course is the same as Plan 222*.
No prerequisite
3 hours, Fall term
Instructor: Krueger
323* Geographical Study of a Selected Region
A geographical analysis of a selected region and its current problems. The region chosen in any given year will depend on the specialized knowledge of faculty available and student demand.
_No prerequisite_
_Not offered 1974-75_

324* Soviet Geography
Introduction to the geography of the Soviet Union, with a focus on selected problems in urbanization, industrialization, resource use and regional economic development in a planned economy.
_No prerequisite_
_3 hours, Fall term_
_Instructor: Bater_

325* Africa
The geography of modern Africa south of the Sahara in the context of changing attitudes to the continent on the part of the “developed” countries.
_No prerequisite_
_3 lectures, Fall term_
_Instructor: Bullock_

330* Cultural Geography
Problems in the delimitation of cultural regions. A study of the diversity of man in his relations with his environment.
_No prerequisite_
_3 lectures, Fall term_
_Instructor: Bullock_

331* Special Topics in Cultural Geography
A detailed investigation of selected issues in man’s relations with the natural environment. Given as a seminar. Issues will be partially selected on the basis of the interests of participants.
_Prerequisite: Geography 330* or consent of instructor_
_Not offered 1974-75_

332* Special Topic in the Geography of Population
Detailed study of selected topics of population geography.
_Prerequisite: Geography 330* or consent of instructor._
_3 hours, Winter term_
_Instructor: Hyma_

341* Historical Geography of Canada 1
The changing geographies of settlement and resource use from the Discoveries to the early nineteenth century.
_Prerequisite: Geography 203* or consent of instructor_
_3 hours, Fall term_
_Instructor: Officer_

342* Historical Geography of Canada 2
The changing geographies of settlement and resource use in the nineteenth and early twentieth centuries.
_Prerequisite: Geography 203* or consent of instructor_
_3 hours, Winter term_
_Instructor: Officer_
345* Political Geography  
A systematic approach embracing a general introduction to methodologies and subjects central to the field. Case studies and discussion subjects will be selected on the basis of student interests.  
Prerequisite: A second year human geography course or consent of instructor  
3 hours, Fall term  
Instructor: Patrick  

349* The City as a System 1  
An examination of theories, models, and research procedures appropriate to the study of internal urban structure. The course focuses on the analysis of city-wide processes. Topics include urban land use, spatial economic processes, transportation and interaction, urban systems, individual spatial behaviour, decision-making (public and private), urban growth, and the processes of development and redevelopment.  
Prerequisite: Geography 202* or 251* or consent of instructor  
3 hours, Fall term  
Instructor: Bunting  

350* Regional Urban Systems 1  
An examination of theories, models, and research procedures appropriate to the study of the external structure and function of urban centres and their role in the spatial economy. Focuses on the growth and support of urban centres and city systems, on relationships between aspects of urbanization and regional development, on the outward growth of cities, and on analytical techniques useful in studying such topics.  
Prerequisite: Geography 207*, Geography 251* or consent of instructor  
3 hours, Fall term  
Instructor: Bunting  

357* Conservation and Resource Management  
History of the conservation movement; ecological principles of conservation and resource management and the development of resources. Analysis, use and planning of recreational resources. The course is the same as Plan. 357* and M. Env. 357*.  
Prerequisite: Env. S. 200* and only for 3rd and 4th year students  
3 hours, Winter term  
Instructors: Davies, Fisher  

Environmental Studies 358*  
Environmental Pollution and its Control  
Guest lecturers, expert in their respective field, discuss air, water, and soil pollution from waste products; biological, economic, political and legal aspects; technical and social control measures. No prerequisite  
3 hours, Fall and Winter terms  
Coordinating Instructor: Farkas  

360* Preparation of Maps and Illustrations  
Basic equipment, materials and techniques involved in the practical construction of maps and other forms of cartographic illustrations, including conventional drafting and plotting procedures, symbolization of data, and map editing consideration for reproduction.  
Prerequisite: Geography 260* or consent of instructor.  
1 hour lecture, 2 hours lab, Winter term  
Instructor: Hildebrand
375* Air Photo Interpretation and Remote Sensing 1
An in-depth study of the principles of air photo interpretation. This involves an analysis of the significance of the following elements of the air photo: rock types, landforms, drainage patterns, erosion characteristics, tonal variations, boundary characteristics, vegetation characteristics and patterns, and cultural (man-made) features. Examples will be drawn from the fields of geology, geography and vegetation mapping. Recommended for those specializing in physical geography, the physical base for planning, or earth sciences. This course is a prerequisite for Geography 470*.
Prerequisite: Geography 275* and Geography 201* or Earth Sciences 130, or consent of instructor
2 hours lectures, 2 hours lab, Winter term
Instructor: Erb

Environmental Studies 380*/381* Environmental Studies Workshop
An interdisciplinary workshop focusing upon major environmental issues, with an emphasis upon problem solving processes; problem definition, obtaining the necessary data, analysis, alternative solution formulation and evaluation. Enrolment in the course is restricted.
Prerequisite: The course is open only to students in third and higher years.
Coordinating Instructors: Thompson, Arch.; Mitchell, Geog.; Keith, M Env.; Martin, Plan.

381* The Nature of Geography
The past traditions in geography. Modern trends in geographical research and teaching.
Prerequisite: Any three full geography credits or consent of instructor
2 hours seminar, Fall term
Instructor: McBoyle

Note: Not available to honours geography students.

391* Field Research
One week field camp session during which a specific area will be analysed from a geographic point of view. Students will be expected to undertake individual or group analysis of specific problems and must present the results in a written report.
Prerequisite: Third Year Honours Geography students only or consent of instructor.
2 hours seminar, Fall term
Estimated cost to student: $50.00
Instructors: Bunting, Patrick

Environmental Studies 400 Environmental Law
Conflict as the core of all aspects of environmental relationships.
A review of several current conflicts in each of the three sections of the course: community planning law; ecological law; and natural resource law. As these conflicts are examined, we will isolate and define the legal tools available to the interests involved in such conflicts and seek to understand both the effect and the limits of these tools under current legislation and practice.
Prerequisite: Third or Fourth Year students
3 hours lecture and discussion, evening, Year
Instructors: Greenspun, Kennedy, Stuart
400* Climatic and Periglacial Morphology and Geomorphological Surveying
Characteristics of the main principles of climatic and climato-genetic geomorphology. Examination of processes and forms related to the periglacial environment. Principles of morphological surveying: morphology, geomorphological mapping, basic laboratory techniques.
Prerequisite: One of Geography 300*, Geography 302*, or Earth Sciences 342* or consent of instructor
3 hours seminar/lab, Winter term
Instructor: Kesik

401* Glacial Geomorphology and some Contemporary Applications
Advanced study of the total effect of glaciation. Glacial and fluvioglacial deposits and depositional conditions will be analysed. Special attention on the environmental influence of glaciation and on practical applications of glacial geomorphologists' techniques and information.
Prerequisite: One of Geography 300*, Geography 302*, or Earth Sciences 342* or consent of instructor
Not offered 1974-75

402* Physical and Chemical Processes in Geomorphology
Applications of the principles of soil and rock mechanics, hydrology, and geochemistry in the analysis of geomorphic processes; watershed behaviour, fluvial processes, sediment transport, dynamics of shoreline behaviour, evolution of natural slopes, chemical processes in weathering and applications to various geologic conditions, hydrologic and chemical interactions in karst phenomena, role of ice in river and frozen ground systems. Cross listed as Earth Sciences 445*.
Prerequisite: One of Geography 300*, Geography 302*, or Earth Sciences 342* or consent of instructor.
Not offered 1974-75

403* Advanced Cartography 1
Advanced study of numerical map analysis and computer mapping techniques.
Prerequisite: Geography 260*, or 271* or consent of instructor
Not offered 1974-75

404* Advanced Cartography 2
Review of conventional production and reproduction techniques for cartographic illustrations. Photography and photomechanical processes applied to cartographic operations. Analysis and application of alternate design and production solutions to cartographic problems.
Prerequisite: Geography 260* or 360* or consent on instructor
3 hours lecture/lab, Winter term
Instructor: Hildebrand

406* Tropical Geomorphology
Basic geomorphological concepts and their application in a tropical environment. Special emphasis on morphology and processes as related to the geological foundation.
Prerequisite: One of Geography 300*, Geography 302*, Earth Sciences 342* or consent of instructor
3 hours seminar/lab, Winter term
Instructor: Erb
407* Field and Lab Techniques in Geomorphology
An analysis of the range of techniques used by geomorphologists. This course will involve intensive field and laboratory work with the possibility of weekend field trips. There will be a charge of between $15. and $20. for field trip expenses.
Prerequisite: Geography 300*, Geography 302*, Earth Sciences 342* or consent of instructor
3 hour seminar/lab, Fall term
Instructors: Gardner, Kesik

408* Special Topics in Climatology and Natural Hazards
Special studies in economic aspects of climate; atmospheric pollution potential; perception of urban climate and air pollution; weather modification; the atmosphere as a natural resource system. Studies of natural hazards.
Prerequisite: Geography 301*
3 hours, Fall term
Instructor: Gardner

410* Recreation Geography
The environmental implications of existing and potential recreational demands. Recreational travel, site capability, economic and ecological impact models will be considered as well as the behavioural aspects of amenity resources.
Prerequisite: Geography 310* or consent of instructor.
3 hours, Fall term
Instructor: Priddle

411* Resource Studies
Study of natural resource problems, with particular attention upon the role of foreign investment and the global corporations in developing resources in Canada and other selected countries.
Prerequisite: Geography 310* or Geography 410*
3 hours, Winter term
Instructor: Patrick

412* Industrial Geography
Theoretical and empirical analysis focusing on a) locational behaviour of manufacturers and the spatial organization of the firm, and b) industrial development (past, present, and future), including some consideration of planned economies.
Prerequisite: Geography 311* or consent of instructor
3 hours, Winter term
Instructor: to be arranged

413* Behavioural Studies
Studies of the behaviour of individuals, groups and organizations in interaction with their environment. Emphasis will be placed on environmental perception and decision-making.
Prerequisite: One of Geography 310*, 311*, or 357* or consent of instructor.
3 hours lectures, Fall term
Instructor: Priddle

414* Resources Management Workshop
Application of theory, methodology and techniques to research projects which focus upon natural resource management problems. Emphasizing social and economic considerations, research projects will utilize individual and group approaches.
Prerequisite: Geography 310* and consent of instructor
2 hours seminar/workshop, and field work, Winter term
Instructor: Mitchell
421 Europe and the Mediterranean
Detailed study of physical, cultural, economic, and political geography of Europe. Geographical aspects of the development of cities, problems of agriculture, changing industrial patterns, distribution of trade, regional disparities, and planning on the city, regional and national levels. Interrelationships of the above basic problems among the European countries, communist or non-communist.

No prerequisite
3 hours, Year
Instructor: Diem

422* Canada
Seminar on the geographical analysis of selected Canadian development problems. Emphasis on topics of continuing Canadian concern.

Prerequisite: Geography 322* or Plan. 222* or consent of instructor
2 hours seminar, Winter term
Instructor: Krueger

423 Central and Eastern Europe
Detailed study of physical, cultural, economic, and political geography of Central and Eastern Europe. Geographical aspects of agricultural problems, industrialization, distribution of trade, economic planning, and relations with the Soviet Union and the West.

No prerequisite
Not offered 1974-75

424* Soviet Geography
Advanced study of selected aspects of the geography of the Soviet Union. A degree of flexibility in the course allows some emphasis on topics of particular interest to the students registered in it.

Prerequisite: Geography 324* or consent of instructor
3 hours, Winter term
Instructor: Bater

425* Africa
Examination of selected aspects of the geography of a major region in Africa with particular reference to problems of development. The region will normally be East Africa; a degree of flexibility will facilitate the selection of topics related to the interests of participants.

Prerequisite: Geography 325* or consent of instructor
2 hours seminar, Winter term
Instructor: Bullock

426-432 In this group of courses other selected world regions will be analysed. The areas chosen will depend on faculty availability and student demand, e.g. Middle East, Latin America, U.S.A., Asia, Polar Lands and Oceania.

Not offered 1974-75

430 Field Research in Regional Geography
A detailed analysis of a selected region with major emphasis upon a field examination of the region (2-3 weeks duration) in spring.

Prerequisite: Fourth year honours geography students or consent of instructor
Not offered 1974-75
445* Advanced Political Geography
A behavioural approach to selected topics in political geography emphasizing the analysis of conflict and conflict management. Discussion and lectures will provide integrating models and themes linking various case studies of conflict situations undertaken by students. While the interdisciplinary nature of conflict research will be emphasized, the course's focus will be centered on concepts and contributions within the field of political geography.
Prerequisite: Geography 345* or consent of instructor
3 hours. Winter term
Instructor: Patrick

449* The City as System 2
A continuation of Geography 349* with an emphasis on specific types of urban sub-systems, e.g. commercial, industrial, residential, institutional and recreational. Consideration is given to applied problems such as commercial blight, residential change, urban quality dimensions and the changing role of the public sector. Special attention is placed on individual student projects.
Prerequisite: Geography 349* or consent of instructor
3 hours, Winter term
Instructor: Bunting

450* Regional Urban Systems 2
A continuation of Geography 350* with an emphasis on student projects.
Prerequisite: Geography 350* or consent of instructor
3 hours, Winter term
Instructor: Preston, Russwurm

451* Soils Geography
An analysis of the factors affecting soil development and classification. Techniques of soil survey and land classification.
Prerequisite: Env. Studies 200* or consent of instructor
2 hours seminar, Fall term
Instructor: Matthews

452* Problems of Rural Land Use
An analysis of the nature of rural land use problems, and a critical evaluation of the methods of rural land use planning. The course focuses on two types of geographical area; metropolitan areas and problems of land use competition, and open space planning; and underdeveloped or depressed rural regions and problems of the creation of alternative employment opportunities. Methods of analysis and decision-making.
Prerequisite: Consent of instructor
2 hours seminar, Winter term
Instructor: Bryant

460 Land Dereliction and Rehabilitation
The course will examine the reasons for land dereliction, its processes, and its effects. Analysis of techniques to rehabilitate such areas will range from principles of landscape architecture to complementing needs of local communities, to optimizing ecological considerations and use of post operation areas. Students examine an area and gather data necessary to prepare an objective and acceptable proposal in the form of a report on methods of operations and post operation rehabilitation. In this course, there will be a small charge for field trip expenses $15 to $20.
Prerequisite: Consent of instructor
Not offered 1974-75
470* Air Photo Interpretation and Remote Sensing 2
Advanced air photo interpretation and its application in geomorphology, geology, resources inventory, engineering soils, hydrology, and pre-planning studies (terrain analysis). Projects in specific fields of interest will form a significant part of the course and will involve the specific field of interest of the participants. Seminars will be presented on selected topics dealing with advanced air photo interpretation techniques, remote sensing techniques, and their application.
Prerequisite: Geography 375* and Geography 300* or 302* or consent of instructor
3 hours seminar and/or lab, Fall term
Instructor: Erb

471* Air Photo Interpretation and Remote Sensing 3
Data gathering from air photos by interpretation and measurement with emphasis on agricultural and urban geography. Recent advances in remote sensing (satellite photography, thermal infrared and radar imagery, multiband imagery). Spectral analysis, image quality, image processing.
Prerequisite: Geography 375* or consent of instructor
Not offered 1974-75

475* Special Readings and Seminar on Selected Topics
Prerequisite: Honours Geography students and consent of instructor
2 hours seminar and/or tutorial, Fall and Winter terms
Instructors: Faculty

476 Special Readings and Seminar on Selected Topics
Prerequisite: Honours Geography students and consent of instructor
2 hours seminar and/or tutorial, Year
Instructors: Faculty

480* Development of Geographic Thought
Historical development of the discipline of geography; contributions of the German, French, British and American geographers in the nineteenth and twentieth centuries.
Prerequisite: 3 full credits in geography or consent of instructor.
Not offered 1974-75

481* Frontiers in Geography
Prerequisite: 3 full credits in geography or consent of instructor
2 hours seminar, Fall term
Instructor: Patrick

482* The Teaching of Geography
Teaching methodology in geography, with particular emphasis on teaching Canadian Geography. Theory and practice. Inductive and deductive approaches. Role of field work, concrete materials, visual aids, textbooks. Pedagogical techniques such as lecturing, questioning, seminar discussion, games, testing, and grading. Observation in local schools, practice teaching.
Prerequisite: In last year of Honours or General Geography programme
2 hours seminar plus practical work, Winter term
Instructor: Krueger

490 Senior Honours Research Essay
Prerequisite: Honours Geography students only
3 hours seminar, Year
Instructors: Irving and faculty
Department of Man-Environment Studies

Professor and Chairman
M.P.A.(Harvard), M.T.P.I.C.

Professor and Dean of Environmental Studies

Assistant Professor and Associate Chairman and Undergraduate Officer
G.S. Davies, B.P.E., B.Sc., M.Sc.(U.B.C.), Ph.D.(Calif.)

Associate Professors
E.J. Farkas, B.S.E.(Princeton), Sc.D.(M.I.T.)
D.W. Fischer, B.S.(Trinity), M.S.(Michigan State), Ph.D. (Colorado State)
J.T. Houston, B.A.(Wheaton), M.A.(Northwestern)
A.T. O'Brien, B.Sc., Ph.D.(Fordham)
W. Shalinsky, B.A., B.S.W.(McGill), M.Sc., D.S.W.(Western Reserve)

Assistant Professors
C.E. De'Ath, B.A.(Auckland), ASOPA Cert.(Sydney), M.Ed., Ph.D.(Pittsburgh)
S.K. Gupta, B.Sc., M.Sc.(Punjab), M.A., Ph.D.(Toronto)
J. Harding, B.A., M.A.(Sask.), Ph.D.(Simon Fraser)
R.F. Keith, B.S.A.(Guelph), M.A., Ph.D.(Michigan State)
S.C. Lerner, B.A.(Ohio State), M.A.(Columbia)
A.V. Morgan, B.A.(Leicester), M.A.(Calgary), Ph.D. (Birmingham)
E.M. Pallet, B.A.Sc., M.Music(Oregon), Ph.D.(Michigan State)
T. McL. Semple, B.A.(Western Ontario), M.A.(Waterloo)
J.B. Theberge, B.Sc.A.(Guelph), M.Sc.(Toronto), Ph.D.(British Columbia)
D.L. Wahlsten, B.A.(Alma College), Ph.D.(California, Irvine)

Lecturer (part time)
J.E. Robinson, B.Sc.(Waterloo)

Faculty members holding cross/ and/or joint appointment(s) as shown
1 Planning and Man-Environment
2 Man-Environment and Anthropology
3 Architecture, Geography, Man-Environment, and Planning
4 Man-Environment and Earth Sciences
5 Man-Environment and Architecture
6 Planning, Man-Environment and Biology
7 Psychology and Man-Environment

Course Descriptions

120* Environmental Issues and the Natural Sciences
Analysis of selected environmental issues using concepts and theories from the natural and life Sciences. Content of course closely integrated with M-Env. 130.
Prerequisite: Honours Man-Environment or consent of instructor
(Must be taken concurrently with M-Env. 130)
3 hours (Year)
130* Environmental Issues and the Social Sciences

Analysis of selected environmental issues using concepts and theories from the social sciences including economics, sociology, anthropology, psychology, political science, social welfare and communication. Content of course closely integrated with M-Env. 120.

Prerequisite: Honours Man-Environment or consent of instructor (Must be taken concurrently with M-Env. 120*)

150* Environmental Issues: Research and Analysis

Lecture and workshop sessions to introduce techniques and skills relevant to environmental studies. Includes elementary research design, sources of information, and problem-solving techniques. Workshops, field and lab demonstrations on topics such as social survey techniques, field ecology, environmental quality measurements, data analysis and media tools.

Prerequisite: Honours Man-Environment or consent of instructor

3 hours (Year)

190* Seminar-Workshop

Individual or small group work on social and environmental topics to help develop skills for defining and resolving problems. Suitable topics selected by students in consultation with faculty and to be carried out partly in conjunction with M-Env. 150*.

Prerequisite: Honours Man-Environment or consent of instructor

6 hours (Years)

Env St. 195* Introduction to Environmental Problems

A discussion of some major environmental problems and issues such as the population explosion, the impact of urbanization on man’s environment, environmental pollution, resource management, conservation, and environmental planning.

(Not available to Man-Environment students)

3 hours lecture and discussion, Fall and Winter terms

Instructors: Krueger, and E.S. faculty

Note

Students in the Faculty of Environmental Studies may take this course in their first or second year only.

Env St 200* Field Ecology

To introduce the main concepts and principles of ecology as a basis for understanding the consequences of man-made changes in the natural environment. Cycling of elements, energetics and structural organization of major ecological systems; population dynamics; impact of natural resource management practices and urban and industrial development on the environment; incorporating environmental quality considerations into development activities: “designing with nature”.

Prerequisite: 2nd, 3rd and 4th year students only.

2 hours lecture, 2 hours lab, Fall and Winter terms

Instructors: Davies, George, Kitchen, Theberge

240* Small Groups and the Environment

This course will focus on the ways small groups of people function. The emphasis will be on analyzing and understanding how the various groups concerned with environmental issues operate and how they might be made more effective.

No prerequisite

3 hours, Fall term

Instructor: Shalinsky
241* Social Change  An analysis of major theories of social change, the sources and patterns of change and change processes, with emphasis on the environmental context.
No prerequisite
3 hours, Winter term
Instructor: Harding

247* Urban Anthropology  Approaches to the study of urban centres, as undertaken by anthropologists. Selected topics such as urban social networks, the urbanization of non-western societies, and the culture of poverty will be pursued.
Prerequisites: Anth. 102 or permission of instructor
Instructor: De’Ath

Env St 252* Media Tools for Environmental Studies  An introduction to the use of audio, slide, film and television formats for project presentation on environmental issues. Students will be involved in three major productions which will stress organization, content, technique and media responsibility.
Prerequisite: E.S. Students only or Consent of instructor/coordinators
3 hours per week, Fall and Winter terms
Instructor: De’Ath; Coordinators: Gough, Steele, Van den Ouden

260* Visual Perception and Communication  An exploration of images, symbols and ideas which constitute the basis of evolution in the perceptual and communication processes. Special emphasis would be placed on films and some of the major movements in art and architecture.
No prerequisite
5 hours, Fall
Instructor: Gupta
Cross-listed as Communications Course

271* Introduction to Quantitative Research Methods  An introduction to scientific method; descriptive and inferential statistics; sampling design. The course emphasizes the methodological and interpretative problems involved in using selected quantitative methods to investigate selected environmental topics. This course is the same as Plan 271* and Geog 271*. The Department of Man-Environment Studies strongly recommends that students, who have not had Grade 13 mathematics, take Math 85*.
Prerequisite: only for students in Man-Environment, Planning, Architecture, or General or Honours Geography.
2 hours lecture, 1 hour lab, Fall and Winter terms
Instructors: Semple, and other faculty

272* Computer Programming in Environmental Studies  The course emphasizes computer programming skills and applications in the context of environmental problems. Cross listed as Plan 272* and Geog 272.
Prerequisite: Geog|Man-Env|Plan 271* or consent of instructor
3 hours, Winter term
Instructor: Semple
275* Special Readings  May be used by students who transfer into Man-Environment Studies at second year level. Background reading and study in consultation with faculty.
Prerequisite: Consent of the instructor
2 hours or equivalent, Fall and Winter terms

290* Seminar-Workshop  Individual or small group work with emphasis on multidisciplinary treatment of environmental problems. Work encouraged on problems of interest to community organizations, local government agencies, or other groups.
Prerequisite: Honours Man-Environment or consent of instructor
6 hours, Year

310* Psychological Man  The psychological correlates of the differing environments in which man develops and continues in adult life. The emphasis will be on individual differences assessed by empirical techniques and objective criteria derived from the physical and cultural environment.
No prerequisite
3 hours, Fall term
Instructor: Semple

320* Environmental Economics  Principal economic forces that affect the environment. Examination of macro and micro concepts of economic welfare including scarcity, leisure externalities, growth and property. Introduction to social benefit-cost analysis as applied to environmental problems.
Cross-listed as Economics 348*
Prerequisite: Honours Man-Environment or Introductory Economics course or consent of instructor
3 hours, Winter term
Instructor: Fischer

330* Psycho-Social Aspects of Environmental Design  Acquire a flexible framework for thinking about the role of technology in man-environment systems focusing on psycho-social processes. Examine Bio-Psycho-Sociotechnology component interaction networks in various systems such as housing, transportation, etc. Attempt suggestive integration of existing research from many disciplines to build sensitive models of utility in concrete situations.
Prerequisite: An Introductory Social Science course or consent of instructor
Fall and Winter terms
Instructor: Pallett

334* Comparative Development of Northern Regions  A comparative study of social and cultural change in Arctic and Sub-Arctic areas brought about by political and economic development of those lands, with specific reference to northern Canada, the Soviet far north, and Siberia.
Cross listed as Sociology 334*
No Prerequisite
2 hours, Fall term
350* Community Action on Environmental Problems

The citizen's role in the solution of environmental problems. The work of various community groups is examined and evaluated. Students take part in one group project to experience the process at first hand.

*2 hours, Winter term
Instructor: Lerner

351* Organization and Environmental Management

Analysis of selected governmental or other organizations performing important functions relating to environment. Their perceptions of policy issues and goals. Programme planning, budgeting, and delivery processes. Role of different specialists and "generalists", nature and extent of public participation.

*No prerequisite
*2 hours seminar, Winter term
*Not offered in 1974 75

356* Canadian Non-Renewable Resources

An introduction to mineral resources and the state of reserves of selected minerals. Geological factors affecting the occurrence of economic minerals and rocks, concentrating upon energy supplies, metallic and non-metallic minerals. The historical development of certain extractive industries will be discussed together with the political and social implications of economic development.

*No prerequisites
*3 lectures, Winter term
*Cross listed as Science 350

357* Man and Resource Use

Review of the main physical, organizational and institutional factors governing Man's decisions to use natural resources. Appraisal of such resources as land, water, food, forests, wildlife, energy, oceans and air with special attention to contemporary conflicts of use, and main issues in resource policy and management. Reference to global and North American situations.

*CROSS-LISTED AS GEOG. 357* AND PLANNING 357*
*3 hours, Fall term*
*Instructors: Davies, Fischer, Francis*

Environmental Studies 358* Environmental Pollution and its Control

Guest lecturers, expert in their respective fields, discuss air, water and soil pollution from waste products; biological, economic, political and legal aspects, and technical and social control measures.

*No Prerequisite
*3 hours, Fall and Winter terms
*Instructor: Farkas*

360* Science, Technology, Art and Environment

An interdisciplinary exploration of concepts and themes which unify many aspects of nature and human artifacts. Such themes as "Nature of Time" as expressed in films, poetry, art, science fiction, psychology and nature are discussed.

*Prerequisite: Consent of the instructor*
*5 hours, Fall term*
*Instructor: Gupta*
*Cross listed as Communications Course*
361* Contemporary Media of Communication and Human Environment

A study of “heroes” and anti-heroes” of the “counter-culture”, with special emphasis on the “new wave” movements in cinema, theatre, art and literature.

Prerequisite: Serious pupils only, with the consent of instructor
5 hours, Winter term
Instructor: Gupta
Cross listed as Communications Course

375* Special Reading or Seminar on Selected Topic

Prerequisite: Consent of the Instructor
2 hours or equivalent, Fall and Winter terms

380*/381* Environmental Studies Workshop

An interdisciplinary workshop focusing upon major environmental issues, with an emphasis upon problem solving processes; problem definition, obtaining the necessary data, analysis, alternative solution formulation and evaluation. Enrollment in the course is restricted.

Prerequisite: The course is open only to students in third and higher years
Coordinating Instructors: Thompson, Arch.; Mitchell, Geog; Keith, Man-Env.; Martin, Planning.

390 Seminar-Workshop

A problem and issue-oriented seminar or workshop; special emphasis on interdisciplinary treatment of environmental problems. Variable credit by consent of faculty.

Prerequisite: Honours Man-Environment students, or consent of instructor
6 hours, Year

Environmental Studies 400 Environmental Law

Conflict as the core of all aspects of environmental relationships. A review of several current conflicts in each of the three sections of the course: community planning law; ecological law; and natural resource law. As these conflicts are examined, we will isolate and define the legal tools available to the interests involved in such conflicts, and seek to understand both the effect and the limits of these tools under current legislation and practice.

Prerequisite: Third or Fourth Year Students
3 hours lectures and discussion, evening, Year
Instructors: Greenspan, Kennedy, Stuart

410 Honours Seminar: Environmental Management

Major problems and issues in the management of environmental impacts stemming from development projects. Synthesis of ecological, economic and institutional aspects. Integrating environmental management with social and economic development policies and programmes.

Prerequisite: Honours Man-Environment or consent of the instructor
2 hours Seminar, Year
Instructors: Davies, Fischer

420 Honours Seminar: Community


Prerequisite: Honours Man-Environment or consent of instructor
2 hours seminar, Year
Not offered in 1974-75
430 Honours Seminar on Environmental Problems

Environmental problems of world-wide significance examined in the broader context of interrelated issues such as social and economic development particularly in “Third World” countries, the nature and implications of the realignments at work between have and have-not countries, and the structure and functioning of international programmes which promote transnational cooperation on problems of global importance. Illustrative examples and case studies drawn from the experience of the United Nations system and other governmental and non-governmental international organizations.

Prerequisite: Honours Man-Environment and consent of instructor; non-majors consent of instructor
2 hours seminar, Year
Instructor: Fischer, Francis
(Alternates with 431)

431 Comparative Approaches to Environmental Management

Environmental programmes of other nation states compared to Canadian approaches. Case studies from U.S., British and European situations, and other countries. Course meets on campus during Winter term and in the field in other countries during Spring term. Spring term limited to a period of 6-8 weeks. Laboratory fee varies with field observation.

Prerequisite: Honours Man-Environment and consent of instructor; non-majors consent of instructor
2 hours, Winter term; 6-8 weeks, Spring term
(Alternates with 430)
Instructors: Fischer, Francis
Not offered in 1974-75

440 Honours Seminar: Environmental Communication and Education

A study of communication, innovation and educational processes in the context of environmental issues. Approaches to environmental education and communication for primary and secondary school programmes and adult education.
2 hours seminar

450 Honours Seminar: Environmental Design

Major psycho-social problems related to design and use of urban, rural and wilderness environments. Integration of psycho-social information with economics and environmental information in the design process.

Prerequisite: Honours Man-Environment or consent of instructor
2 hours Seminar

470 Environmental Teaching

Practical training as a discussion leader or workshop assistant with first year students plus a weekly seminar on environmental teaching.

Prerequisite: Third and fourth year honours Man-Environment students and consent of the instructor

475* Special Readings or Seminar on Selected Topics

Prerequisite: Consent of instructor
2 hours or equivalent, Fall and Winter terms

476 Special Readings or Seminar on Selected Topics

Prerequisite: Consent of instructor
2 hours or equivalent, Year
490 Seminar-Workshop  
490a (0.5 credit)  
490b (1.0 credit)  
490c (1.5 credit)  
A series of seminars and workshop periods over which a student will be expected to develop and present an analysis of a major environmental problem in the form of a thesis essay. Group or individual work as appropriate. Variable credit by consent of faculty.

*Prerequisite: Honours Man-Environment Year*
School of Urban and Regional Planning

Associate Professor and Director
L.R.G. Martin, B.A.(Queen's), M.A., M.R.P., Ph.D.(Syracuse), M.T.P.I.C.

Associate Professor and Associate Director
W. Shalinsky, B.A., B.S.W.(McGill), M.Sc., D.S.W.(Western Reserve)

Professor and Dean of Environmental Studies

Associate Professor and Graduate Officer
G.G. Mulamootil, B.Sc.(Mysore), M.Sc.(Bombay), Ph.D.(Delhi)

Associate Professor and Undergraduate Officer
J.T. Horton, B.A.(Wheaton), M.A.(Northwestern)

Professors
R.S. Dorney, B.Sc., M.Sc., Ph.D.(Wisconsin)
K. Izumi, B.Arch.(Manitoba), M.C.P.(M.I.T.), M.T.P.I.C., A.I.P.
R.R. Krueger, B.A., M.A.(Western), Ph.D.(Indiana)

Associate Professors
G.B. Priddle, B.A.(Western), M.A., Ph.D.(Clark)
K.S. Sayegh, B.Sc.(Cairo), M.C.P., Ph.D.(Harvard), M.T.P.I.C.
S.M. Weaver, B.A., M.A., Ph.D.(Toronto)

Assistant Professors
J.K. Gerecke, B.A.(Saskatchewan), M.A.(U.B.C.)
S. Herzog, B.Arch.(Toronto)
C.M. Kitchen, B.A.(Queen's), M.A.(Waterloo)
J.B. Theberge, B.Sc.A.(Guelph), M.Sc.(Toronto), Ph.D.(U.B.C.)

Adjunct Professor
D.M. Connor, B.Sc.(Toronto), M.Sc., Ph.D.(Cornell)
J.A. Kennedy, B.A.(Loyola), Q.C.

Professional Liaison Officer
H.T. Lemon, M.T.P.I.C.

Faculty members holding joint and/or cross appointments as shown
1 Planning, Geography and Biology
2 Geography and Planning
3 Architecture, Geography, Man-Environment and Planning
4 Planning and Man-Environment
5 Anthropology and Planning
6 Planning, Man-Environment and Biology
Course Descriptions

100 Introduction to Urban and Regional Planning Concepts and Techniques
An introduction to the regional city; the development of contemporary planning concepts and principles; the nature, purpose and scope of urban planning; the planning process and decision-making in a democratic society. Particular attention is directed to methodological aspects of designing a planning programme: identification of objectives and constraints, conduct of basic surveys and analysis, plans and policies preparation, evaluation and implementation.
Prerequisite: Planning students only
One three hour lecture and discussion session, Year
Instructors: Faculty

156* Introduction to Urban and Regional Planning Concepts
An introduction to contemporary planning ideas for students whose subsequent work might bring them in contact with professional planners. Planning concepts and principles; the development of contemporary planning ideas; the nature, purpose and scope of urban and regional planning; the planning process and decision-making in a democratic society.
Prerequisite: None
(Not available for credit to Planning students)
One two hour lecture and one hour discussion session, Fall and Winter terms
Instructors: Faculty

159* Graphics for Planning
Basic instruction in graphic techniques used in planning. Emphasis will be placed on the use of graphics for the communication of ideas.
Prerequisite: Planning students only
Two hours studio, Fall and Winter terms
Estimated cost to student: $20
Instructor: van den Ouden

Environment Studies 195*
Introduction to Environmental Problems
A discussion of some major environmental problems and issues such as the population explosion, the impact of urbanization on man's environment, environmental pollution, resource management, conservation, and environmental planning.
Not available to Man-Environment students
3 hours lecture and discussion, Fall and Winter terms
Instructors: Krueger, and ES Faculty

Note Students in the Faculty of Environmental Studies may take this course in their first or second year only

Environment Studies 200*
Field Ecology
To introduce the main concepts and principles of ecology as a basis for understanding the consequences of man-made changes in the natural environment. Cycling of elements, energetics and structural organization of major ecological systems; population dynamics; impact of natural resource management practices and urban and industrial development on the environment; incorporating environmental quality considerations into development activities; "designing with nature".
Prerequisite: 2nd, 3rd and 4th year students only
2 hours lecture, 2 hours lab, Fall and Winter terms
Instructors: Davies, George, Kitchen, Theberge
222* Canadian Regional Issues
Selective study of Canadian development issues pertaining to the use of land, urbanization, regional and resource development; issues will be related to the structural and functional forces that are characteristics of the major regions of Canada, e.g., Atlantic Provinces, British Columbia.
Prerequisites: none
Three hours lectures, Winter terms
Instructor: Horton

230* The Small Group in the Planning Process
The small group and its relevance to the planning process. Focus on work groups such as committees, councils and boards. Various important elements of small groups such as leadership, goal setting, influence, decision-making and interpersonal relations will be examined and related to planning.
Prerequisite: Sociology 101*, or consent of instructor
Three lectures, Winter term
Instructor: Shalinsky

Note Students may not take both Planning 222* and Geography 322*

Environmental Studies 252* Media Tools for Environmental Studies
An introduction to the use of audio, slide, film and television formats for project presentation on environmental issues. Students will be involved in three major productions which will stress organization, content, technique and media responsibility.
Prerequisite: E.S. students only or consent of instructor/ coordinators
3 hours per week, Fall and Winter terms
Instructor: De'ath; Coordinators: Gough, Stele, van den Ouden

255* Planning Surveys and Analysis
Sources of data for planning and their analysis. The course will emphasize the sources, methods of collection and analysis of urban and regional land-use data. Particular attention is paid to the types of land-use information essential to transportation, housing, public facilities and recreation planning. Both lecture and workshop are related to a significant problem of land-use planning in Ontario.
Prerequisite: Planning 100 or consent of instructor
Two hours lectures, two hours workshop, Winter term
Instructor: Gerecke

256 Principles of Environmental Design
Design concepts in Urban and Regional Planning, illustrated by recent work. Individual and group projects in planning design in urban and regional settings, using graphic, model film and verbal presentations.
Prerequisite: Planning 100, or consent of instructor
Two hours lectures, two hours studio, Year
Instructor: Herzog

258* Readings and Research in Planning
Special readings and research on planning topics chosen in consultation with the instructor. This course gives the opportunity for supervised individual reading and study of planning or related topics in which the student is particularly interested.
Prerequisite: Planning 100, or consent of instructor
Fall or Winter terms
Instructors: Faculty
271* Introduction to Quantitative Research Methods
An introduction to scientific method; descriptive and inferential statistics; sampling design. The course emphasizes the methodological and interpretative problems involved in using selected quantitative methods to investigate selected environmental topics. This course is the same as Geog. 271* and M.Env. 271*.
The School of Planning strongly recommends that students, who have not had Grade 13 Maths, take Math 85*.
Prerequisite: only for students in General or Honours Geography, Planning, Man-Environment, or Architecture
2 hours lecture, 1 hour lab. Fall and Winter terms
Instructors: Semple and other faculty

272* Computer Programming in Environmental Studies
This course emphasizes computer programming skills and applications in the context of environmental problems.
Cross listed as Geog. 272* and M.Env. 272
Prerequisite 271*, or consent of instructor
Three hours, Winter term
Instructor: Semple

300 Seminar/Workshop in Urban and Regional Planning
An integrated approach concerned with advanced study, analysis and design synthesis in the structuring of complex environmental problems. Studies range in scope from neighbourhood design to area redevelopment, and new towns. These will take place in a variety of urban, metropolitan and regional contexts and be of such nature as to equip the student with an adequate conceptual framework for practice.
Prerequisite: 3rd Year Planning students only
One three hour workshop, Year
Instructors: Faculty

301* Planning Design
A study of a particular design aspect of planning through a series of individual and group projects. The topic varies each term.
Prerequisite: consent of instructor
One three hour meeting, studio/workshop, Fall and Winter terms
Instructor: Herzog

307* Social Survey Techniques
Social research and the planning process; interview and self-administered surveys; questionnaire design; profile data; data processing; sampling; non-survey data collection techniques; practical applications. Cross-listed as Geography 307*.
Prerequisite: May be taken in 2nd or 3rd year
Two hours lectures, one hour practical or discussion, Fall and Winter terms
Instructor: Faculty

316* Multivariate Statistics
The theory and application of multivariate statistics, with particular emphasis upon the use of the computer. Cross-listed as Geography 316*.
Prerequisite: Planning 271*, or consent of instructor
Three hours seminar and/or tutorial, Fall term
Instructor: Steiner
317* Nonparametric Statistics
The theory and application of non-parametric statistics with emphasis upon social science problems. Cross-listed as Geography 317*.

*Prerequisite: Planning 271*, or consent of instructor
Two hours lectures, one hour practical, Winter term
Instructor: Mitchell

318* Spatial Analysis
Advanced quantitative analysis of spatial patterns and interactions. Focus on a selection of techniques from gravity models, linear programming, nearest neighbour analysis, Markov chain analysis, graph theory, simulation and trend surface analysis. Cross-listed as Geography 318*.

*Prerequisite: Planning 271*, or consent of instructor
Three hours lectures, Winter term
Instructors: Bryant and Walker

319* Regional Planning Techniques
Application of economic and social measurement techniques in regional planning. Discussion of input-output analysis; cost-benefit analysis, planning, programming and budgeting systems; and social area analysis. Cross-listed as Geography 319*.

*Prerequisite: Econ. 101*, 102*, or consent of instructor
Three hours seminar and/or tutorial, Fall term
Instructor: Faculty

320* Urban Social Planning
This course examines a variety of urban social concerns and possible solutions to them. The solutions will focus on social planning, community development and social action. As well, the relationship between physical and social planning will be considered.

*Prerequisite: none
Three hours lectures, Winter term
Instructor: Shalinsky

332* The Sociology of Regions
Basic concepts of sociology; occupational and concomitant social adjustments of rural society in response to forces of urbanization and industrialization; social movements generated within the farm population.

*Prerequisite: Sociology 101*, or consent of instructor.
Three hours lectures, Fall term
Instructor: Weaver

333* The Sociology of Regional Planning
Power structures, basic social institutions, attitudes and values related to the implementation of regional plans; regional development of human and natural resources in Canada and abroad.

*Prerequisite: Sociology 101*, or consent of instructor
Three hours lectures, Winter term
Instructor: Weaver

342* Urban and Regional Planning (Part 1)
The physical structure of the city and its cultural, social, economic and behavioural bases; supporting systems and environmental relationships.

*Prerequisite: None. (Not available for credit to Planning students)
3 hours, Fall term
Instructor: Faculty
School of Urban and Regional Planning

343* Urban and Regional Planning: (Part 2) The role of the public and private sectors in regional development and their relationship to the planning process; current urban and regional issues and plans. 
Prerequisite: Planning 342* or consent of Instructor. (Not available for credit to Planning students)
Three hours, Winter term
Instructor: Faculty

344* Principles of Recreation Planning An exploration of the nature and functions of recreation in modern urban-industrial societies and an analysis of alternative approaches to the planning of recreation opportunities in urban-centred regions. The demand for and supply of recreation opportunities; standards, models and systems; recreation planning policies and agencies; and selected recreation planning issues. 
Prerequisite: This course is open only to students in 3rd and 4th years.
Three lectures, Fall term, Winter term Planning students only
Instructor: Faculty

357* Conservation and Resource Management History of the conservation movement; ecological principles of conservation and resource management. Analysis, use and planning of recreational resources. This course is the same as Geography 357* and Man-Environment 357*.
Prerequisite: Environmental Studies 200*. This course is open only to students in 3rd and 4th years
Three lectures, Winter term
Instructors: Dorney, George, Kitchen, Theberge

Environmental Studies 358* Environmental Pollution and its Control Guest lectures, expert in their respective fields, discuss air, water and soil pollution from waste products; biological, economic, political and legal aspects; technical and social control measures. 
No prerequisite
3 hours, Fall and Winter terms
Instructor: Farkas

358* Regional Planning and Development The relationship of economic planning to regional planning. Theory and practice of regional planning and development to urban-centred, broad socio-economic, and frontier regions. A series of workshops focus upon the social and economic problems of a particular Canadian region and the role of federal, provincial and local governments in formulating and applying remedial policy. Reference is made to comparative planning strategies and policies in other nations. 
Prerequisite: one of Planning 100, 156*, 342*, or consent of instructor
2 hours lectures, 2 hours workshop
Instructor: Martin

360* Technology in Urban and Regional Planning The influence of transportation, communications, and water and sewage systems on the form, function and development of cities and regions; the application of this knowledge in urban and regional planning. 
Prerequisites: Planning 256* or consent of instructor
Three hours lecture, term to be arranged
Instructor: Faculty
370* Land Development Planning
An examination of planning issues related to the economics and financing of public and private development projects including shopping plazas, residential subdivisions, and new towns. The course focuses on sources of financing, financial programming, effects of planning decisions on land values, and techniques of project evaluation.
Prerequisites: Planning 255* or consent of instructor
Three hours lectures, term to be arranged
Prerequisites: Planning 255*, or consent of instructor
Three hours lecture, Term to be arranged
Instructor: Faculty

380*/381* Environmental Studies Workshop
An interdisciplinary workshop focusing upon major environmental issues, with an emphasis upon problem solving processes; problem definition, obtaining the necessary data, analysis, alternative solution formulation and evaluation. Enrollment in the course is restricted.
Prerequisite: The course is open only to students in third and higher years
Coordinating Instructors: Thompson, Arch.; Mitchell, Geog.; Keith, Man-Env.; Horton, Planning

391* Field Research Methods and Projects
Selected field trip experiences directly related to the theme content of the Seminar/Workshop 300, including assignments, follow-up discussion, and presentation of research papers. The School covers the cost of travel and accommodations for field trips. Students are responsible for the cost of their meals. Approximately $45.00 will cover the cost of meals on a one week field trip.
Prerequisite: enrolment in Plan 300
Instructor: Faculty

Environmental Studies 400 Environmental Law
Conflict as the core of all aspects of environmental relationships. A review of several current conflicts in each of the three sections of the course: community planning law; ecological law; and natural resource law. As these conflicts are examined, we will isolate and define the legal tools available to the interests involved in such conflicts, and seek to understand both the effect and the limits of these tools under current legislation and practice.
Prerequisite: Third or Fourth Year students
3 hours lecture and discussion, evenings, Year
Instructors: Greenspan, Kennedy, Stuart

414* Housing Policies
Focus on Canadian housing policies and programmes, particularly with regard to the housing of low and moderate income families. Economic, political, physical and social considerations underlying these policies will be examined in detail. Some consideration is given to housing problems and programmes in the United States and developing countries.
Prerequisite: Planning 256*, or consent of instructor
Three lectures, Fall term
Instructor: Sayegh
430* Social Policy Planning  
This course will examine and evaluate a number of social policy issues (poverty, health, education and public safety) in relation to social goals, social indicators, and program planning and development. The role of planners in social policy formulation and implementation will be stressed.  
**Prerequisites:** Planning 330*, or consent of instructor  
Three hours lecture, term to be arranged  
Instructor: Shalinsky

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 jurisdiction of provincial bodies and agencies.  
**Prerequisite:** One course in Political Science, or consent of instructor  
One two hour lecture/seminar, Year  
Instructor: Rich

470* History of Urban Planning  
An overview of the history and philosophy underlying urban planning and civic design. Morphological analysis of urban settlements; social, cultural, technological and aesthetic influences in the evolution of urban form; the role, structure and function of cities in civilization. Selected urban case studies with particular emphasis upon their relevance to contemporary concerns. Illustrated lectures and student research projects.  
**Prerequisite:** Year 3 or 4 Planning students, or consent of instructor  
Two one hour lectures/seminars, Winter term  
Instructor: Pressman

475* Projects, Problems and Readings in Planning  
Special planning projects and problems chosen in consultation with instructor.  
**Prerequisite:** Consent of instructor  
Three hours seminar and/or tutorial, Fall and Winter term  
Instructors: Faculty

476 Projects, Problems and Readings in Planning  
Special planning projects and problems, chosen in consultation with instructor.  
**Prerequisite:** consent of instructor  
Three hours seminar and/or tutorial, Year  
Instructors: Faculty

480 The Philosophy and Methodology of Urban and Regional Planning  
Focus on basic values implicit in policies and decisions in environmental planning. Major currents in Planning thought are related to the problems and issues typically faced in both urban-centred and resource-based Planning in Canada. The course takes the form of a seminar-workshop, which through a number of student projects, is concerned with relating technological change, environment and the planning process.  
**Prerequisite:** Honours Planning students only  
Three hours seminar-workshop, Year  
Instructor: Izumi
490 Senior Honours Essay  

Practical experience in the identification of a problem in the planning field. Conduction of individual research into this problem and presentation of the results of this research form that meets both professional and academic standards. Two credits.  

Prerequisite: Honours Planning students only  

Instructors: Faculty
Environmental Studies

There are a number of courses offered in the Faculty of Environmental Studies of an integrative nature which extend across the academic interests of the four units. The courses are of general interest and are open to all students in the University. There is no Department of Environmental Studies.

The following persons have wide ranging interests and hence have been appointed to the Faculty of Environmental Studies rather than to a specific Department and/or School:

Professor and Dean of Environmental Studies  

Visiting Professor  
P. Dansereau, B.A.(Montreal), B.Sc.Agr.(Montreal), D.Sc. (Geneva)

Adjunct Professor  
D.B. Greenspan, B.A.(Toronto), LL.B.(Osgoode Hall)
B. Stuart, B.A.(Bishop's), LL.B.(Queen's)

Faculty members cross appointments as shown  
1 Architecture, Geography, Man-Environment, and Planning

195* Introduction to Environmental Problems  
A discussion of some major environmental problems and issues such as the population explosion, the impact of urbanization on man's environment, environmental pollution, resource management, conservation, and environmental planning.  
Not available to Man-Environment Students  
3 hours lecture and discussion, Fall and Winter terms  
Instructors: Krueger and ES Faculty

Note  
Students in the Faculty of Environmental Studies may take this course in their first or second year only.

200* Field Ecology  
To introduce the main concepts and principles of ecology as a basis for understanding the consequences of man-made changes in the natural environment. Cycling of elements, energetics and structural organization of major ecological systems; population dynamics; impact of natural resource management practices and urban and industrial development on the environment; incorporating environmental quality considerations into development activities; "designing with nature".  
Prerequisite: Geography 102*, for 2nd, 3rd and 4th year students only  
2 hours lecture, 2 hours lab, Fall and Winter terms  
Instructors: Davies, George, Kitchen, Theberge

252* Media Tools for Environmental Studies  
An introduction to the use of audio, slide, film and television formats for project presentation on environmental issues. Students will be involved in three major productions which will stress organization, content, technique and media responsibility.  
Prerequisite: E.S. students only or consent of Instructor/Coordinators  
3 hours per week, Fall and Winter terms  
Instructor: De'ath; Coordinators: Gough, Steele, van den Ouden
358* Environmental Pollution and its Control
Guest lecturers, expert in their respective fields discuss air, water and soil pollution from waste products; biological, economic, political and legal aspects; technical and social control measures.
No prerequisite
3 hours, Fall and Winter terms
Coordinating Instructor: Farkas

380*/381* Environmental Studies Workshop
An interdisciplinary workshop focusing upon major environmental issues, with an emphasis upon problem solving processes; problem definition, obtaining the necessary data, analysis, alternative solution formulation and evaluation. Enrolment in the course is restricted.
Prerequisite: The course is open only to students in third and higher years.
Coordinating Instructors: Thompson, Arch.; Mitchell, Geog.; Keith, Man-Env.; Martin, Planning

400 Environmental Law
Conflict as the core of all aspects of environmental relationships.
A review of several current conflicts in each of the three sections of the course; community planning law; ecological law; and natural resource law. As these conflicts are examined, we will isolate and define the legal tools available to the interests involved in such conflicts, and seek to understand both the effect and the limits of these tools under current legislation and practice.
Prerequisite: Third or Fourth Year Students
3 hours lecture and discussion, evening, Year
Instructor: Greenspan, Kennedy, Stuart
Fine Arts

Associate Professor and Associate Chairman

N.I. Patterson, B.A.(Washington)

Professors
V. Burnett, B.S.(Columbia), M.A.(California)
A.M. Urquhart, B.F.A.(Buffalo)

Assistant Professors
H. Martens, B.A., M.A.(Minnesota), Ph.D.(Columbia)

Instructors
J. Uhde, M.A. (Prakeyno's University, Bro, Czecheslovakia)
W. Janzen Jr., B.Mus.(Manitoba), M.M.(Wisconsin), A.M.M.

Lecturers
C. Crockford, B.E.(Alberta), M.A.(British Columbia)
H. MacKenzie, ARCA, B.F.A(Mt. Allison)
V. Taborsky, Dipl.(Prague, Czecheslovakia)

Requirements for Fine Arts General B.A. in Art

To fulfill the requirements for a general degree in Fine Arts students must take 12 half courses in Fine Arts, including 110*, 111*, 120*, 121*. Of the eight remaining half courses at least four must be on the third year level. Courses in music will be considered as electives and not as part of the regular Art program in Fine Arts.

Students from any faculty may take courses in Fine Arts on an elective basis with the consent of their departments, or as part of their regular programme where their departments so direct.

Undergraduate Courses

110* Introduction to World Art 1
A comparative survey of Western art, from prehistoric times to the Renaissance, emphasizing visual form as an expression of its historical and cultural context.
No prerequisites, Fall term

111* Introduction to World Art 2
A comparative study of non-Western art, including the Orient, and the development of modern art from the Baroque to the Twentieth Century, emphasizing visual form as an expression of its historical and cultural context.
Prerequisite: Fine Arts 110*, Winter term

120* Fundamentals of Visual Art 1
An introduction to the fundamental principles and concepts of visual art, through a series of experimental studio problems in two and three dimensional materials and media.
Lab fee. Fall term

121* Fundamentals of Visual Art 2
A series of studio projects designed to develop basic skills and apply principles of visual dynamics in the various media of visual art. Lab fee.
Prerequisite: Fine Arts 120*
Winter term
210* Modern Art 1  A survey of the history of modern art, examining its origins in the eighteenth century and the romantic and realistic art of the nineteenth century, showing how the late nineteenth century developed the basic characteristics of the twentieth century art. Prerequisite: Fine Arts 110*-111*

211* Modern Art 2  A survey of modern art examining the development of 20th century art from the Post-Impressionists through the multiple trends of the present decade. Both movements and individual artists will be studied. Prerequisite: Fine Arts 210*

212* Italian Renaissance Art 1  A survey of painting, sculpture, and architecture, especially in Florence and Siena, starting with Giotto and his contemporaries and covering innovations in perspective, anatomy, and iconography through the end of the 15th century. Prerequisite: Fine Arts 110*/111*, or consent of Instructor
Not offered 1974-75

213* Italian Renaissance Art 2  A continuation of Fine 212* starting with the masters of the High Renaissance, Leonardo, Raphael, and Michelangelo, and proceeding through Mannerism, Baroque, and Rococo in Florence, Venice and Rome. Prerequisite: Fine Arts 212* or consent of Instructor. Not offered 1974-75

216* (Anthro. 230*) Primitive Art  A study of prehistoric world art (Paleolithic, Mesolithic, and Neolithic), the art of Africa, the Americas, and Oceania, and European folk art (both continental and colonial). Not offered 1974-75

218* Western Religious Art  An introductory survey of the visual art and architecture of Judaism and Christianity in the Common era. The development and subsequent changes of style in places of worship and ceremonial objects and ornaments, and the changing forms of religious expression through visual art, will be studied. Not offered 1974-75

220* Fundamentals of Painting 1  Exploration of painting problems in various media as vehicles for serious creative expression: the fundamentals of composition and painting techniques (paint, materials, and preparation of painting surfaces) will be presented through studio projects. Lab fee. Prerequisite: Fine Arts 120*-.121*

221* Fundamentals of Painting 2  The creation of both non-objective and representational forms on a two-dimensional surface using oil as a painting medium. Lab Fee Prerequisite: Consent of Instructor Fall term

222* Fundamentals of Sculpture 1  Exploration of sculpture problems in various media as vehicles for serious creative expression: emphasis will be given to developing understanding and mastery of three dimensional forms and the preparation and handling of sculptural materials and tools. Lab. fee. Prerequisite: Fine Arts 120*-.121*
223* Fundamentals of Sculpture 2
A continuation of Fine Arts 222* with an emphasis on independent problems. Lab fee.
Prerequisite: Fine Arts 222*
Winter term

224* Introductory Graphics 1 (General Drawing)
Students will make analytical and expressive drawings in a variety of media, in order to develop accurate observation and understanding of form. Lab fee.
Prerequisite: Fine Arts 120*-121*

226* Introductory Graphics 2 (General Printmaking)
An introductory course in materials and methods of printmaking with emphasis on silk screen techniques.
Lab fee
Prerequisite: consent of Instructor.
Full and Winter terms

227* Scientific Drawing
Through studio experiences, students will learn techniques for making accurate scale drawings of biological subjects in line and value, using various media. Methods of preparing drawings for reproduction will be included.
No prerequisite
Full term

228* Applied Arts
The history, design and practice of various applied arts will be explored in slide lectures and studio projects. Specific arts will vary from year to year: current offerings are given below.

228A* Expressive Textile Forms
The history of textile arts and the problems of design for textile media will be explored, combining lectures and studio projects in both two and three dimensional expressive forms. Traditional textile materials and methods will be applied to the creation of contemporary expressive and autonomous forms. Students will supply their own materials.
Not offered 1974-75

234* Introduction to Film Making 1
Basic introduction to the field of audio visual media: principle techniques and methods; scripting, production and directing; camera, sound and editing techniques; film forms.
Photo supplies, film stock and processing at student expense.
(Super 8mm).
Lab Fee
Prerequisite: Fine Arts 120*-121* or consent of instructor
Full term

235* Introduction to Film Making 2
Practical introduction to film techniques. Theory, experiments and assignments in script writing, production planning, directing, editing and camera work. Further differentiation in film forms. Lab fees.
Prerequisite: Fine Arts 234*
Winter term
244* History of Film 1  
Silent Film  
The historic development of world cinematography in its silent era (1895-1929), including a short mention of the prehistory of film (before 1895), covering the most important artistic movements, works by outstanding directors and their contribution to the film as an independent form of art. Regular screenings will accompany discussion of historic and aesthetic aspects of film.  
Film fee  
Fall term

245* History of Film 2  
Sound Film  
A continuation of Fine 244*: the expression of film history into the sound era (since 1929) including the most recent period.  
Film fee  
Winter term

246* Religion and Film 1  
(Religious Studies 266R*)  
A theological approach to the study of film as a world-transforming phenomenon for man. An assessment of film's special characteristics as an art form capable of addressing man's quest for a significant existence. Consideration of a wide range of films and directors, with particular emphasis on Ingmar Bergman.  
Film fee $5.00

247* Religion in Film 2  
(Religious Studies 267R*)  
An exploration of selected themes - death, evil, guilt, fate, alienation, love, redemption - in the films of several of today's leading directors: Bunuel, Pasolini, Kurosawa, Fellini, Antonioni, Polanski.  
Film fee $5.00

310* (C. Civ. 351*) Greek  
Art and Architecture  
A survey of the art and architecture of the ancient Greek world from the Minoan to the Hellenistic periods.  
3 lectures. Consult Classics listing.

311* (C. Civ. 352*) Roman  
Art and Architecture  
A survey of the art and architecture of the Roman world from Etruscan to Imperial times.  
3 lectures. Consult Classics listing.

312* Renaissance Art  
Outside Italy 1  
A survey of painting, and related developments in sculpture and architecture, from the late Gothic period through the High Renaissance. Emphasis will be on the Flemish and German schools.  
Prerequisite: Fine Arts 110*-111* or consent of instructor.  
Not offered 1974-75

313* Renaissance Art  
Outside Italy 2  
Mannerism, Baroque, and Rococo in Northern Europe and Spain. The contributions of such masters as Brueghel, Rembrandt, Rubens and Velasquez will be studied as well as the emergence of genre and landscape painting and the development of national schools.  
Prerequisite: Fine Arts 312* or consent of instructor.  
Not offered 1974-75

314* Medieval Art 1  
A survey of painting, sculpture, architecture, and related arts from the time of early Christian art to the emergence of the Romanesque style, and including the Byzantine art of this period.  
Prerequisite: Fine Arts 110*-111* or consent of instructor.
315* Medieval Art 2 A survey of painting, sculpture, architecture, and related arts commencing with the Romanesque period, continuing through to the beginning of the late Gothic period, and including Byzantine art to the capture of Constantinople.

Prerequisite: Fine Arts 314* or consent of the Instructor.

316* Canadian Art 1 An examination of Canadian art beginning with the aboriginal arts of Indians and Eskimos, extending through the imported styles of settlers, especially from Britain and France, in the seventeenth, eighteenth and nineteenth centuries, to the development of the nationalist styles of the early twentieth century, culminating in contemporary Canadian art.

No prerequisites.

317* Canadian Art 2 A continuation of Fine Arts 316*.

Prerequisite: Fine Arts 316*.

320* Advanced Painting 1 An exploration of the technique of watercolour painting as a means of creating both non-objective and representational forms on a two-dimensional surface. Lab fee.

Prerequisite: Fine 220* or consent of instructor.

Winter term

321* Advanced Painting 2 A continuation of Fine Arts 220* with emphasis on independent problems. Lab fee.

Prerequisite: Fine 220*.

Not offered 1974/75.

322* Advanced Sculpture 1 Exploration of sculpture problems, specifically the organization and integration of three dimensional objects in a real environment. Lab fee.

Prerequisite: Fine 222*.

Not offered 1974/75.

323* Advanced Sculpture 2 A continuation of Fine 322* with emphasis on independent problems. Lab fee.

Prerequisite: Fine Arts 222*.

Not offered 1974/75.

324* Advanced Drawing 1 A course in which drawing is investigated as a means of expression and communication. An understanding of the human figure – its structure, its movement, and its connotation – will be a central goal of the work. Objects and the landscape will also be studied as sources of artistic possibility. The student will be encouraged to experiment with imagery, to develop personal vision, and to devise individual formal modes of expression. Lab fee.

Prerequisite: Fine 224 and consent of instructor.

325* Advanced Drawing 2 A continuation of Fine Arts 324*.

326* Advanced Printmaking The practice and study of various graphic techniques with emphasis on coloured intaglio, silk screen, and photographic processes. Lab fee.

Prerequisite: Fine 226*.
327* Advanced Printmaking  
A continuation of Fine 326* with emphasis on independent problems. Lab fee.  
Prerequisite: Fine 326*.

328* Calligraphy 1  
A study of the art of written forms, combining studio projects with slide lectures on the history of writing, illuminating, and lettering. Students will strive for mastery in various calligraphic forms including Roman, Uncial, Gothic, Italic and Contemporary free scripts. Lab fee.  
No prerequisites.  
Not offered 1974/75.

329* Calligraphy 2  
Studio work in techniques of preparation of graphic material for reproduction, using illustration and typography as well as calligraphic forms, together with slide lectures on the history of printed forms. Lab fee.  
Prerequisite: Fine 328*.  
Not offered 1974/75.

334* Advanced Film Making 1  
Further exploration in documentary film. Visual significance, motivation and other aspects of script writing. Film Stock and processing paid by students.  
Prerequisite: Fine 234* and 235*. Fall term.

335* Advanced Film Making 2  
Examination of production methods in film and TV industry. Production of films, Lab fee.  
Prerequisite: Fine 334*.

346R*/347R* Special Topics in Film  
Special topics will be announced from year to year.

370* Film Theory 1  
(Anatomy of Film)  
A development of ideas gained in Fine Arts 244* and 245*. Provided with the basic historical knowledge, the student will analyse the aesthetic aspects of cinema (principles known as “film language”).  
Selected contemporary films will be discussed. Regular film screening will accompany the course.  
Prerequisite: Fine 244*-245* or Fine 234*-235* or Permission.  
Fall term.

371* Film Theory 2 (Film Aesthetics and Criticism)  
An extension of Fine 370*. The main accent will be placed upon major theories of cinematography, such as those of Kracauer, Metz, and Eisenstein, and upon the development of the students own judgment in the form of critical expression.  
The impact of the film medium upon modern society will also be discussed as well as the relationship between film and television.  
Prerequisite: Fine 370*. Winter term.

390* Selected Subjects in Fine Arts  
Research and reading courses under the direction of individual instructors.  
Admission by consent of instructor. Fall term.
391* Selected Subjects in Fine Arts
Research and reading courses under the direction of individual instructors.
*Admission by consent of the Instructor. Winter term.

392* Selected Subjects in Fine Arts
Studio and practice courses under the direction of individual instructors.
*Admission by consent of instructor. Fall term.

393* Selected Subjects in Fine Arts
Studio and practice courses under the direction of individual instructors.
*Admission by consent of the Instructor. Winter term.

420* Senior Seminar in Graphics Techniques 1
*Admission by consent of Instructor.
Fall term.

421* Senior Seminar in Graphics Techniques 2
*Admission by consent of Instructor.
Winter term.

434* Senior Seminar in Film Techniques 1
Extended study and practice of film forms and techniques.
Production of films with pedagogic value. Film stock and processing paid by the students.
*Prerequisites: Fine Arts 334 and 335.
Fall term.

435* Senior Seminar in Film Techniques 2
Continuation of 434. Production of films based on fiction.
Film stock and processing paid by students.
*Prerequisite: Fine 434.
Winter term.

470* Senior Seminar in Film Concepts 1
*Admission by consent of Instructor.

471* Senior Seminar in Film Concepts 2
*Admission by consent of Instructor.

472* Senior Seminar in Graphics Concepts 1
*Admission by consent of Instructor.

473* Senior Seminar in Graphics Concepts 2
*Admission by consent of Instructor.

490* Senior Honours Presentation 1
Each student will work under the direction of a Fine Arts faculty member on an advanced creative project; the result of this endeavour will be presented in the form of an exhibition or its equivalent (i.e.: film, illustrated book, portfolio, or essay), which will be examined by faculty members of Fine Arts and also where pertinent, by members of other departments.
*Required of all students in Honours Fine Arts.
*Admission by permission only.

491* Senior Honours Presentation 2
A continuation of Fine 490*.
*Admission by permission only.
Requirements for Fine Arts General B.A. Degree in Music

To fulfill the requirements for a general degree in Fine Arts in Music students must take the equivalent of 14 half courses in Music including 150*G/151*G, 254*G/255*G. The remaining courses must be selected in consultation with the Music Faculty.

Students from any faculty may take courses in Music on an elective basis.

Undergraduate Courses

102G*/104G* Introduction to the Fine Arts
An integrated study of works of art and musical compositions, and their relationship to the time period in which they were created. The emphasis is on actual experiences of the arts.

No prerequisites
Not offered 1974-75.

150G* Introduction to Music
Examination by means of listening and analysis, of styles of music ranging from early Christian Chant to electronic and computer music. Composition to be studied included major forms such as sonata, symphony, opera, mass, etc., as well as smaller forms.

3 lectures. Fall term.

151G* Introduction to Music
Continuation of 150*G.
Prerequisite: 150*G or consent of Instructor.
3 lectures. Winter term.

166G* Music Studio
Practical performance study with approved instructor and examination administered by music faculty. A half-course credit normally requires two terms of private study, but may be achieved in one term if supplemented with approved related studies in music literature.
Prerequisite: consent of music faculty

252G* Music and Literature
A study of music which is related to literary works from the various periods and genres, including Greek drama and mythology, the Bible, Goethe, Heine, Shakespeare, etc., and which have taken form in a variety of musical genres, such as lied, opera, oratorio and symphonic music.
Not offered in 1974-75.

253G* Music and Literature
A study of music which is related to literature concentrating on one or several writers, and which has taken form in one or several of the musical genres, such as lied, opera, oratorio and symphonic music.
Not offered in 1974-75.
254G* Bach to Beethoven  
Music from around 1700 to 1827, the Baroque and Classical Periods of music. Major composers studied are Bach, Haydn, Mozart, and Beethoven. Listening to music is an integral part of the course. 
3 lectures. Fall term.

255G* Music of the Romantic Period (19th century)  
Included among the many musical compositions studied are operas of Wagner, Verdi and Mussorgsky, the lieder of Schubert, Schumann and Wolf, symphonic of Brahms, Mendelssohn, Tschaikowsky, and piano music of Chopin. 
3 lectures. Winter term.

260G* Choral Literature  
Study of choral and ensemble music of all styles, sacred and secular, from the middle ages to the present. Laboratory sessions will consist of actual singing of choral works, leading to public performance. 
Prerequisite: 150/151G or consent of Instructor. 
3 lectures. Fall term.

261G* Choral Literature  
Continuation of 260G. 
3 lectures. Winter term.

262G* Instrumental Literature  
The study of the music written from the seventeenth century to the present for a variety of instrumental groups, such as chamber music, symphony, concertos. 
Prerequisite: Fine 150G* - 151G* or consent of the instructor. 
3 lectures. Fall term.

263G* Instrumental Literature  
Continuation of 262G*. 
Prerequisite: 262G*. 
3 lectures. Winter term.

266G* Music Studio  
See 166G for course description. 
Prerequisite: 166G* and consent of music faculty.

273G* Traditional Folk Music  
Countries to be discussed: Great Britain, Canada, the United States and the Antipodes. A series of lectures and discussions supplemented by records, tapes, and field recordings. Delineation of characteristic motifs in folk music. Various folk instruments will be used by the lecturer throughout the course: guitar, auto harp, hammer dulcimer, appalachian dulcimer, and five string banjo. 
3 lectures. Winter term.

300G* Stratford Festival Seminar  
An interdisciplinary course intended for students interested in English, Music, Drama, and Speech. The focus of the seminar is centred in the dramatic and musical productions at Stratford Festival theatres plus performances at the Shaw Festival at Niagara-on-the-Lake and selected productions at Toronto and London, Ontario. 
Not offered 1974/75. 
Prerequisite: An introductory course in Music, Drama, or Speech, or consent of instructor.
301G* Stratford Festival Seminar Continuation of Fine Arts 300G*.
Not offered 1974-75.

351G* Ancient, Medieval and Renaissance Music The study of music from pre-Christian times to approximately 1600.

352G* Music of the Twentieth Century A study of representative musical compositions of the twentieth century and their relationship to social, literary and political movements.
Prerequisite: 150G*, 151G* or consent of instructor 3 lectures. Winter term

366G* Music Studio See 166G* for course description.
Prerequisite: 266G* and consent of music faculty.

466G* Music Studio See 166G* for course description.
Prerequisite: 366G* and consent of music faculty.
General Engineering

000 Tutorial

Students will meet with a faculty member designated as their class professor. Performance in problem assignments and conceptual difficulties with other courses will be discussed, along with interrelation of present coursework, later work and engineering practice.

1 hour per week, both terms. (Consultation periods with teaching assistants regarding specific course problems if required at the initiative of the students or the class professor, will be available.)

010 Orientation

Given by the Department of Co-ordination in Fall and Winter terms for students in first year Engineering. Its purpose is to introduce the students to the various features of the Co-operative Programme. Discussion concentrates on such aspects as the role of the Department of Co-ordination, preparation for and participation in the employer interviews, work reports, and the expectations of the work term.

061 History and Philosophy of Science

The major conceptual transformations in the evolution of science and technology.

The nature of science; science and technology in Egypt and Babylon. The development of science in Greece. The Alexandrian school and the separation of science and philosophy. The medieval attitude toward science. The Renaissance. Copernicus and Galileo. Sir Isaac Newton. Developments during the 18th and 19th centuries. The 20th century revolution in pure science and technology; scientific technology as a determining characteristic of global civilization and some critical questions it poses.

3 hours per week.

062 Introduction to Human Communication Systems

Broadly, the processes involved in man-man, man-machine and mass communications will be discussed. Models of communication systems. The contributions and points of view of the various disciplines which make up the spectrum of communication studies today. Necessary fundamental concepts from these disciplines. Applications of the theories in fields relevant to the student.

3 hours per week, lectures and seminars.

101 Topics from Scientific Thought

A variety of topics selected from modern science are treated in the lectures at a conceptual level and then used as a base for discussion. Certain aspects of historical, philosophical and particularly social significance are included according to the inclinations of the students and discussion leaders.

3 hours per week. Not offered in 1974-75.

102 Introduction to the Sciences of Man

The course is intended to introduce the engineering, mathematics and science undergraduates to some of the sciences of man (anthropology, sociology and psychology). The course will be conducted on the basis of both lecture and tutorial hours. Lectures will be under the supervision of a single person responsible for the conduct of the course. He may invite participation from the interested disciplines as required.

3 hours per week.
103 Topics from the Arts and Humanities

The course will explore some of the major movements of thought which are still shaping modern affairs and modern consciousness. The topics may vary from term to term but examples would be Marxism, Racism, Freudianism, Existentialism, the meaning of civilization, artistic expression and Christianity. Lectures, readings and seminars together should offer a stimulating, if glancing, acquaintance with a few of the major strands of the present intellectual environment.

3 hours per week.

111 Graphics (A Term)

A course in the fundamentals of graphical projections of all types – orthographic, isometric, oblique and true perspective. Introduction to spatial co-ordinate plotting. Fundamentals of free hand sketching for communication of concept.

3 hours per week.

111 Graphics (B Term)

The application of graphics to the solution of vector problems, both coplanar and non-coplanar. Graphic calculus, both integration and differentiation, design of all types of nomographs: design of special slide rules: continuation of free hand sketching.

3 hours per week.

113 Engineering Measurement


3 hours lecture, term project.

Fall term only.

120 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 hours lecture, 1 hour tutorial

Winter and Spring terms

121 Digital Computation

Introduction to electronic digital computers, hardware and software organization; basic features of FORTRAN IV; examples of efficient numerical algorithms for basic scientific computations.

2 hour lecture, 2 hour tutorial, one term

Winter and Spring terms
122 Electricity and Magnetism

Introduction to fundamentals of electromagnetics, circuits, wave motion and propagation. Electromagnetics: Coulomb's Law, electric field and potential, capacitor; resistivity and Ohm's Law; Ampere's Law, magnetic fields and forces, inductor. Circuits: series and parallel circuits, Kirchoff's laws; ohmic dissipation of energy, stored energies in capacitors and inductors. Wave motion: graphical representation, rotating vectors, superposition. Wave propagation: (i) sound: velocity, wavelength, energy, frequency and resonance, (ii) optics: plane, concave and convex mirrors and lens; reflection and refraction; interference and diffraction, polarization; electricity and light.

3 hour lectures, 2 hours lab, 1 hour tutorial

Winter and Spring terms

250 Basic Concepts of Engineering and Applied Science

Some of the basic analytical tools common to engineering and applied science will be developed and used to clarify the roles of the different groupings within science and technology. Topics covered will include quantification, probability, precision, methods of representation, graphs, the design process, testing, modelling, historical basis and some future considerations.

3 hours per week. No prerequisites. Fall Term. Non-engineering students only. Not offered in 1974-75.
Department of Germanic and Slavic Languages
and Literature

Associate Professor and Chairman of the Department

M. Richter, Staatsexamen (Berlin and Bonn), M.A., Ph.D. (Toronto)

Assistant Professors

M. Kuxdorf, B.A., M.A. (Waterloo), Ph.D. (Alberta)

Associate Chairman

(German)

M. Kuxdorf, B.A., M.A. (Waterloo), Ph.D. (Alberta)

Associate Chairman

(Russian)

A. Donskov, B.A., M.A. (British Columbia), Dr.Phil. (Helsinki)

Professors

J.W. Dyck, A.B. (Bethel), M.A. (Missouri), Ph.D. (Michigan)

F. Heier, B.A., M.A. (British Columbia), Ph.D. (Michigan)

S. Hoefert, B.A., M.A., Ph.D. (Toronto)

I. Levitsky, A.B. (Rochester), M.A. (Buffalo), Ph.D. (Duke)

Visiting Professor

H. Boeschenstein, Dr.phil. (Rostock), F.R.S.C.

D. Jöns, Dr.phil., Prof.habil. (Kiel)

Associate Professors

W. Shelest, M.A. (Ottawa), Dr.phil. (München U.F.U.)

J. Whiton, B.A., M.A., Ph.D. (Minnesota)

A. Zwiers, Doctorandus (Amsterdam), litt. Dr. (Groningen)

Assistant Professors

G. Firnau (Mrs), Staatsexamen (Berlin), Ph.D. (Yale)

F. Jakobsh, B.A., M.A. (Manitoba), Ph.D. (Waterloo)

H.W. Panthel, B.A. (Waterloo), M.A. (Cincinnati), Ph.D. (Waterloo)

Lecturers

T. Sommer (Miss), B.A., M.A. (Waterloo)

A. Strack (Miss), Staatsexamen (Tübingen and Berlin)

(part time)

H. Marsden (Mrs.), B.A. (Randolph-Macon), M.A. (Waterloo)

Dean of Women

Undergraduate Courses

German

Note 1 All courses with the exception of German 10 are one term (half) courses.

Note 2 Half courses are designed for the convenience of students (Engineering and other Co-operative) who are enrolled in term-programmes. Nevertheless, to obtain credit Arts students must follow up – though not necessarily in the same year – 101* with 102*, 112*, or 114*; 111* with 112*, 102*, or 114*; 113* with 114*, 102*, or 112; 121* with 122*, 201* with 202*; 241* with 242*, 251* with 252*; 351* with 352*; 451* with 452*.

Note 3 Any other two term (half) courses constitute one full course.

Note 4 Except for German 10, all the following courses are Honours courses, but are also open to students enrolled in General programmes.
Waterloo in Germany Programme

The Department offers a programme in German language and literature at the University of Mannheim on the Rhine. The programme is open to 3rd and 4th-year students normally qualified to enrol in German courses at this level. In exceptional cases, 2nd-year students will also be considered. Students who would like to begin their studies in Mannheim in the Winter Semester (Oct. 15 to Feb. 15) must apply by April 1. The application deadline for those who would like to begin their studies in the Summer Semester (April 15 to July 15) is Feb. 1. Applications should be submitted to: "Waterloo in Germany" Department of Germanic and Slavic Languages and Literatures, University of Waterloo, Waterloo/Ontario.

10 Reading and Translation

This course is designed to assist graduate students in acquiring a reading knowledge of German. Usage and structure of German scientific writings. Translation in the fields of specialization.
Two terms, Lectures arranged
Open to graduate students of all departments

101* First Year German

For students with little or no knowledge of German. (Not open to students with Ontario High School Grade 13 German or equivalent, nor to students who have credit for German 111*/112* or 113*/114*.) The basic elements of German grammar with an emphasis on oral practice and pronunciation. Language laboratory. Introduction to aspects of German culture and reading of appropriate graded texts.
Open to all university students
One term, 3 hours in classroom, 1 hour language laboratory
(One section, German 101A* offers more intensive oral practice with an additional language lab hour per week.)

102* First Year German

Course description as in German 101*.
Prerequisite: Either German 101*, 111*, 113*, or equivalent

111* First Year German (Science Oriented)

For students with little or no knowledge of German. (Not open to students with Ontario High School Grade 13 German or equivalent, nor to students who have credit for German 101*/102* or 113*/114*.) The basic elements of German grammar with an emphasis on reading and translation of elementary scientific literature from various fields. The basic elements of German pronunciation. Introduction to aspects of German culture.
Open to all university students
One term, 3 hours

112* First Year German (Science Oriented)

Course description as in German 111*.
Prerequisite: Either German 111*, 101*, 113*, or equivalent
Department of Germanic and Slavic Languages and Literatures

113* First Year German (Business Oriented) For students with little or no knowledge of German. (Not open to students with Ontario High School Grade 13 German or equivalent, nor to students who have credit for German 101*/102* or 111*/112*.) The basic elements of German with an emphasis on reading and translation of texts related to business and economics.
Open to all university students
One term, 3 hours

114* First Year German (Business Oriented) Course descriptions as in German 113*.
Prerequisite: German 113*, or equivalent

121* Introduction to German Literary Movements
Introduction to the major periods and movements of German literature. Reading and interpretation of short representative texts, mainly from the 19th and 20th centuries. The further development of the four language skills (speaking, understanding, reading, and writing) is an integral part of this course.
One term, 3 hours
Prerequisite: This course is normally for students with at least 2 years of high school German. Other students with equivalent knowledge of German should obtain the permission of the instructor

122* Introduction to German Literary Movements
Course description as in German 121*.
One term, 3 hours
Prerequisite: German 121* or equivalent

201* Intermediate 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: Either German 102*, 112*, 114*, or equivalent

202* Intermediate Scientific German
Course description as in 201*.
One term, 3 lectures
Prerequisite: German 201* or equivalent

231* Contemporary Literature
Reading and interpretation of selected literary works since 1945. This course is specifically designed for students who have taken but one year of German.
One term, 3 hours
Prerequisite: German 102* or equivalent
Students with German 281*/282* are ineligible

232* Contemporary Literature
Course description as in German 231*
One term, 3 hours
Prerequisite: German 231* or equivalent
241* German Conversation and Composition
This course is a continuation of First Year German (101*/102*).
It offers extensive practice in both the spoken and written language. It provides vocabulary building, grammar review, and exercises in pronunciation and comprehension.
One term, 3 hours, plus one optional hour language lab
Prerequisite: Either German 102*, 112*, 114*, or permission of instructor
Not open to students who have credit for German 251*/252*

242* German Conversation and Composition
Course description as in German 241*
One term, 3 hours, plus one optional hour language lab

251* German Conversation and Composition
This course offers extensive practice in both the spoken and written language. It provides vocabulary building, grammar review, and exercises in pronunciation and comprehension.
One term, 3 hours, plus one optional hour language lab
Prerequisite: German 122* or permission of instructor.
Not open to students who have credit for German 241*/242*

252* German Conversation and Composition
Course description as in German 251.
One term, 3 hours (lectures and language lab)
Prerequisite: German 251* or equivalent

271* German Thought and Culture
A survey of cultural currents to the time of Enlightenment.
Lectures will focus on major developments in literature, philosophy, religion, art, architecture, and music as seen against the historical background of the German speaking peoples.
This course is taught in English
One term, 3 lectures
Prerequisite: None

Note
Arts students can take this course in their second or subsequent years, students of other faculties in any year (Chapter 8 for course requirements in the Faculty of Arts)

272* German Thought and Culture
A survey of cultural events from Goethe to the present. Lectures will focus on major developments in literature, philosophy, religion, art, architecture, and music as seen against the historical background of the German speaking peoples.
This course is taught in English
One term, 3 lectures

281* Post-War Literature
Reading and interpretation of major works since 1945 in prose, drama and poetry. Main authors: Brecht, Borchert, Böll, Frisch, Dürenmatt, Grass, Eich.
One term, 3 hours
Prerequisite: German 122* or equivalent
Students with German 231*/232* are ineligible

282* Post-War Literature
Course description as in German 281*.
One term, 3 hours
Prerequisite: German 281* or equivalent
341* The Age of Goethe
(Storm and Stress, Classicism) Reading, interpretation, and critical analysis of representative works (Goethe, Schiller, Hölderlin, etc.).
One term, 3 lectures
Prerequisite: German 122* or 232*.

342 The Age of Goethe
(Romanticism) Reading, interpretation, and critical analysis of representative works (Novalis, Tieck, Brentano, etc.).
One term, 3 lectures
Prerequisite: German 122* or 232*

351* Intermediate Conversation and Composition Conversation on modern topics. Exercises in advanced grammar, stylistics, and composition.
One term, 3 lectures
Prerequisite: German 242*, 252*, or equivalent

352* Intermediate Conversation and Composition Course description as in German 351*.
One term, 3 lectures
Prerequisite: German 351*

361* Young Germany and Biedermeier Reading, interpretation, and critical analysis of prescribed prose, drama and poetry (Grillparzer, Mütike, Stifter, Gotthelf, etc.).
One term, 3 lectures
Prerequisite: German 122* or 232*

362* Poetic Realism Reading, interpretation, and critical analysis of prescribed prose, drama and poetry (Storm, Keller, Ludwig, Hebbel, Raabe, Fontane, etc).
One term, 3 lectures
Prerequisite: German 122* or 232*

371* Modern German Literature Reading, interpretation, and critical analysis of prescribed texts relating to the “Moderne” and various literary movements around the turn of the century.
One term, 3 lectures
Prerequisite: German 122* or 232*

372* Modern German Literature Reading, interpretation, and critical analysis of prescribed texts from the early 20th century to the end of World War II (Kafka, Brecht, etc.).
One term, 3 lectures
Prerequisite: German 122* or 232*

391* Masterpieces of German Literature A study of significant prose and dramatic works of German literature from 1770 to the present. These works will be studied in groups according to themes such as: political freedom and tyranny, personal responsibility and egoism, flesh and spirit, man in society. The works studied will include titles such as: Prinz von Homburg (Kleist), Woyzeck (Büchner), Thus Spake Zarathustra (Nietzsche), Death in Venice (Thomas Mann), Steppenwolf (Hesse), Metamorphosis, The Trial (Kafka), plays by Brecht, Hochhuth, Weiss, and others.
This course is taught in English.
One term, 3 lectures
Open to all students
392* Masterpieces of German Literature
Course description as in German 391*.
One term, 3 lectures
Open to all students

451* Advanced Conversation, Grammar and Composition
This course is conducted in German and provides intensive practice in spoken and written German on the advanced level.
One term, 3 lectures
Prerequisite: German 352* or equivalent

452* Advanced Conversation, Grammar and Composition
As 451*.
One term, 3 lectures
Prerequisite: German 451*

461* Introduction to the History of the German Language with Readings in Middle High German
One term, 3 lectures
Prerequisite: German 122* or 232*

462* Middle High German Literature
Reading and interpretation of samples from the major works of the first “Blütezeit” in German literature (1170 to 1250) and of the Late Middle High German era (up to 1500): Early Minnesang, Heinrich von Morungen, Reinmar der Alte, Walther von der Vogelweide, Nibelungenlied, Wolfram von Eschenbach, Meister Eckhart, Oswald von Wolkenstein, Johannes von Tepl, Sebastian Brant, etc.
One term, 3 lectures
Prerequisite: German 461*

471* German Poetry
A study of the main thoughts, themes, forms, and schools in German poetry from the beginnings to Goethe.
One term, 3 lectures
Prerequisite: German 122* or 232*
Offered in alternate years

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 122* or 232*
Offered in alternate years

481* Humanism/Reformation
Reading, interpretation, and critical analysis of prescribed texts (Erasmus, Luther, Sachs, Bidermann, etc.).
One term, 3 lectures
Prerequisite: German 122* or 232*
Offered in alternate years

482* Baroque and Enlightenment
Reading, interpretation, and critical analysis of prescribed texts (Opitz, Gryphius, Grimmelshausen, Hofmannswaldau, Angelus Silesius, Haller, Klopstock, Lessing, Wieland, etc.).
One term, 3 lectures
Prerequisite: German 122* or 232*
Offered in alternate years

495*498* Reading Courses in Approved Topics
One term each, 3 lectures.
Open to fourth year students only
Russian

Note 1 All courses with the exception of Russian 10 are one term (half) courses.

Note 2 Half courses are designed for the convenience of students (Engineering and other Co-operative) who are enrolled in term-programmes. Nevertheless, to obtain credit Arts students must follow up—though not necessarily in the same year—101* with 102*; 111* with 112*; 201* with 202*; 251* with 252*; 271* with 272*; 351* with 352*; 381* with 382*; 451* with 452*.

Note 3 Any other two term (half) courses constitute one full course.

Note 4 Except for Russian 10, all the following courses are Honours courses, but are also open to students enrolled in General programmes.

10 Reading and Translation

This course is designed to assist graduate students in acquiring a reading knowledge of Russian. Usage and structure of Russian scientific writings. Translation in fields of specialization.
Two terms. Lectures arranged
Open to graduate students of all departments

101* First Year Russian
(Art's Oriented) For students with little or no knowledge of Russian. The elements of Russian grammar and composition; with emphasis on oral practice and pronunciation. Language Laboratory and Visual aids. Selected readings of major Russian authors.
Open to all university students, except those who have credit for Russian 111*|112*.
One term, 4 hours

102* First Year Russian
(Art's Oriented) Course description as in Russian 101*.
One term, 4 hours
Prerequisite: Russian 101* or equivalent

111* First Year Russian
(Science Oriented) For students with little or no knowledge of Russian. Essential grammar, sentence structure. Reading and translation of scientific literature according to the students' fields of interest.
Open to all university students, except those who have credit for Russian 101*|102*
One term, 3 hours

112* First Year Russian
(Science Oriented) Course description as in Russian 111*.
One term, 3 hours
Prerequisite: Russian 111, Russian 101, or equivalent

201* Scientific Russian
A review of the fundamentals of grammar is followed by a more advanced study of the 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.
Prerequisite: Russian 102*, 112* or equivalent.
One term, 3 lectures.
202* Intermediate Scientific Course description as in 201*.
Russian Prerequisite: Russian 201* or equivalent
One term, 3 lectures

251* Conversation, Composition, Grammar This course is conducted largely in Russian and provides intensive
and Phonetics practice in spoken Russian. Vocabulary building, comprehension,
pronunciation and intonation are stressed.
Prerequisite: Russian 102*, 112* or equivalent
One term, 3 hours (lectures and language lab.)

252* Conversation, Composition, Grammar As 251*.
and Phonetics Prerequisite: Russian 251* or equivalent
One term, 3 hours (lectures and language lab.)

261* Introduction to Reading of representative works from Russian Classicism,
Russian Literary Romanticism, 19th Century Realism, and various periods of 20th
Movements century Russian literature.
Prerequisite: Russian 102* or permission of instructor
One term, 3 lectures

262* Introduction to Russian Literary Movements As 261*.
Prerequisite: Russian 261*
One term, 3 lectures

271* Russian Thought and A survey of cultural history from 862 to 1861. Lectures will focus
Culture on major developments in literature, religion, philosophy, art,
arithmetic, and music as seen against the background of Russia's historical past.
This course is taught in English
Note Arts students can take this course in their second or subsequent years, students of other faculties in any year (Chapter 8 for course requirements in the Faculty of Arts).

272* Russian Thought and A survey of cultural history from 1861 to the present. Lectures will focus
Culture on major developments in literature, philosophy, art,
and music as seen against the background of Russia's historical past. Discussion will be devoted primarily to works of Russian literature.
This course is taught in English
One term, 2 lectures, 1 discussion

351* Intermediate Conversation and Composition Written reports on prescribed themes and topics. Oral drill and translation.
Prerequisite: Russian 252* or equivalent.
One term, 3 lectures

352* Intermediate Conversation and Composition As 351*
Prerequisite: Russian 351*
One term, 3 lectures

361* Russian Realism Reading, interpretation, and critical analysis of selected fiction and drama (Gogol, Goncharov, Ostrovsky, Turgenev, Chernyshevsky).
Prerequisite: Russian 102*.
One term, 3 lectures
362* Russian Realism  Reading, interpretation, and critical analysis of selected fiction and drama (Dostoevsky, Leskov, Saltykov, Shchedrin, Tolstoy, Chekhov).
Prerequisite: Russian 102*
One term, 3 lectures

371* The Golden Age of Russian Literature  Reading and interpretation of prescribed prose, drama and poetry from Lomonosov to Pushkin.
Prerequisite: Russian 102*
One term, 3 lectures

372* The Golden Age of Russian Literature  Reading and interpretation of prescribed prose, drama and poetry from Pushkin to the 1860's.
Prerequisite: Russian 102*
One term, 3 lectures

381* The Peoples of the Soviet Union  Especially emphasized will be the study of non-Slav peoples of the Caucasus and Central Asia, European Russia and Siberia. Czarist and Soviet policy towards national minorities, assimilation and integration problems in the light of linguistic divisions; development of literary languages. Some achievements of Soviet anthropology.
One term, 3 lectures

382* The Peoples of the Soviet Union  As 381.
Prerequisite: Russian 381*
One term, 3 lectures

391* Great Russian Novels  From Pushkin to Dostoevsky (Pushkin: Eugene Onegin, Gogol: Dead Souls, Turgenev: Fathers and Sons, Dostoevsky: Crime and Punishment, and others).
Themes especially emphasized will be: the complex society, its merits, responsibility or guilt in relation to the individual; East-West confrontation; reform ideas; Nihilism; the superfluous man; tears behind laughter, etc.
This course is taught in English
One term, 3 lectures
Open to all students

392* Great Russian Novels  From Tolstoy to Solzhenitsyn (Tolstoy: War and Peace, Zamiatin: We, Pasternak: Doctor Zhivago, Solzhenitsyn: Cancer Ward, and others).
Themes as in Russian 391*.
This course is taught in English
One term, 3 lectures
Open to all students

451* Advanced Conversation, Grammar and Composition  This course is conducted in Russian and provides intensive practice in spoken and written Russian on the advanced level.
Prerequisite: Russian 352* or equivalent
One term, 3 lectures

452* Advanced Conversation, Grammar and Composition  As 451*.
One term, 3 lectures
461* Twentieth Century Russian Literature
Reading, interpretation, and critical analysis of selected fiction and drama (Andreev, Bunin, Gorky, Kataev, Sholokhov, A.N. Tolstoy).
Prerequisite: Russian 102*.
One term, 3 lectures

462* Twentieth Century Russian Literature
Reading, interpretation, and critical analysis of selected fiction drama (Arbusov, Bulgakov, Erenburg, Nabokov, Pasternak, Solzhenitsyn).
Prerequisite: Russian 461*
One term, 3 lectures

481* Russian Poetry
A study of themes and forms of representative authors of Classicism, Romanticism (Lomonosov, Derzhavin, Pushkin, Lermontov, Nekrasov, Fet, Tiutchev, etc.).
Prerequisite: Russian 102*
One term, 3 lectures

482* Russian Poetry
A study of themes and forms of representative authors from Symbolism to the present (Blok, Esenin, Mayakovsky, Akhmatova, etc.).
Prerequisite: Russian 102*
One term, 3 lectures

495*-498* Reading Courses in Approved Topics
Open to fourth year students only.
One term each, 3 lectures

Ukrainian

101* Beginners' Ukrainian
Basic grammar, reading, oral practice in language laboratory, translation and writing exercises.
One term, 3 hours (lectures and language lab.)
Open to undergraduate students of all departments; recommended to graduate students of Russian as a second Slavic language.

102* Beginners' Ukrainian
Course description as in Ukrainian 101.
One term, 3 hours (lectures and language lab.)
Prerequisite: Ukrainian 101 or equivalent

201* Intermediate Ukrainian
This course will be conducted in Ukrainian and provides intensive practice in grammar, composition, and conversation.
One term, 3 hours (lectures and language lab.)
Prerequisite: Ukrainian 102 or equivalent

202* Intermediate Ukrainian
Course description as in Ukrainian 201.
One term, 3 hours (lectures and language lab.)
Prerequisite: Ukrainian 201 or permission of instructor

301* Introduction to Ukrainian Literature
Reading and critical interpretation of texts chosen from the works of Skovoroda, Kotliarevs'ky, Shevchenko, Franko, I. Ukrainka and others.
One term, 3 lectures
Prerequisite: Ukrainian 202 or permission of instructor
302* A Critical Survey of Literary Movements in 20th Century Ukrainian Literature

With special attention to the rise of the new angry generation of poets of the Sixties (W. Symonenko, L. Kostenko, V. Korotych, and others).

One term, 3 lectures

Prerequisite: Ukrainian 301 or permission of instructor
Department of History

Professor and Chairman of the Department

Associate Professor, Associate Chairman

Professors
K.W. Beachey, B.A.(Queen's), Ph.D.(Edinburgh)
P.G. Cornell, E.D., M.A., Ph.D.(Toronto)

(part time)
D.C. Masters, B.A., M.A.(Toronto), D.Phil.(Oxford)
G.A. Ostrander, B.A.(Columbia), M.A., Ph.D.(California-Berkeley)

Adjunct Professors

(Advisory Board)
A.J. Siirala, Th.Cand.(Helsinki), Th.Lic.(Lund), Th.D.(Helsinki)
P. Stingelin, B.A.(Basel), Ph.D.(Zurich)

Associate Professors
D.N. Baker, B.A.(U.B.C.), A.M., Ph.D.(Stanford)
M.T. Cherniavsky, M.A.(Oxford)
D.A. Davies, B.A., Ph.D.(Washington)
K.R. Davis, B.A.(Toronto), M.A.(Wheaton), Ph.D.(Michigan)

G F.H. Epp, B.A.(Bethel College), M.A., Ph.D.(Minnesota)
L.A. Johnson, B.A.(Waterloo), M.A., M.Phil.(Toronto)
P. Keresztes, M.A.(Toronto), Ph.D.(Graz)

G W. Klaassen, B.A.(McMaster), D.Phil.(Oxford)
A. Lentini, B.A., M.A., Ph.D.(Cambridge)
R.C. MacGillivray, B.A.(Queen's), A.M., Ph.D.(Harvard)
E.P. Patterson, B.A.(Baylor), M.A.(Kansas), Ph.D.(Washington)

J P.S. Smith, M.A.(Toronto), Ph.D.(New Mexico)
J J.A. Wahl, C.R., B.A.(Western), M.A., Ph.D.(St.Louis)

Assistant Professors
J.A. Barbier, M.A., Ph.D.(Connecticut)
J L. Grayson, B.A.(York), M.A., Ph.D.(Toronto)
R.W. Guiss, B.A.(Toronto), D.Phil.(Oxford)
P.J. Harrigan, B.A.(Detroit), A.M., Ph.D.(Michigan)
D.J. Horton, B.A.(Waterloo) Ph.D.(McGill)
S.K. Johannesen, B.A.(Evangel College), M.A., Ph.D.(Missouri)
K.M. McLaughlin, B.A.(Waterloo), M.A.(Dalhousie) Ph.D.(Toronto)
J.O. Stubbs, B.A.(Toronto), M.Sc.(Econ.) (London), D.Phil.(Oxford)
J.W. Walker, B.A.(Toronto), M.A.(Waterloo), Ph.D.(Dalhousie)
D.E. Wright, B.A.,(Cambridge), Ph.D.(McMaster)
Department of History

Part-time Lecturers R  W.O. Packull, B.A.(Guelph), M.A.(Waterloo)
N. Robinson, B.A.(Toronto), A.M.(Harvard)

Faculty member holds cross appointment as shown
1 Cross appointment in Classics

Bachelor of Arts

a) General Programme

Students majoring in history should consult the General Programme requirements described in Chapter 8. They will normally choose one course from the Introductory and three courses from the Survey listings below. In their third year they must also take at least one course from the Depth Study listings (or from the Senior Seminar listings, if permitted by the instructor). The exact programme for each student will be worked out in consultation with a department advisor.

b) Honours Programme

Students taking the Honours programme in History should consult the Honours Programme requirements in Chapter 8. The exact programme for each student will be worked out in consultation with a departmental advisor.

Undergraduate Courses

Note 1 Courses offered by the History Department are divided into four basic categories to allow for sequential development. The four categories are as follows:

<table>
<thead>
<tr>
<th>Level</th>
<th>Courses</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 level:</td>
<td>Introductory Courses</td>
<td>(For General and Honours credit)</td>
</tr>
<tr>
<td>200 level:</td>
<td>Survey Courses Group 1</td>
<td>(For General credit only)</td>
</tr>
<tr>
<td></td>
<td>Group 2</td>
<td>(For General or Honours credit)</td>
</tr>
<tr>
<td></td>
<td>Group 3</td>
<td>(For Honours credit only)</td>
</tr>
<tr>
<td>300 level:</td>
<td>Depth Courses</td>
<td>(For Honours credit only)</td>
</tr>
<tr>
<td>400 level:</td>
<td>Senior Seminars</td>
<td>(For Honours credit only and intended primarily for Honours students)</td>
</tr>
</tbody>
</table>
Note 2  General students are reminded that they must take at least one Depth course – or Senior Seminar, if granted permission – for Honours credit in order to complete their major. A student cannot take both a General and a corresponding Honours course for credit: e.g., 203*, 204* and 264*; 213 and 277; 222* and 383B*; 223*, 224* and 265; 227*, 228* and 266.

Note 3  Half courses (meeting for one term only) are designated by an asterisk (*) after the course number. In 265, 291, 295, 380, 383 and 399, students should use these numbers when registering for the full year. If registering for a half course only, use the alternative numbers: for example, 265A* (Fall), 265B* (Winter etc).

Note 4  The G,P,R,J, suffixes indicate administered by one of the Colleges: Conrad Grebel (G), St. Paul's (P), Renison (R), St. Jerome's (J).

Note 5  In both undergraduate and graduate courses an instructor may grant a grade of Incomplete for a certain time in special cases, such as illness. If all the required work is not completed in the specific period, a grade is allotted. Unless a major portion of this work has been submitted this grade is normally an F. All incomplete grades are automatically turned into Fs after a lapse of seven months for full undergraduate courses, four months for graduate courses.

Introductory Courses

100 The Historian's Craft  This course examines a number of topics with the aim of introducing students to the nature of historical explanations. Participants will examine how and why history has been studied, and perhaps come to some conclusion about how and why it should be studied.

Wahl, Staff

101 Crisis and Change in Western Civilization  This course will examine the development of Western Civilization by focussing on some of the major transformations which the western world has experienced. Beginning with a study of the implications of the Fall of the western Roman Empire and the medieval world that emerged from it, it will move quickly to a study of the urban revolution and early capitalism, and to the religious and scientific revolutions of early modern times. It will analyse the changes effected by the French Revolution, industrialization and nationalism on nineteenth century society, and will conclude with a study of the effects of twentieth century wars and revolutions. Through both lectures and small tutorials, student will be introduced to historical controversy and methodology, techniques of theme writing and research and source analysis. It is recommended both for future honours history students and for students in other areas who wish an overview of the dynamic forces in Western Civilization.

MacKinnon, Lentin, Harrigan, Baker.

10IR* Major Themes of Western Civilization 1  An introduction to the historical development of European civilization from Graeco-Roman and Judaeo-Christian origins to the emergence of sovereign states.

Fall.

Packull
102R* Major Themes of Western Civilization 2
The development of modern nationalism and the clash of nationalism and internationalism as a theme of 20th-century history.
Winter
Packull

103* The Emergence of the Third World
Surveys the history of the social, political and economic changes which have led to the creation of new nations and the resurgence of old nations and peoples in Asia, Africa and the New World.
Fall.
Walker

104* The Emergence of the Third World
Surveys the history of the social, political and economic changes which have led to the creation of new nations and the resurgence of old nations and peoples in Asia, Africa and the New World.
A continuation of 103*.
Winter
Beachey

105* The Meaning of Civilization
This course is structured around the series of films, Civilization, narrated by Kenneth Clark, and has two objectives. One is to offer an introduction to some of the masterworks of Western art and architecture, with an eye to processes of change in form and sensibility. The films will constitute the core of this aspect of the course, supplemented by prints and brief documentary readings. The other is to consider classics of modern thought by Weber, Freud, Lévi-Strauss, and others that implicitly challenge suppositions of the films in regard to the definition, motifs, purposes and costs of civilization.
Winter
Johannesen

110 An Introduction to Historical Method
This course is designated for able students with a special interest in history. The aim is to provide an introduction to the techniques of historical enquiry through the study of one period in some depth.
Not offered in 1974-75.

120 An Introduction to Western Intellectual History
This course is a foray into intellectual history which will explore some of the seminal visions of the human predicament and some of the solutions posed by thinkers of the Western world over the past 2,500 years. The work is tailored especially for students who want to be challenged intellectually and who are willing to opt for more, and more stimulating reading than is usual in introductory subjects. This is a course of continuous readings and discussions, meeting twice a week in small seminars. Written work will be required and a high level of participation in seminars; but there are no lectures.
Harrigan, Davies, Black
123* Major Themes in Canadian History
This course examines the development of social and economic class, race and cultural relations, growth and under development, Imperialism and its consequences, and the evolving Canadian state.

Fall
Johnson

Survey Courses

Group 1
3 hours. No prerequisite. The following course may not be taken for Honours History credit.

201* Expansion of Europe from the 15th to the 18th Century
Surveys the major explorations, conquests and settlements of the Portuguese, Dutch, French and English empires. The eighteenth-century decline of the French, Spanish, and English empires in the new world is outlined.
Patterson

202* Expansion of Europe in the 19th and 20th Centuries
Surveys European expansion especially in Africa and Asia and traces the rise of the nationalist-independence movements which culminate in the end of empire in the mid-twentieth century.
Patterson

203 The Twentieth Century World
A thematic examination of recent history by means of such concepts as modernization, political ideologies, and international institutions.
Stubbs

Fall
Stubbs

203B* The Twentieth Century World 2 (Part 2 of 203).
Winter
Stubbs

211* British History to 1603
A survey of the main stages in the transition of Britain from a remote province of the Roman Empire to a prominent independent state of post-Reformation Europe. Within the chronological framework, cultural and social as well as political and institutional developments will be examined.
Fall
Cherniavsky

212* British History since 1603
A survey of the shaping of British society and the British experience from the time of Shakespeare to the present: constitutional conflict and compromise, rise and fall of empire, industrial and urban revolution, world wars and welfare state.
Winter
Wright
213 British Empire and Commonwealth History
A topical survey rather than the usual chronological treatment, divided into halves on the broad themes "The British Influence" and "The Colonial Identity". In the first term there will be sections on the institutional framework, imperial biographies and development of communications; in the second, sections on native peoples, colonial economics and the history of the commonwealth ideal.
Craton

214 Ireland since 1509
A study of the political, social and religious history of Ireland, with special attention to the Reformation, the 17th-century rebellions, and the 19th and 20th-century struggle for home rule and independence.
MacGillivray

222* Modern French Canada
A survey of the development of French-speaking peoples in Canada since Confederation. This course will investigate, in depth, such issues as the social and economic development of the francophone population in Quebec as well as in the other prov- resulting political constitutional strategies, and the development of national identity and nationalist movements both in Quebec and other provinces. A knowledge of French is not required.
Winter
Horton

223* Canadian History to 1867
An analysis of selected issues: New France, Atlantic outlook, Loyalism and the crisis of Empire, rebellion and reconstruction, regional loyalties and the strategy of Confederation.
Fall
Not offered in 1974-75.

224* Canadian History since 1867
An analysis of selected issues: westward expansion, regionalism and the crisis of Canadian federalism, framing a foreign policy, French-Canadian Nationalism, urbanization and the New Society.
Fall
Johnson

225 Canadian Culture and Society
This course will take the form of an inquiry into the nature of the Canadian experience. An examination of the social and cultural evolution of Canada from New France to the present will focus on such themes as regionalism, nationalism and imperialism.
Grayson

225A* Canadian Culture and Society 1
(Part 1 of 225).
Fall
Grayson

225B* Canadian Culture and Society 2
(Part 2 of 225).
Winter
Grayson

227* The History of Selected Racial and Regional Minorities in North America
An examination of the formative years of the Afro-Canadian Afro-American and Native Indian communities in Canada and the United States.
Fall
Walker
228* The History of Selected
Racial and Regional
Minorities in North America
An examination of the emergence of minority assertiveness
and the position of minorities in modern Canadian society.
Winter
Walker

233 Men, Women and
Families in Modern History
A survey of sexual relations and the family in European culture
since the sixteenth century with special attention to the role
of sex related ideologies to larger processes of economic and
political change. The course will also provide an introduction
to research methods in the field of demography and vital statis-
tics, as they may be useful to historians.
Johannesen

235G* (RS 227G*) History
 of Christianity 1
The development of Western and Eastern Christianity to the
end of the medieval period.
Not offered in 1974-75.
Klaassen

236G* (RS 228G*) History
 of Christianity 2
Roman Catholicism, Eastern Orthodoxy and Protestantism from
the Reformation to the present.
Not offered in 1974-75.
Klaassen

Group 2 3 hours. Lectures and seminars. The following courses have as a
prerequisite an introductory history course or the permission
of the instructor. These courses are for both Honours and
General credit.

255 Ancient Civilization
A survey of the social, political and economic history of Greece
and Rome with an introduction to the civilization of the Ancient
Near East. (Classics 251*, 252* is an acceptable alternative,
but Hist. and C. Civ. 251*, 252* may not both be taken for
credit).
Wahl, Staff

260 Europe in Renaissance
and Revolution
This course will focus on Europe in transition (1300-1600)
and emphasize those political, intellectual, social and economic
changes most significant to the emergence of modern Europe.
Davis

261* Europe in the
Eighteenth Century
This course hopes to bring out the characteristics of European
civilization between 1680 and 1789. The first term will survey
international relations; religion, politics and society in France,
the Empire and Russia; the origins and impact of the Enlighten-
ment, and the concept of Enlightened Absolutism.
Fall
Lentin
262* Europe in the Eighteenth Century
The second term will attempt to define 18th-century man in his cultural setting and changing attitude to the human condition, by sampling his art, architecture, music and belles lettres. These will be studied under three headings: (a) heroic striving in the age of the baroque (b) aristocratic culture and the rococo (c) neo-classicism, sentimentalism and the search for lost innocence.
Winter
Lentin

263* Europe in the Nineteenth Century
A study of Europe from the French Revolution to approximately 1900 with particular emphasis on the social and intellectual forces that affected European society and the historical role of institutions in European society.
Fall
Harrigan

264* Europe in the Twentieth Century
The course will stress a close examination of those issues both domestic and international, which constitute the distinctive features and trends of twentieth century Europe.
Winter
Wynne

267G* Canadian Minorities
1: Mennonites
A study of the 200-year history of the Mennonite community in Canada: immigration and emigration, church-state relations, military exemption, internal and external separations, changing way of life, conflicts between the old and the new.
Epp

268G* Canadian Minorities
2: East European Groups
An examination of the backgrounds, immigration, contribution and conflicts in Canada of sub-immigrant groups as Doukhobors, Germans, Hutterites, Jews, Ukrainians.
Epp

269R History of Modern Revolutions
A comparative study of the French Revolution, the Russian Revolution, the World War I German Revolution, Fascism and Nazism, the Chinese Communist Revolution, Revolution in the "Third World". Special attention will be given to respective revolutionary theories and the social changes which precede and accompany revolutions.
Packull

281 South Asian History
Economic, social and political repercussions of contact with Europe since 1600. Emphasis will be on events in the Indian sub-continent.
Not offered in 1974-75

282 East Asian History
A study of the development of East Asia to the Opium War (China) and the Meiji Restoration (Japan), with emphasis on the distinctively oriental societal characteristics; institutions and viewpoints.
Guisso
284* Latin America, Colonial Period

The course will be organized around two broad themes: "Race and Society" and "The Economics of Colonialism". Topics will include the destruction of Indian culture, forced labor and slavery, American treasure and Atlantic trade, the rise of the great estates, race mixture and eighteenth century mercantilism.

Fall
Barbier

285* Latin America, National Period

The central themes of the course are the persistence of colonialism in the economy, political system and societal makeup, and the gradual fragmentation of the region as nationalism and industrialization begin to break down colonial forms. The period covered is independence (ca. 1825 to the present).

Winter
Barbier

291* Ancient and Pre-Colonial Africa

a) A survey of the societies, cultures and civilizations produced by the peoples of sub-Saharan Africa from ancient times to the colonial period. b) A study of sub-Saharan Africa from the establishment of colonial rule to the present, with particular attention to the African response to European control and to contemporary issues in independent Africa.

Fall/Winter
Walker

291A* Ancient and Pre-Colonial Africa

(Part 1 of 291)
Fall
Walker

291B* Colonial and Independent Africa

(Part 2 of 291)
Winter
Walker

295 History of the United States

A survey of American society, politics and thought, and of the relations of the United States with the outside world from 1776 to the present.

Ostrander, Eagles

295A* History of the United States, 1776-1865

(Part 1 of 295)
Fall
Ostrander

295B* History of the United States, since 1865

(Part 2 of 295)
Winter
Eagles

Group 3

3 hours. Lectures and seminars. The following courses have as a prerequisite an introductory course or the permission of the instructor. They are taught at Honours level only.

258 History of Medieval Europe

The political, cultural, economic and ecclesiastical development of Europe from 300 to 1300.

MacKinnon
Department of History

265 Canadian History
Selected topics in Canadian History. The course will be thematic rather than strictly chronological. Considerable emphasis will be placed on historiography: how historians have interpreted major social, political and economic themes. (For additional detail, see 265A* and 265B*).

McLaughlin, Grayson

265A* Canadian History 1
In the pre-Confederation period the course will examine the effect of the Metropolitan centres of Paris and London on the colonies and contrast their influence with that of the Canadian frontier. We shall also be concerned with the conquest theory, the development of French Canadian nationalism, the Loyalist tradition, the effects of the American Revolution on Canada and the achievement of Confederation.

(The first half of 265 for students taking only the Fall half-term.)
Fall
McLaughlin, Grayson

265B* Canadian History 2
In the post-Confederation period the course will study Canada’s development from Colony to Nation – (to Colony?). Such themes as sectionalism, economic nationalism, continentalism and imperialism, Anglo-Saxon Racism and French Canadian Nationalism, Rural and Urban Protect will constitute areas of discussion.

(The second half of 265 for students taking only the Winter half-term.)
Winter
McLaughlin, Grayson

266 The History of Selected Racial and Regional Minorities in North America
An examination of the formative years of the Afro-Canadian, Afro-American and Native Indian communities and of the emergence of minority assertiveness and the position of minorities in modern Canadian society.

Walker
Not open to students who have taken History 227*/228*

277 British Empire and Commonwealth History
A topical survey rather than the usual chronological treatment, divided into halves on the broad themes “The British Influence” and “The Colonial Identity”. In the first term there will be sections on the evolution of the institutional framework, imperial biographies and the development of communications; in the second, sections on native peoples, colonial economics and the history of the commonwealth ideal.

Craton
Not open to students who have taken History 213

Depth Courses
3 hours. Lectures and seminars. The following courses are open to students above the First Year level. In every case the prerequisite is an Introductory or Survey course appropriate to the subject, or the permission of the instructor. In some cases there are specific additional prerequisites. These courses may only be taken for Honours credit. General students taking these courses will therefore be expected to work at Honours-level standard.
Classics 365* 366* Greek History

See Classics Dept. for description. This course is acceptable for History credit.

343G* Mystical and Utopian Movements from the 12th to the 17th Century: 1

A study of the recurring dream of the coming golden age in the High Middle Ages beginning with Joachim of Fiore, including the Spiritual Franciscans and the Taborites, and ending with the Revolutionary of the Upper Rhine.

Alternates with History 347G*

Fall

Klaasen

344G* Mystical and Utopian Movements from the 12th to the 17th Century: 2

A study of the Utopian theme from the German Peasant Revolt to the fifth Monarchy Men including More's Utopia and several other lesser known statements.

Alternates with History 348G*

Winter

Klaasen

345* Roman History, 287 to 27 B.C.

A study of the middle and late republic, with particular emphasis on the social and constitutional crises which shaped them.

Fall

Wahl, Staff

346* Roman History, 27 B.C. to 337 A.D.

A study of imperial Rome, with particular emphasis on those institutions of law and government which were the great achievement of the Roman empire.

Winter

Wahl, Staff

347G* Radical Reformation

1 (also RS 321G*)

A study of spokesmen for radical reform of the church, including Andreas Carlstadt, Thomas Muntzer, Caspar Schwenckfeld, Sebastian Franck and Michael Servetus.

Alternates with History 343G*

Not offered in 1974-75

348G* Radical Reformation

2 (also RS 322G*)

A study of Anabaptism and its place in the history of the Christian church and of the Reformation period.

Alternates with History 344G*

Not offered in 1974-75

350 History as an Intellectual Discipline

This course focusses on three aspects of historical study: the history of history in the Western tradition; philosophical questions raised by the study of history; and the historian's use of social scientific assumptions and methods. Primarily for third year Honours students.

Baker

351* Special Subject

Seminars and public lectures in special fields.

Not offered in 1974-75

352 The United States in World Affairs

An analysis of American foreign policy in the nineteenth and twentieth centuries.

Eagles
353 Medieval Church History
From 312-1449
A study of the evolution of the dogmatic approach. Topics will include dogmatic moral and political questions which affected the teaching of the church.

Wahl, Staff

355* Russian History 1613-1825
The course will focus on selected themes in the development of the Russian state and society from the beginning of Romanov rule to the middle of the nineteenth century.

Fall
Davies

356* Russian History Since 1825
The course will focus on selected themes in Russia's development in the nineteenth and twentieth centuries, including the Soviet Period.

Winter
Davies

357* German History 1648-1848
The course will cover in some depth selected topics of political, social and economic history of the Germanic lands from the Peace of Westphalia to the revolution of 1848.

Fall
Wynne

358* German History 1848-1933
The course will cover briefly the Unification of Germany; the empire under William I and William II; the Revolution of 1918 and some aspects of the Weimar Republic to Hitler. German nationalism will be analysed in both courses.

Winter
Wynne

359* France in Revolution 1780-1870
A study of French society and the four revolutions that affected it with particular attention to social and institutional forces.

Fall
Harrigan

360* French History Since 1870
A study of France from 1870 to the present with particular emphasis on the political and intellectual forces that affected French society.

Winter
Baker

361 English History 1485-1660
A study of achievements and crises in the Tudor and early Stuart periods.

MacGillivray

362 British History Since 1760
A study of society, politics and thought in the world's first industrialized state.

Wright

363 Medieval English History
A study of government, church and society.

Cherniavsky
364 Spain and Portugal
Since 1469
The development of the Old Regime, the relations of Spain and Portugal with the outside world, the rise of liberalism, and the destruction of the bourgeois political order. The course will terminate with an examination of the Spanish Civil War and the contemporary "corporatist" regimes.

Barbier

366 European Intellectual History
Major themes in European thought and culture since the 17th century, with an emphasis on the emergence, transformation and decline of Enlightenment perspectives and the contemporary search for alternatives.

Baker

367R* A History of Militarism 1
A seminar on the history of militarism from ancient times to the present with special focus on the social setting and social effects of militarism within modern western society. The works of several major military writers of the 19th and 20th centuries, as well as criticisms of militarism will be examined. Students may pursue topics of their own interest.

Packull

368 International History
Since 1870
A study of the international relations of the European states with due regard to non-European influences on diplomatic history during this period.

Stubbs

369R* A History of Militarism 2
This seminar will study the historical evolution of radical militarism within modern society beginning 1789. The writings of revolutionary and guerrilla-warfare theoreticians will be examined in historical perspective. Students may pursue topics of their own interest.

Packull

370 West Indian History
A study of the circum-Caribbean region from aboriginal times until the present, paying particular attention to the impact of European imperialism on the indigenous people, a comparison of the various types of European imperialism, the history of plantations, slavery and slave society, independence movements, and the problems posed by modernisation, underdeveloped and neo-colonialism.

Craton

372 East African History
An examination of the historical development of East Africa from its partition among the European powers in the late nineteenth century to the present day. Special attention will be given to the slave trade, colonial administration, emergence of nationalism, and the basic problems faced by the territories of Uganda, Kenya, Tanzania and Zanzibar since attaining their independence.

Beachey

374G* The Middle East Conflict
A survey of regional, religious and imperial rivalries from ancient to modern times, with emphasis on the 20th century and the Arab-Israeli conflict.

Fall
Epp
375 History of China
The continuation of History 282. Particular attention will be devoted to responses to the technically sophisticated cultures of the West; modernization; reform and revolution; modifications of Communism and democracy; the development of the People's Republic.
Guisso
Prerequisite: History 282

377 History of Modern India
Selected issues in the development of India since 1526, centering primarily on traditional Hindu society, the Muslim and Western impact on that society and the emergence of independent India. Not offered in 1974-75

380* Canada 1867-1967
This course will examine (a) the development of a "national consensus" in British North America after Confederation. Continentalism, Imperialism, Bi-culturalism and Economic nationalism will be major themes. (b) Canada's emergence as a 20th century nation. Emphasis will be placed on economic and social change, regional unrest, and the development of Canadian nationalism.
Johnson

380A Canada, 1867-1914 (Part 1 of 380)
Fall
Johnson

380B* Canada Since 1914 (Part 2 of 380)
Winter
Johnson

382 Canadian Intellectual History
An historical analysis of Canadian culture, both nationally and regionally.
Not offered in 1974-75
English

383 History of French Canada
The course will emphasize social and economic issues in the development of French Canada and the emergence of modern Quebec.
Horton

383A* History of French Canada to 1867
The course will emphasize social and economic issues in the development of French Canada to Confederation.
(The first half of 383, for students taking only the Fall half-term.)
Fall
Horton

383B* History of French Canada Since 1867
The course will treat the emergence of modern Quebec, with special emphasis on social and economic issues.
(The second half of 383, for students taking only the Winter half-term.)
Winter
Horton
384 Canada in Crisis
A study of social movements in Canada during the interwar years, 1919-1940. The course will emphasize a comparative analysis of the underlying assumptions, overt goals and active participants in such movements as the social gospel, the Progressives and the C.C.F.
Grayson

386* Ontario History to Confederation
The course will examine the growth of Ontario from a pioneer settlement, with particular emphasis on economic, social, political and cultural aspects of change. An emphasis will be placed on the sources and method of local historical research.
Fall
English, McLaughlin

387* Ontario History Since Confederation
The course will examine the emergence of Ontario as an industrial giant and the development of its hegemony in Canada. An emphasis will be placed on the sources and methods of local historical research.
Winter
English, McLaughlin

388 History of Canadian-American Relations
Mainly, but not exclusively the history of diplomatic relations. In addition, selected topics of a political, economic, social and cultural nature will be studied in comparative terms.
Not offered in 1974-75

389 Canada in World Affairs: The Twentieth Century
An analytical and historical examination of Canadian foreign policy in the international system: domestic sources of Canadian foreign policy; the international sources of Canadian foreign policy; the international system as a source of Canadian diplomacy; the instruments of foreign policy; the "linch-pin" thesis and pre-1939 policy; and the influence of public opinion and the bureaucratic apparatus in the making of foreign policy.
English

390 History of North American Indians
An examination of the main themes in the history of the Indians of Canada since 1600. Some attention will also be given to the Indians of the United States comparing their history with that of the Canadian Indians.
Patterson

392 Colonial American History
The development of an American civilization with emphasis on colonial and Revolutionary origins. Selected topics in social and intellectual history will be explored in depth.
Johannesen

393 History of American Nationalism 1790-1920
The study of cultural nationalism, expansionism, sectionalism, imperialism, anti-imperialism and the idea of "the American mission" in the world.
Ostrander

394 Twentieth Century Spanish America
This course will examine the various means by which nations and a sense of nationalism have developed, or failed to develop, in the Spanish-speaking countries of the Western Hemisphere.
Barbier
395 History of Science
A survey of scientific developments in Western Civilization from
its roots in the ancient world to the present, with emphasis on
the scientific revolutions of the 17th and 20th centuries and on
the relation of science to society, government, religions, industry
and technology, and the arts.
*Not offered in 1974-75

396* Brazil in the Twentieth
Century
An examination of the Brazilian Republic since 1889. Such topics
as the role of the military in politics, of corporatism in economic
and social development, and the transition from a colonial to
an industrialized economy will be explored.
*Not offered in 1974-75
Smith

397 The History of Public
and Private Law to 1500
An historical study of the evolution of law and the legal approach.
Topics in the history of Roman, Canon, and Common Law will
be discussed to provide the student with an appreciation of law
as it exists today.
Wahl

398* The Spanish World:
from Reform to Revolution,
1714-1833
This course will be concerned with the breakdown of the Spanish
empire and the destruction of the society that it sheltered. Topics
to be covered include the Spanish Enlightenment and the Bourbon
Reforms, the rise of the national and liberal traditions, the Wars
of Independence, the period of reaction, and the triumph of
nationalism and liberalism.
*Not offered in 1974-75
Barbier

399 Directed Studies in
Special Topics
Study in a limited field under tutorial guidance. A high standard
of written work will be expected.

399A* Directed Studies in
Special Topics
Study in a limited field under tutorial guidance. A high standard
of written work will be expected.
Fall

399B* Directed Studies in
Special Topics
Study in a limited field under tutorial guidance. A high standard of
written work will be expected.
Winter
Senior Seminars

3 hours. Seminars and consultations. These seminars are limited to students who have taken relevant Survey or depth courses, their equivalent elsewhere, or related courses in other disciplines. In all cases the instructor’s permission is required. These courses are designed for senior Honours students. Outstanding General students or Third-Year Honours students may be admitted with the approval of the instructor.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>Roman History</td>
<td>Keresztes</td>
</tr>
<tr>
<td>401</td>
<td>Medieval History</td>
<td>MacKinnon</td>
</tr>
<tr>
<td>405</td>
<td>The Intellectual History of the Renaissance and Reformation</td>
<td>Davis</td>
</tr>
<tr>
<td>406</td>
<td>Europe and Russia in the 18th Century</td>
<td>Lentin</td>
</tr>
<tr>
<td>410</td>
<td>Early Modern English History</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td>411</td>
<td>English History from the 17th to the 19th Century</td>
<td>MacGillivray</td>
</tr>
<tr>
<td>412</td>
<td>19th and 20th Century British History</td>
<td>Wright</td>
</tr>
<tr>
<td>413</td>
<td>Modern French History</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td>414</td>
<td>Modern European Intellectual History</td>
<td>Baker</td>
</tr>
<tr>
<td>415</td>
<td>Modern German History</td>
<td>Wynne</td>
</tr>
<tr>
<td>418</td>
<td>Russian History since 1861</td>
<td>Davies</td>
</tr>
<tr>
<td>420</td>
<td>Canada in the 19th Century</td>
<td>McLaughlin</td>
</tr>
<tr>
<td>421</td>
<td>Ontario History</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td>422</td>
<td>France and Its Atlantic Empire in the 18th Century</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td></td>
<td>Prerequisite: A reading knowledge of French</td>
<td></td>
</tr>
<tr>
<td>423</td>
<td>Modern Quebec</td>
<td>Horton</td>
</tr>
<tr>
<td></td>
<td>Prerequisite: A reading knowledge of French</td>
<td></td>
</tr>
<tr>
<td>424</td>
<td>Canadian Labour History</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td>425</td>
<td>Canadian Cultural History</td>
<td>English</td>
</tr>
<tr>
<td>426</td>
<td>Colonial American History</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td>427</td>
<td>19th Century United States History</td>
<td>Ostrander</td>
</tr>
<tr>
<td>428</td>
<td>Modern American History</td>
<td>Eagles</td>
</tr>
<tr>
<td>429</td>
<td>Modern Latin American History</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td>430</td>
<td>British Imperial and Colonial History</td>
<td>Craton</td>
</tr>
<tr>
<td>431</td>
<td>Colonial Latin American History</td>
<td>Barber</td>
</tr>
<tr>
<td>432</td>
<td>African History</td>
<td>Beachey</td>
</tr>
<tr>
<td>435</td>
<td>The History of Native Response to Colonial Rule</td>
<td>Patterson</td>
</tr>
<tr>
<td>436</td>
<td>Black History in North America</td>
<td>Walker</td>
</tr>
<tr>
<td>440</td>
<td>Far East Asian History</td>
<td>Guisso</td>
</tr>
<tr>
<td></td>
<td>Prerequisite: either History 282 or 375</td>
<td></td>
</tr>
<tr>
<td>442</td>
<td>History of India</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td>450</td>
<td>Marxism and Canadian History</td>
<td>Johnson</td>
</tr>
<tr>
<td>452</td>
<td>The History of Science</td>
<td>Not offered in 1974-75</td>
</tr>
<tr>
<td>453</td>
<td>20th Century International History</td>
<td>Stubbs</td>
</tr>
</tbody>
</table>
Other Senior Courses*

These courses are limited to senior Honours students.

465 The History and Theory of Historical Writing
3 hours. Lectures and seminars. (For Make-up year students only)
Cherniavsky

466+ The History and Theory of Historical Writing
This half course will be offered in conjunction with a half-course in the philosophy of history offered by the philosophy Department.
Winter
Cherniavsky

491 Directed Studies in Special Topics
Senior students only
Faculty

* Not counted as Senior Seminars
Department of Human Relations and Counselling Studies

**Professor and Chairman** J.S. Minas,¹ B.A.(Wayne), Ph.D.(Illinois)

**Professors** G.T. Barrett-Lennard, B.Sc., B.A.(Western Australia), Ph.D. (Chicago)
J.M. Butler,² B.Sc., Ph.D.(Minnesota)
J.A. Dyal,² B.A.(Oklahoma), Ph.D.(Illinois)
N.H. High,³ B.S.A.(Toronto), M.S., Ph.D.(Cornell)
M. Lerner,² B.A., M.A.(Ohio State Univ.), Ph.D.(New York University)
A.H. Mahrer, B.S.(Western Reserve), M.A., Ph.D.(Ohio State)

**Assistant Professors** M. Forest, B.A.(New York), M.A.(Columbia), Ed.D.(Massachusetts)
J. Forest,⁵ B.A.(Montreal), Ed.D.(Massachusetts)
J. Goldstein, B.A.(McGill), M.A.(Columbia), Ph.D.(Chicago)
R. O'Day, B.A.(British Columbia), M.A., Ph.D.(Michigan)
A.S. Wiener, B.A.(New Jersey), Ph.D.(Wright Institute, California)

**Adjunct Professors** S.S. Appleton, B.A., M.D.(Toronto)
R.K. Bierman, B.A.(Yeshiva), Ph.D.(SUNY, Buffalo)
W.W. Dick,⁴ B.A., B.D.(Toronto), M.A., Ph.D.(Ottawa)
O. Weizmann,⁴ B.A.(Ohio State), Ph.D.(Illinois)
J.L. Williams,⁴ B.A., M.A(Alberta), Ph.D.(Missouri)
J.J. Wine,⁴ B.A.(Bridgewater College), M.S.(Iowa State), Ph.D. (Alberta)

**Adjunct Lecturers** D.W. Groff, B.A.(Western Ontario), M.Sc.(Guelph)
R.L. Knight, A.B.(Antioch)

**Faculty members holding cross appointments as shown**
¹ Cross appointment in Philosophy
² Cross appointment in Psychology
³ Cross appointment in Sociology
⁴ Cross appointment in Counselling Services
⁵ Cross appointment in Renison College

The department and its programme are interdisciplinary in staff and scope. The interdisciplinary effort is centered about the concepts of development and change, individual change in dyadic and group situations, change and organizational processes in groups, and in social change.

The department emphasizes efforts to understand the person as such, and the person in the context of group, institutional, and social structure. It has, therefore, a humanistic perspective aspiring to illuminate and contribute to the quality of human living. Personal development and humanistically oriented institutional and social development constitute a major axis of concern in the programme. These aspects of the orientation of the department are reflected in its educational and research components, and in the developing involvement of programme members in activities and projects in the larger community.

The department seeks to achieve a fusion of scholarly, scientific humanistic, and social values and activities. Integration of know-
ledge and values is seen as an essential condition for adequate response to human and social problems.

To fulfill the requirements for a general degree in Human Relations and Counselling Studies a student must complete 120*, 201*, 202*, 230*, and a minimum of three additional full-year courses or equivalent in the Department. See also the calendar section dealing with the General Programme requirements of the Faculty of Arts (page 111). Students intending to major in Human Relations and Counselling Studies should consult the Undergraduate Officer of the Department as early as possible in order to plan related elective courses in other departments.

Note During the 1974/75 academic year, only students in Year 2 will be admitted as majors.

Undergraduate Courses

100* Human Relations in Contemporary Life An exploratory introduction to the field of human relations with emphasis upon contemporary life and conditions. A survey of principles of human relations as they relate to such contemporary topics as family life, human potential and development, the meaning of work, education, technology, and social change.
3 hours. No prerequisite

120* Concepts of the Person and Human Nature Models and conceptions of the nature of man. A study of approaches to understanding human nature in its social context.
3 hours. No prerequisite

201* Counselling Process and Personal Facilitation An introduction to theory, method, and resource development in personal counselling.
3 hours. No prerequisite

202* Counselling Process and Personal Facilitation 2 A continuation of 201*.
3 hours. Prerequisite: Human Relations 201*

220* Small Group Processes Study of intensive group experience, process patterns and effects – with special reference to groups intended to facilitate personal and relational learning. Consideration, for example, of process guidelines and principles in experimental groups, variation in structural and compositional factors and in leadership orientation and styles, and of the differing applications and social significance of intensive groups. Class sections will be small to permit direct learning from experience and observation as well as from discussion, research and writing in the field.
3 hours. Prerequisite: Consent of instructor

230* Human Relations Counselling and Organizational Processes Organizations as systems of human relations. Case-studies, for example, industrial, educational, and human service organizations, with comparison of differing systems. Human relations analysis of organizations and the concept of intrinsically beneficial systems. Counsellors and change-agents as organizational "helpers."
3 hours. Prerequisite: Psychology 253*, Sociology 212* or consent of Instructor
252* Models of Human Community
Visions of ideal or alternative human communities. Significant attempts in deliberate creation of such communities. Learnings from experiments and practice in special communities. Problems in the design of communities for human well-being, emphasizing aspects of personal and communal life. Inquiry toward a concept of optimal community.
3 hours. Prerequisite: Consent of Instructor

272* The Politics of Humanism
Examines the institutions and philosophy of humanism in contemporary Canada. Special attention to the human potential movement and to various welfare schemes at the national, provincial and local levels.
3 hours. No prerequisite

282* Personal Dimensions of Inequality
An in-depth interdisciplinary analysis of the personal dimensions associated with the class system through the works of Reich, May, Marcuse, Lefevre, Lukas, Vallieres, Weill, Fanon, Guevara, and others. Special emphasis will be given to the impact of inequalities in income, assets, basic services, power, and social honour among groups in society on possibilities for existential growth and development. Action research will be encouraged and facilitated.
3 hours. No prerequisite

380 (a,b,c)* Special Subjects
To be offered at different times as announced by the Department.
3 hours. Prerequisite: Consent of instructor

390 (a,b,c)* Directed Reading
Specially arranged for individual students.
3 hours. Prerequisite: Consent of instructor

501* Naturalistic Research
An introduction to naturalistic research in areas in which it may be impossible, undesirable or impractical to engage in controlled experimentation. Discovery and refinement of hypotheses will be stressed since they are intrinsic to naturalistic research. A model for naturalistic research and analysis will be presented.
3 hours. Prerequisite: Consent of instructor
Courses offered by the Inter-Faculty Programme Board are intended to enrich existing University offerings, to provide a multidisciplinary context within which students may deal with fundamental issues and problems confronting today's world and to foster co-operation and awareness of others' interests and goals among the various members (students and professors alike) of the University community.

How may the University student himself contribute to solutions to urgent social problems? What tools are available to enable one to cope with the mass of information and pseudo-information encountered in the communications media? What are the dominant issues facing man today? How does one determine values appropriate for man in today's world? How can human conflict be resolved in a non-violent way? How is social justice to be achieved through social planning? In what ways can leisure contribute to the future of mankind? What, after all, is the nature of man? These questions and issues provide the basis of the Inter-Faculty Studies courses.

An outline of the programme requirements for the Communication Studies Programme can be found in Chapter 8 of this calendar.

**Arts 100 Communications**
An examination of the origins, evolution, and future dimensions of communications media designed to facilitate an understanding of adequacies and inadequacies of media, to relate them to the purposes of human awareness, and to explore needs and means of maintaining accountable controls over the media. The course seeks to assist students in discovering the range of informational, research and exploratory resources open to them; in gaining some preliminary experience in utilizing such sources; and in applying a critical judgment to material secured. (Arts 100 is a multi-media course offered in part on Channel 19 TV.)

*Instructor: D. Gordon*

**Arts 120*/121* Focal Issues in Contemporary Society**
An attempt to bring together and condense what are believed to be essential elements of the several social science disciplines. The core of the study is a group of selected contemporary issues with implications that cut across the various disciplines. An effort will be made to discuss values appropriate for our age. Integrating concepts are personality and culture. (Among specific issues discussed are race, class, violence, pollution, youth culture, family, the new consumerism and democracy. Regular lectures and discussion will be supplemented by films, visiting lecturers, student-directed research and role-playing.)

*3 lectures, Winter term*

*Instructor: W. Klaassen*
The Student-Initiated Workshops on Technological and Social Problems have been established in response to the needs felt by faculty and students at the University of Waterloo for increasing the involvement of the University, as an institution with a unique concentration of knowledge, resources and expertise, in seeking solutions to urgent technological and social problems, and developing in students the ability to work with fellow students from a variety of disciplines in formulating and defining complex problems, demonstrating initiative and resourcefulness in obtaining relevant information from documents, interviews, and field work, and evaluating and weighing the relative merits of alternative solutions with a view toward constructive utilization of the findings.

Workshops are to be student-initiated, student-planned, and student directed.

It is assumed that the idea for a Workshop will originate with a group of interested undergraduate students, who will then submit to the WOTASP Co-ordinator, preferably before the start of the term, a one-page statement presenting the problem that is to be the subject of investigation. The statement should outline:

a) the problem,
b) some possible approaches that might be used within the Workshop,
c) suggestions as to how the findings might contribute to a constructive solution to the problem,
d) references to relevant information sources, research reports, and publications,
e) a statement from each faculty resource person (if possible, more than one) who has agreed to consult with the students as necessary,
f) a list of resources needed (technical apparatus, paper materials and other items),
g) proposed grading criteria, and
h) names of students interested in enrolling in the Workshop.

The Inter-Faculty Programme Board will provide, as necessary, consultation and advice to the students on all aspects of the proposal, including assistance in locating resource persons to evaluate student performance and assign grades, in consultation with the Co-ordinator.

Further details may be obtained from the WOTASP Co-ordinator or the Inter-Faculty Programme Board office.
IFS 220 Social Philosophy and Social Justice
This course provides partly an introduction to, and partly an overview and synthesis of, social philosophy and the social sciences. The unifying themes are the continued emphasis on normative questions and foundational and methodological questions about social philosophy and social science. Although all the social sciences are touched upon, somewhat more emphasis is given to politics, economics, sociology and anthropology than to psychology as such. In general, questions are raised via normative issues, especially the issues of social justice, and through interaction the idea of social planning becomes prominent.
Winter term
4 hours (2 2-hour sessions per week)
Not offered in 1974-75

IFS 230* Nonviolence and Political Reality
This course will concentrate on the question of the possibility of a nonviolent approach to resolving human conflict with special emphasis on the nature and uses of power, the nature of the nation state and the problem of relating a personal ideal to the realities of communal life. (First-year students admitted with permission of the instructor.)
Winter term
3 hours
Instructor: W. Klaassen

IFS 240* Man, Leisure, and Society
Leisure from both historical and contemporary perspective; leisure as viewed by the Utopians - the dream versus the reality; as a class phenomenon; as non-work; as culture-pop and otherwise; and as a problem. Leisure and social institutions; the family, the school, the church, the polity, the economy. Leisure and the future of man.
Winter term
3 hours
Instructor: G.S. Kenyon

IFS 300 Media Writing Exposition
An examination of the terms and forms of expression characteristic of non-fiction presentation in the media of print, radio and television. Lectures, seminars and workshops will be combined to seek to establish basic criteria for media expositions, to assess them and apply them to individual student projects.
To be offered only if enrollment exceeds 15
3 hours
Instructor: D. Gordon
Department of Kinesiology

Professor and Chairman of the Department
Professor and Dean of the Faculty of Human Kinetics and Leisure Studies
Associate Professor and Associate Dean of Undergraduate Affairs for the Faculty of Human Kinetics and Leisure Studies
Assistant Professor and Associate Chairman (Undergraduate Affairs)

Associate Professors
D. Hayes, B.Sc., B.P.E., M.Sc., D.P.E.(Springfield)

Visiting Associate Professor
M. Sheets, B.A.(California), M.Sc., Ph.D.(Wisconsin)

Assistant Professors
P.J. Bishop, B.Sc., B.P.E.(Waterloo), M.Sc.(Western Illinois)
H.J. Green, B.A., B.P.H.E.(Queen's), M.A.(Alberta), Ph.D. (Wisconsin)
K.C. Hayes, D.I.P.P.E.(Hons.) (Exeter), M.S., Ph.D.(Massachusetts)
P.G. King, B.P.E.(UNB), M.Sc., Ph.D.(Alberta)
B.D. McPherson, B.A., M.A.(Western), Ph.D.(Wisconsin)
R.W. Norman, B.A., B.P.E.(McMaster), M.Sc.(Alberta)
C.H. Pierce, B.A.(Grinnell), M.A.(De Pauw), Ph.D.(Kansas)
R.E. Priddle, (Mrs.), B.P.H.E.(Toronto), M.S.(Springfield)
R.P. Schlegel, B.A.(Western), M.Sc.(Illinois), Ph.D.(Ohio State) (Ohio State)
I.A. Thomson, B.A., M.Sc.(McMaster), Ph.D.(Waterloo)
W.N. Widmeyer, B.A.(Western), B.P.E.(McMaster), M.A. (California)
I. Williams, M.S., Ph.D.(Illinois)

Lecturers
G.H. Raycroft, B.P.E., M.Sc.(Alberta)
R.D. Graham, B.A.(Western)
J. Officer (Mrs), A.T.C.(R.A.D, London)

Adjunct Professor
D.J. Pugliese, B.A., B.P.E.(McMaster), Ed.M.(Buffalo)

Course Description

Courses in Kinesiology, Health Studies and Dance are offered within the Department of Kinesiology. Descriptions of Health Studies and Dance courses follow those for the Kinesiology courses below. For details of programmes in all three areas see Chapter 11.
102* Bio-physical Basis of Kinesiology
The study of human physical movement from mechanical, anatomical and physiological viewpoints is discussed. The course provides a general orientation to the study of Kinesiology.
2 lectures, 1 tutorial, Fall term

103* Psycho-social Basis of Kinesiology
The study of human physical activity, from psychological, sociological and aesthetic perspective is examined.
lectures, 1 tutorial, Winter term

116* Organic Chemistry
An introduction to organic chemistry.
3 lectures. Winter term

171* History of Sport and Physical Activity
A cultural historical review of the development of sport and physical activity from the early Greek period to modern times. Special emphasis is placed on the development of sport in Canada since 1900 and the role of physical activity of all kinds in today's society. 
*May not be offered in 1975
3 lectures. Winter term

200* Human Anatomy
A study of the human anatomical systems and their integration. Particular emphasis is placed on the skeletal, articular and muscular systems. 
Prerequisite: Kinesiology students or permission of instructor
3 lectures, 2 hours lab, Fall term

205* Physiology of Exercise
An examination of the transient and persistent effects of exercise on physiological functions. Topics include muscular and cardio-respiratory function and the effects of varying environments upon their performance.
Prerequisite: Honours Dance students only
3 lectures, 3 hours laboratory in alternating weeks, Winter term
Not offered in 1975

222* Statistical Techniques Applied to Kinesiology
An introduction to descriptive and inferential statistics and the interpretation of data. A major consideration of the course is the use of statistics in the solution of problems in Kinesiology.
Prerequisite: Kinesiology students only
2 hours lecture, 2 hours laboratory
Fall term

280* Administration
A study of the principles underlying general administrative behaviour with an emphasis upon understanding the role and mechanics of decision making. Case study analysis and practical project work are utilized to foster the development of the student's administrative technique.
3 lectures, Winter and Spring terms

300* Physiology of Physical Activity (Part 1)
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 303, 304
3 lectures, 2 hours lab, Fall term
317* Biochemistry  Carbohydrates, lipids, proteins, hormones and vitamins. Metabolism of these groups of compounds in humans. 
Prerequisite: Kinesiology 116 or equivalent or, Grade 13 Chemistry 
3 lectures, Fall term

321* Introduction to the Analysis of Human Movement  Anatomical, neural and mechanical considerations of human physical activity are examined. 
Prerequisite: Physics 103, Kinesiology 200 and 222. 
3 lectures, 2 hours lab, Winter and Spring terms

330* Research Design  An introduction to the basic principles of scientific inquiry in Kinesiology. A systematic treatment of the logic and practice of methods and techniques employed in research related to physical activity with an examination of design, sampling, data gathering and analysis. 
Prerequisite: Kinesiology students only 
3 lectures, Fall and Spring terms

335* Evaluation of Human Motor Performance  Methods and procedures used in evaluating human physical performance are studied and practiced. Measurements of strength, motor performance, work capacity, reaction time and others, are included. 
Prerequisite: Kinesiology 222 
3 lectures, 2 hours lab, Winter and Spring terms

340* Care and Prevention of Athletic Injuries  Prevention and correction of accidents in athletic activities. The use of proper personal and field equipment, support methods, conditioning exercises, the medical examination and therapeutic aids. 
Prerequisite: Kinesiology 200 
3 lectures, 2 hours lab, Fall and Winter terms

346* Nutrition (Health Studies 346*)  An elementary course in nutrition with special emphasis on diet for sport and certain physiological conditions. 
Prerequisite: Kinesiology 317 or equivalent 
3 lectures, Winter term

352* Aging, the Aged and Leisure: A Sociological and Social Psychological Perspective  Employing a sociological and psychological frame of reference, the process and problems of aging are analysed. Special emphasis is given to the problem of leisure time in the later years of life. 
Prerequisites: Sociology 101 and one other Sociology course 
3 lectures, Fall and Spring terms

355* Motor Learning  An introduction to the theories of learning motor activity, individual differences, retention, transfer and other topics. Laboratory sessions enable the student to reproduce some of the standard experiments in this field. 
Prerequisite: Kinesiology students only or permission of instructor 
3 lectures, 2 hours lab. Winter term
356* Information Processing in Human Perceptual Motor Performance

An information processing model of perceptual-motor behaviour are presented. Human performance theory is used to study those processes mediating input and output information. Specifically, the subprocesses of storage of information in memory, perception, retrieval of information from memory and execution of movement are examined. Principles derived from the model are applied to the teaching of motor skills, the study of mental retardation and the study of skill deterioration in old age.

Prerequisite: Kinesiology 355* or consent of instructor
2 lectures, 1 tutorial, Winter, Spring terms

401* Physiology of Physical Activity (Part 2)

A study of the metabolic and environmental aspects of exercise, fatigue, training, and physical fitness. Work capacity in relation to age and sex is examined.

Prerequisites: Kinesiology 300 and 317
3 lectures, 2 hour lab, Winter and Spring terms

405* Applied Kinesiology

Principles of physiology and movement analysis as they apply to the development of maximal human motor performance are examined. Consideration is given to the effects of environmental, psychological and social factors on such development. Intended for students not electing Kinesiology 401*, Physiology of Physical Activity, Part 2.

Prerequisite: Kinesiology 300 and 321.
3 lectures, 2 hours lab, Winter term
Not offered in 1975

410* Growth, Development and Aging (Health Studies 410*)

The changing capacities and interests of man are studied as he grows and develops. The contribution of physical activity to growth, and physical, psychological and sociological development is examined.

Prerequisites: Kinesiology 200 and Biology 303
3 lectures, Fall and Spring terms

420* Kinesiological Determinants of Facility and Equipment Design

A study of the interrelationship between the environment which man structures and human motor abilities. Currently available facilities and equipment are studied as to suitability of design with reference to the size, strength, work capacity and other limitations of the user.

Prerequisites: Kinesiology 200, 321
3 hours lecture, Fall and Spring terms

422* Administration of Facilities

A study of the problems involved in the planning and maintenance of various athletic plants used by schools and recreation agencies and the selection and care of the equipment and supplies used with these facilities.

3 lectures. Fall and Winter terms.
Will not be offered 1974 through 1976
425* Kinesiology of Sport and Dance
A detailed analysis, from a mechanical and anatomical perspective, of skilled and unskilled performance in dance and selected sports activities. Cinematography and electromyography laboratory sessions are emphasized to investigate changes which occur during skill acquisition. "Normal" and "abnormal" movement patterns are studied for insight into central nervous system mechanisms involved in skilled movement.
Prerequisite: Kinesiology 321.
3 lectures, 2 hours lab., Winter and Spring terms

431*/432* Research Project
An independent research project on an approved topic, supervised by a faculty member. Required of all students enrolled in Honours and General programmes in Kinesiology.

Kinesiology 431* includes an approved design and the completion of the first segment of the paper.
Prerequisites: depending upon the topic selected, the student is required to achieve at least 60% in appropriate courses. A complete listing is available in the Departmental office.

Kinesiology 432* includes the completion of the project begun in Kinesiology 431*.
Prerequisite: Kinesiology 431*.

442* Adapted Physical Activities
The study of individual problems and their implications for the Kinesiologist. Body mechanic problems, orthopaedic disabilities, neurological disabilities, psychologic disorders, heart disturbances and nutritional problems are discussed in depth.
Prerequisite: Kinesiology 200.
2 lectures, 2 hours lab., Winter term

451* Personality and Motivation in Physical Activity
An application of major psychological theories to the central problems of sport and physical activity. Current research in the area is examined. Major emphasis is placed upon gaining an insight into those psychological factors influencing performance and behaviour of the sport participant.
Prerequisite: Psychology 101, 355 or consent of instructor.
3 lectures, Fall and Spring terms

452* Sport in Society (Recreation 303* Sociology 374*)
An introduction to the sociology of sport. Utilizing the major frames of reference of the social sciences, the function of sport in contemporary society is examined.
Prerequisite: Sociology 101 and one other Sociology course.
3 lectures, Winter and Spring terms

453* The Psychology of Sport and Physical Activity
This course focuses on the effects of participating in physical activity programmes upon the socio-psychological adjustment of the individual. Although attempts are made to show how common sports and physical activity situations generally influence development and adjustments, emphasis is given to the uniqueness of the individual personality and how a person reacts to different situations.
Prerequisite: Psychology 101, 355, or consent of instructor.
3 hours lecture, Fall and Spring terms
455* The Individual in Sport Situations
(Recreation 307*) An introduction to the social psychology of sport and physical activity, including sport involvement and personality, attitude, and beliefs; the team as a small group; and social influence and facilitation in sport situations.
Prerequisite: Two term courses in psychology or consent of instructor.
3 lectures. Winter and Spring terms

470* Seminar in Kinesiology An examination of the current major issues in Kinesiology. Included will be discussion of trends in applied kinesiology.
Prerequisite: Kinesiology students only.
3 hours. Winter term

472* Directed Study in Special Topics For the student who desires to pursue a particular topic in depth through guided independent research and/or reading. A faculty member must approve a student’s project prior to registration. May be repeated in subsequent terms.
Prerequisite: Consult with department.
Fall, Winter and Spring terms

480* 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.
Prerequisite: Kinesiology students only
3 lectures. Fall, Winter and Spring terms

Physical Activities Courses
Instructional courses at basic and advanced levels for over twenty sports are available to all Kinesiology students. Detailed listings are available at the time of pre-registration. In addition, outdoor camping and ski schools are offered to upper year students. A nominal charge will be made to cover the extra costs of these two schools.
All activity courses are elective and non-credit.
Students should consult with a faculty advisor concerning requirements in this area for entry into careers such as teaching.

Health Studies

140* Foundations of Health Science 1 A survey course directed towards the health of man – conception through youth. Topics include conception (prediction, control, genetics), early growth and development, puberty and adolescence, fitness, nutrition, consumer behaviour, and lifestyle determination.
3 lectures, Fall term

141* Foundations of Health Science 2 A survey course directed towards the health of man – middle age through death. Topics include family planning, cancer, cardiovascular and systemic diseases, transplants, accidents, fitness, aging, and death.
3 lectures, Fall term
240* Man Adapting  
An analysis of human adaptation to various environmental influences, and of the interaction between heredity and environment in determining health and disease.
3 lectures, Fall term

241* Epidemiology  
An investigation of the communicable and non-communicable diseases of man. The etiology, duration, and severity of selected diseases are studied, along with resistance and immunity: natural and artificial.
3 lectures, Winter term

302* An Introduction to Biomathematics (Mathematics 302)  
Course material has been selected with particular reference to some of the fundamentals of medical science including macro-molecular processes, environmental health, genetics and genetic engineering, aging processes and theories and quantitative models which describe events in these areas. Subjects such as types of distributions, data processing and simple differential equations as they relate to biological phenomena, also form part of the course.
Prerequisite: Kin. 116* or 1st year Chemistry or consent of instructor.
2 lectures, Fall term

303* An Introduction to Biomathematics (Mathematics 302)  
A continuation of Health Studies 302.
Prerequisite: Health Studies 302.
2 lectures, Winter term

345* Community Health  
A course designed to help students investigate the concept and functioning of community health.
Prerequisites: H.S. 140, 141, or consent of instructor.
3 lectures, Winter and Spring terms

346* Nutrition  
An elementary course in nutrition with special emphasis on diet for sport and certain physiological conditions.
Prerequisite: Kinesiology 317 or equivalent.
3 lectures, Winter term

348* Health Behaviour  
The study of social psychological processes underlying health-related behaviours with attention to the inter-relationships of health information, attitudes and health behaviour, health behaviour measurement, perception of illness as related to medical care utilization, and interpersonal and group health behaviour.
Prerequisites: H.S. 140, 141, Psychology 253 or consent of instructor.
3 lectures, Winter and Spring terms

349* Principles of Behaviour Modification  
A course providing a general overview of behaviour modification principles and procedures. Basic principles of reinforcement, punishment, modelling and desensitization are examined as they relate to the treatment of socially significant behaviours including mental health problems.
Prerequisites: Health Studies 140*, Psychology 101, or consent of instructor.
2 lectures, 1 lab., Fall and Spring terms
410* Growth, Development and Aging  
The changing capacities and interests of man are studied as he grows and develops. The contribution of physical activity to growth, and physical, psychological and sociological development is examined.  
Prerequisites: Kinesiology 200 and Biology 303.  
3 lectures, Fall and Spring terms

431* Research Project  
An independent research project on an approved topic, supervised by a faculty member. Includes an approved design and completion of the first three chapters of the paper.  
Prerequisite: Approval of supervisor.

432* Research Project  
An independent research project on an approved topic, supervised by a faculty member. Includes data collection, data analysis, and presentation of results in thesis form.  
Prerequisite: Completion of Health Studies 431*.

440* Marriage and Family  
The analysis of contemporary trends in Canadian family life. Topics include mate selection, family planning, family life cycle, family dissolution, and the impact of contemporary culture and values on the modern family.  
Prerequisite: Consent of instructor.  
3 lectures, Fall term

442* Epidemiology of Chronic Disease  
An investigation of the epidemiology of selected “non-infectious” diseases. Specific diseases emphasized will vary from year to year (e.g., cardiovascular diseases, malignant neoplasms at various sites; chronic diseases of respiratory and digestive systems). The course emphasizes disease causation (identification of “risk factors”) and prevention.  
Prerequisite: Health Studies 241* or consent of instructor.  
3 hours lecture, Winter term

445* Health Seminar  
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.  
Prerequisite: Consent of instructor.  
3 lectures, Winter term

472* Independent Study  
For the student who desires to pursue a particular topic in depth through guided independent research and/or reading. A faculty member must approve a student’s project prior to registration. May be repeated in subsequent terms.  
Prerequisite: Consult with Department.  
Fall, Winter and Spring terms
Dance

162* Introduction to the Dance
An overview of dance as manifest through its earliest forms as an expression of folk culture to its artistic presentation in contemporary investigation of the perspectives from which dance can be studied.
2 hrs./wk., lect., 2 hrs./wk. studio laboratory.
Fall term

163* A Study of the Medium of Movement
A course leading to an understanding of the broad conceptual framework of movement emphasizing the qualitative nature of movement and its relationship to creative expression.
Prerequisite: Dance 162* or consent of the instructor.
2 hrs./wk. lect., 2 hrs./wk. studio laboratory.
Fall term

262* Dance Theory: Process
This course focuses upon selected compositional theories of major dance artists as examples of the changes in choreographic approach from the 30’s to 70’s.
Prerequisite: Dance 163* or consent of instructor
2 hrs/wk lect. 4 hrs/wk studio laboratory, Fall term

263* Dance Theory: Product (Modern Dance)
This course focuses upon theories of dance as they engender a particular view of art and a particular view of the human body and thus delimit the nature of the created work itself. The nature of a theory is discussed, as is the nature of scientific and aesthetic theories. Ultimately the student develops his own theory of dance.
Prerequisite: Dance 262*
2 hrs/wk lect. 4 hrs/wk studio laboratory, Winter term

264* History of the Classic Dance to 1909
Historical survey of the development of the classics from elements appearing in the Greek Theatre to the end of the Russian classic period in the early 20th century.
Prerequisite: Dance 162* or consent of instructor
2 hrs/wk lect. 2 hrs/wk studio, Fall term

362* Socio-cultural Study of the Dance
Dance as an avenue for socio-cultural expression is examined from the perspective of the social sciences.
Prerequisites: Soc. 101 and Dance 264* or permission of instructor
2 hrs/wk lect. 2 hrs/wk tutorial, Winter term

363* Dance Ethnology
A comparative study of ethnic dance forms with a particular emphasis on dance style as significant cultural pattern. The course attempts to develop an understanding of the effect of particular ideologies and political systems on the development of a cultural dance form.
Prerequisite: Dance 264 or consent on instructor
2 lectures, 2 studio, Winter term
364* Developmental Aspects of Movement  
A study integrating the cognitive and perceptual developments in children as they relate to motor development. Primary emphasis is placed on investigating movement experiences suitable for children.  
*4 hours per week, 2 hours lecture, 2 hours tutorial to be arranged*  
Fall term

365* Dance Criticism  
This course covers questions about the role of the critic, his audience, his credentials, etc. The course also focuses upon particular dance events, in the studio and on the stage, for the purpose of developing critical faculties in a living context.  
Prerequisite: Dance 263*  
*2 hrs/wk lect. 2 hrs/wk studio laboratory, Winter term*

Dance 366* 20th Century Ballet: Part 1 (History)  
An indepth study of the factors affecting the Ballet in the 20th century from the advent of the Russians in Paris in 1909 to the influence of contemporary dance in recent years.  
Prerequisite: Dance 264*  
*2 hrs/wk lect. 2 hrs/wk tutorial, Full term*

367* 20th Century Ballet: Part 2 (Analysis)  
Analysis and study of the themes and styles of 20th century ballets and the changing attitudes to the theatre. Consideration is given to the adaptations of the classical idiom to the artistic trends of this century.  
Prerequisite: Dance 366*  
*2 hrs/wk lect. 2 hrs/wk studio laboratory, Winter term*

461*/462* Research Project  
An independent research project on an approved topic, supervised by a faculty member. Required of all students enrolled in Honours Option in Dance, Dance 461* includes an approved design and the completion of the first segment of the paper.  
Prerequisite: depending upon the topic selected, the student is required to achieve at least 60% in appropriate courses. A complete listing is available in the Departmental office.  
Dance 462* includes the completion of the project begun in Dance 461*.  
Prerequisite: Dance 461*

463* Seminar in Dance  
An examination of current and major issues in dance.  
Prerequisite: Kinesiology (Dance Option) students only  
*3 hrs/wk, Winter term*

464* Philosophy of the Dance  
The concern of this course is the relationships of man to the art products which he fashions. Questions such as, are all people creative? are discussed as is the validity of a distinction between art and life. A phenomenological analysis of dance is presented, discussed, critiqued and evaluated.  
Prerequisite: Phil. 100 and two full courses in the dance

The Faculty of Human Kinetics and Leisure Studies also teaches Inter-Faculty Studies 240* Man, Leisure, and Society. See page 498 for details.
Department of Management Sciences

Professor and Chairman of the Department
D.J. Clough, B.A.Sc.(Toronto), M.B.A.(Toronto)

Associate Professor and Associate Chairman
F.E. Burke, B.A.(London)

Professors
S.D. Saleh, B.A.(Cairo), M.A., Ph.D.(Case Western Reserve)
S.S. Sengupta, M.A., D.Phil.(Calcutta)

Associate Professors
I. Bernhardt, B.A.(N.Y.U.), Ph.D.(U.C. at Berkeley)
W.P. McReynolds, B.A.Sc.(Toronto), M.Sc.(U.B.C.), Ph.D.(Toronto)
K.J. Radford, M.A.(Cantab), FSS(UK)

Assistant Professors
J. Bradfield, B.A., M.A., Ph.D.(Rochester)
M.E. El-Gazzar, B.Sc., M.Sc.(Cairo), Ph.D.(Waterloo)
J.B. Moore, B.A.Sc.(Toronto), M.Math., Ph.D.(Waterloo)
R.G. Vickson, B.Sc.(UBC), Ph.D.(MIT)

Adjunct Professor
M. Saltsman, M.P.

Research Associates
N. Bernhardt, A.B.(Reed)
B.G. Bloor, B.Math.(Hons.) (Waterloo)

Activities and Scope

The Department of Management Sciences, Faculty of Engineering was established in 1969, as a graduate department and has recently extended its activities to undergraduate programmes.

The present activities of the department are: (1) the pursuit of advanced research in selected fields of the management sciences, (2) the provision of post-graduate courses of instruction for people who want to achieve high professional qualifications, and (3) the provision of undergraduate courses in the management sciences for students registered in the Faculty of Engineering.

Active faculty engagement in advanced research as well as experience in professional practice is considered essential to the development of adequate courses of instruction. The boundaries between pure research, applied research and professional practice become indistinct when the aim is to discover imaginative new ways to solve complex management problems. The research activities of the faculty members fall into three major categories: operations research, applied economics, and organizational behaviour. A major aim of the Department is to strengthen and develop these major fields of study.
Undergraduate Programmes

At the present time, the Department offers a programme option consisting of a package of four MS courses for students registered in any undergraduate programme in the Faculty of Engineering. The main objectives of this minor programme are to provide an awareness of the nature of managerial problems, to present some of the issues, concepts, and techniques related to these problems and to motivate the students to learn the scientific approaches to management. Although the courses emphasize practical problems, rigorous theoretical and conceptual approaches are presented.

The structure of the four course package is based on the appreciation of the complexity of management problems and the importance of being introduced to the different principles, considerations and approaches of tackling them. In a programme of this nature, it is considered advantageous to have an overall appreciation of the nature of the problems rather than dealing, in some depth, with only a few of them. Therefore, the minor programme is intended to introduce several approaches and different considerations in relation to managerial decision making. Enrolment in these courses will start in term 3B and will be primarily for engineering students who will take all four courses offered.

Course Descriptions

(2 hours lecture and one hour lab per week)

406 Managerial Decision Making 1
The nature and context of managerial decision making, Elementary introduction to utility theory. Basic probability theory; review of important concepts. Strategies for decision. Criteria for decisions, including multiple objectives. Brief introductions to optimization. Examples from management problems.

407 Managerial Decision Making 2

405 Managerial Economics
The course is designed to give the student an appreciation of the usefulness of basic concepts from economics in managerial decision making. Topics considered will include costs, cost as foregone opportunities, accounting definition of cost, production as a process in time relating costs to benefits.

404 Organizational Behaviour
The course presents a systematic approach to the study of human behaviour in organizations. It synthesizes different concepts and findings from the behavioural sciences and shows their applications to business. More specifically the course deals with some manpower problems, i.e., selection, training, control, and motivation problems; with interpersonal and small group behaviour, norms and values, leadership and authority, and with organizational structure and change.
Production Industrial Option

A new option offered jointly with the Mechanical Engineering Department, to allow for specialization in Production and Industrial Engineering.

Course Descriptions

3 hours lectures and 1 hour lab per week

21 Applied Probability and Statistics

23 Engineering and Managerial Economics
Application of the concepts of efficiency and costs to engineering and management decision making. Choice of inputs and processes. Evaluation of capital projects. Examples will include make or buy decisions and replacement of equipment decisions.

31 Industrial Statistics and Design of Experiments

43 Economics of Enterprise and Benefit/Cost Analysis
Applications of models of household and enterprise behaviour to private and public decision making. Seller strategy in consumer and industrial markets. Valuation of nonmarket goods. Examples will include use of buyer behaviour data to determine market segments, use of history of competitor behaviour to determine bidding strategy, and evaluation of a public investment.

44 Industrial Psychology
(Cross listed as Psychology 333)

46 Stochastic Models of Industrial Operations
Definition and classification of stochastic processes. Detailed analysis of Markov processes including analytic (generating functions) and graphical methods. Recurrent events including birth and death processes, branching processes and random walks. Waiting line models and their applications. Markovian decision problems. Application areas include inventory control, reliability, equipment replacement, maintenance, design of service facilities, reservoir control, etc.

Prerequisite: MS21
47 Optimization Models for Policy Analysis


51 Systems Simulation

Systems as multicomponent, bounded interacting objects. Conservative and non-conservative systems. Physical and mathematical analogues and models. Model formulation and computability: Simulation as iterative approximation of non-provable convergence. Event distribution models and Monte Carlo simulation, with industrial examples. Cybernetic (or dynamic) simulation, with industrial examples.

52 Management Information Systems

The information system as a component of the organization; relation to the management process; role in support of decision making; data and information in the organization; components of an information system; data bases; computer support; human consideration in implementation. Industrial examples as supporting case material.

53 Decision Theory and Organization

Group interactions and the problems of industrial macro-organizations. Discussion of organizational decision-making and control processes, with particular emphasis on the relevant theories of structural relations of organizations.
Faculty of Mathematics

Department of Applied Analysis and Computer Science

Professor and Chairman of the Department
P.C. Fischer, M.B.A.(Michigan), Ph.D.(M.I.T.), F.S.A.
(On Sabbatical Leave, 1974-75)

Distinguished Professor
J. Aczel, Ph.D.(Budapest), Habil. D.Sc.(Hung. Academy of Sciences), F.R.S.C.

Professors
J.A. Brzozowski, M.A.Sc.(Toronto), Ph.D.(Princeton)
B. Forte, Ph.D.(Pisa), Habil. D.Sc.(Rome)
C. Froese Fischer (Mrs.), M.A.(U.B.C), Ph.D.(Cantab.)
(On Sabbatical Leave, 1974-75)
J.W. Graham, M.A.(Toronto)
H. Haruki, Ph.D.(Osaka)
J.D. Lawson, B.A.Sc.(Toronto), Ph.D.(Waterloo), F.I.M.A.
M.A. McKiernan, M.A.(Loyola), Ph.D.(J.I.T.)
T. Pietrzykowski, M.A.(Warsaw, Ph.D.(Polish Academy of Sciences)

Associate Professors
D.D. Cowan, B.A.Sc.(Toronto), Ph.D.(Waterloo)
K. Culik, M.Sc., R.N.Dr.(Charles University, Prague), Ph.D.
(Czechoslovak Academy of Sciences)
W.M. Gentleman, B.Sc.(McGill), Ph.D.(Princeton)
J.A. George, M.Sc.(Alberta), Ph.D.(Stanford)
P.L. Kannappan, B.Sc.(Annamalai), Ph.D.(Washington)
(On Sabbatical Leave, 1974-75)
J.G. Linders, M.A.Sc.(Toronto), Ph.D.(Imperial College)
E.G. Manning, M.Sc.(Waterloo), Ph.D.(Illinois)
R.B. Simpson, M.A.Sc.(Toronto), Ph.D.(Maryland)

Assistant Professors
E.A. Ashcroft, B.A.(Cantab.), Ph.D.(Imperial College)
R. Benesch, M.Sc.(Alberta), Ph.D.(Queen's)

Director of First Year Studies in the Faculty of Math
P.C. Brillinger, B.A.(McMaster), M.A.(Waterloo)

Director of Computing Centre
P.H. Dirksen, M.A.(Waterloo)

K.O. Geddes, B.A.(Saskatchewan), M.Sc., Ph.D.(Toronto)
J.F. Gentleman (Mrs.), B.S.(Math., M.S.Stat.(Chicago), Ph.D.
(Waterloo)
M. Malcolm, B.Sc.(Denver), M.S.(Denver/Stanford), Ph.D.
(Stanford)
D.E. Morgan, B.Sc.(Rose Polytechnic Institute), M.S.(Michigan),
Ph.D.(Waterloo)
J.I. Munro, B.A. Honors. Math.(New Brunswick), M.Sc.(U.B.C.),
Ph.D. Comp.Sc(Toronto)
C.T. Ng, B.Sc.(Chinese University, Hong Kong), Ph.D.(Waterloo)
R.W. Peebles, B.Sc.(McGill), Ph.D.(Pennsylvania)
E.L. Robertson, B.Sc.(California Inst. Tech.), Ph.D.(Wisconsin)
L.D. Rogers, B.Sc.(McGill), Ph.D.(Waterloo)
(part-time)
J.H. Vellinga, B.A.(Western), M.A.(Waterloo)

Lecturers
V.A. Dyck, M.Math.(Waterloo)
M.I. Irland, M.S.Comp.Sc.(Illinois), M.Phil.(Waterloo)
Faculty of Mathematics

Research Associates
E.J.H. Chang, M.D.(U.B.C.)
R.T. Moenck, B.Sc.(Sussex), M.Sc., Ph.D.(Toronto)

Research Assistant Professor
P. Kritzinger, M.Sc.Eng.(Witwatersrand), Ph.D.(Waterloo)

Postdoctoral Fellow
T.S.E. Maibaum, B.Sc.(Toronto), Ph.D.(London)

Faculty Members holding cross appointments as shown
1 Applied Mathematics and Statistics and A.A.C.S.
2 Applied Mathematics and A.A.C.S.
3 A.A.C.S. and Statistics

Department of Applied Mathematics

Professor and Chairman of the Department
D.G. Wertheim, B.A.(McMaster), M.A.(Toronto), Ph.D.(Toronto)

Professors
C. Froese Fischer (Mrs),1 M.A.(U.B.C.), Ph.D.(Cantab.)
(On Sabbatical Leave, 1974-75)
B. Forte,1 Ph.D.(Pisa), Habil. D.Sc.(Rome)
M.A. McKiernan,1 M.A.(Loyola), Ph.D. (I.I.T.)

Associate Professor
C.F.A. Beaumont, B.A.(McMaster), M.A.(Toronto)

Associate Dean of Faculty of Math

Associate Professors
J. Cizek,3 R.N.Dr.(Charles University, Prague), C.Sc.
(Czechoslovak Academy of Sciences, Prague)
J. Froese, B.A.(Manitoba), M.A.(Queen's), Ph.D.(U.B.C.)
W.H. Hui, B.Sc.(Peking), Ph.D.(Southampton)
G.J. Lastman, M.A.(U.B.C.), Ph.D.(Texas)
(On Sabbatical Leave, 1973-74)
D. Lovelock, Ph.D.(Natal, Durban)
F.R. McCourt,3 B.Sc., Ph.D.(U.B.C.)

Associate Chairman of the Department
I.J. McGee, B.A.Sc.(Toronto), M.Sc.(Waterloo), Ph.D.(Yale)
(On Sabbatical Leave, 1974-75)

Assistant Professors
Z. Dvoracek, M.S., R.N.Dr.(Charles University, Prague), Ph.D.
(Czechoslovak Academy of Sciences, Prague)
G.W. Horndeski, B.Sc.(Washington Uni., St. Louis), Ph.D.
(Waterloo)
S.P. Lipshtitz, B.Sc. Hons.(Natal), M.Sc.(South Africa), Ph.D.
(Witwatersrand)
R.G. McLennan, M.Sc.(Queen's), Ph.D.(Cambridge)
M.E. Snyder, M.Sc.(Western), M.Sc.(Waterloo)
Lecturers

B.J. Marshman, (Mrs.), Ph.D.(Waterloo)
P.J. Trushel, B.A. Maths(Colorado College, Colo.Springs), Ph.D.(Waterloo)

Research Associate

D.R. Salahub, B.Sc.(Alberta), Ph.D.(University of Montreal)

Research Assistant Professor

S. Kim, B.Sc.(Seoul, Korea), M.Sc.(Idaho), Ph.D.(Waterloo)

Postdoctoral Fellows

Y-S. Huang, B.S.(Tunghai Uni. Taiwan), Ph.D.(Waterloo)
E. Leibowitz, B.Sc.(Hebrew Uni.), M.Sc.(Weizmann Inst. of Sci., Rehovoth), D.Sc.(Technion Israel Inst. of Technology, Haifa)
K.M.S. Saxena, M.Sc.(Lucknow), Ph.D.(Indian Inst. of Technology, Kanpur, India)

Adjunct Professors

D.J. Henderson, B.A.(U.B.C.), Ph.D.(Utah), F.Inst.P.
H. Rund, Ph.D.(Cape Town), Habilitation (Freiburg)

Faculty members holding cross appointments as shown

1 Applied Mathematics and A.A.C.S.
2 Applied Mathematics and Statistics and A.A.C.S.
3 Applied Mathematics and Chemistry

Department of Combinatorics and Optimization

Professor and Chairman of the Department

G. Berman, M.A., Ph.D.(Toronto)

Distinguished Professor

W.T. Tutte, Ph.D.(Canab.), F.R.S.C.

Professors

H.F. Davis, Ph.D.(M.I.T.)
J. Edmonds, B.A.(Geo.Washington), M.S.(Maryland)

Associate Dean of Faculty of Math

K.D. Fryer, B.A.(Western), Ph.D.(Toronto)

Associate Dean of Graduate Studies

P.L. Hammer, Ph.D. Math.(University of Bucharest, Romania)
R.C. Mullin, B.A.(Western), Ph.D.(Waterloo)

Associate Professors

J. A. Bondy, D.Phil.(Oxon)
R.C. Read, M.A.(Cambridge), Ph.D.(London)
C.E. Haft, B.S.(Stanford), Ph.D.(Waterloo)
R.A. Honsberger, B.A.(Toronto), M.A.(Waterloo)
U.S.R. Murty, M.A.(Osmania), Ph.D.(Indian Statistical Institute)
(On Sabbatical Leave, 1973-74)
H. Shank, M.Sc.(Chicago), Ph.D.(Cornell)
D.H. Younger, Ph.D.(Columbia)

Assistant Professors

M. Best, M.Math.(Waterloo), Ph.D.(California, Berkeley)
R.N. Burns, B.Sc.(Toronto), Ph.D.(Waterloo)
A.R. Conn, B.Sc.(Imperial College), M.Sc.(Manitoba), Ph.D.
(Waterloo)
G.B. Faulkner, B.A.Sc.(Toronto), Ph.D.(Waterloo)
D.M. Jackson, Ph.D.(Cambridge)
P. Schellenberg, Ph.D.(Waterloo)

Associate Director of Computing Centre

J.W. Dodd, B.A.Sc.(Toronto), M.Sc.(Waterloo)

Assistant Professor (part-time)
Faculty of Mathematics

Lecturers:
Assistant Lecturer
F. Anderson, B.A.(McMaster)

Chairman Administration
Assistant to the Dean
R.G. Dunkley, B.A.(Western)

Assistant to the Dean
W.I. Miller, B.A.(Queen’s)

P. Zima, M.Sc.(Charles University, Prague)

Postdoctoral Fellows
F.R. Bernhart, M.S.(Mich.), Ph.D.(Kansas State)
S.B. Maurer, B.A.(Swarthmore), Ph.D.(Princeton)
W.R.H. Richardson, Ph.D.(Waterloo)

Adjunct Professors
F.I. Johnson, R.S.(Georgia Tech), Ph.D.(California, Berkeley)
C.St.J.A. Nash-Williams, Ph.D.(Cantab.), F.R.S.E
R.E. Woolsey, Ph.D.(Texas)

Department of Pure Mathematics

Associate Professor
A. Kerr-Lawson, B.A.(Toronto), M.A.(Chicago), Ph.D.(McMaster)

Chairman of the Department

Professors
(On Sabbatical Leave, 1973-74)
G.E. Cross, M.A.(Dalhousie), Ph.D.(U.B.C.)
D.Z. Djokovic, Ph.D.(Belgrad)
(On Sabbatical Leave, 1974-75)
R.A. Staal, Ph.D.(Toronto)
D.B. Sumner, M.Sci.(Cantab.), D.Phil.(Witwatersrand)
J.W. Tucker, B.Sc.(King’s College, London), Ph.D.(Birbeck College, London)

Associate Professors
J.G. Anderson, M.Sc.(Durham), Ph.D.(Newcastle upon Tyne)
J.A. Baker, M.A.(Saskatchewan), Ph.D.(Waterloo)
(On Sabbatical Leave, 1974-75)
S. Burris, Ph.D.(Oklahoma)
Y. Chen, M.Ph.(Frankfurt), Ph.D.(Bochum)
G. Dankert, Dip.Math.(T.U. Hannover), Ph.D.(Cologne)
W.J. Gilbert, M.A.(Cantab.), D.Phil.(Oxon)
(On Sabbatical Leave, 1974-75)
D.A. Higgs, B.Sc.Hons.(Witwatersrand), M.A.(Cantab.), Ph.D. (McMaster)
P. Hoffman, B.A.(Toronto), Ph.D.(Manchester)
F.C.Y. Tang, B.Sc.(Hong Kong), M.S.(South Carolina), Ph.D. (Illinois)

Associate Professor of Foundations of Mathematics

Assistant Professors
I.J. Cummings, Ph.D.(U.B.C.)
(On Sabbatical Leave, 1973-74)
L.J. Dickey, M.A.(Arizona), Ph.D.(Wisconsin)
J. Malzun, Ph.D.(Toronto)
E.M. Moskal, B.A.(Toronto), Ph.D. (Illinois)
(On Sabbatical Leave, 1974)
D. Mowat, Ph.D.(Waterloo)
K.A. Rowe, B.S.(Toronto), M.S.(Wisconsin), Ph.D.(Illinois)
Instructor (part-time)  J.E. Totten, B.A.(Saskatchewan), M.M.(Waterloo)

Research Assistant  W.W. Wadge, B.Sc.(U.B.C.)

Postdoctoral Fellows  S. Bulman-Fleming, Ph.D.(Queen's)
J. Fischer, B.A.(Adelphi, N.Y.), M.A.(York), Ph.D.(Waterloo)

Adjunct Professor  W. A. Benz, Ph.D.(Mainz)

Faculty Members holding cross-appointments as shown:
1 Pure Mathematics and Philosophy.
2 St. Jerome's and Pure Mathematics.

Department of Statistics

Professor and Chairman of the Department  D.A. Sprott, Ph.D.(Toronto)

Professors  S.N. Afriat, M.A.(Cambridge), D.Phil.(Oxford)
W.F. Forbes, Ph.D., D.Sc.(London), D.I.C.
B. Forte, Ph.D.(Pisa), Habil. D.Sc.(Rome)
V.P. Godambe, M.Sc.(Bombay), Ph.D.(London)

Professor, Associate Chairman of the Department  J.G. Kalbfleisch, B.Sc.(Toronto), Ph.D.(Waterloo)

Associate Professors  M.A. Bennett, B.A.(Nottingham), F.S.A., F.C.I.A.
W.H. Cherry, Ph.D.(Melbourne)
W.M. Gentleman, B.Sc.(McGill), Ph.D.(Princeton)
J.D. Kalbfleisch, Ph.D.(Waterloo)
J.F. Lawless, Ph.D.(Waterloo)
W.S. Rickert, Ph.D.(Waterloo)
K.R. Shah, M.A.(Bombay), Ph.D.(Indian Statistical Institute)
M.E. Thompson (Mrs.), B.Sc.(Toronto), Ph.D.(Illinois)
R.V. Thysell, B.Sc.(Montana), Ph.D.(Iowa)
J.C. Young, B.A.Sc.(Toronto), M.Sc.(Waterloo), Ph.D.(Edinburgh)

(part-time)  G.W. Bennett, Ph.D.((Adelaide)

Assistant Professors  L. Billard, Ph.D.(New South Wales)
R.I. Fyford, B.Sc.(U.B.C.), Ph.D.(Southampton)
J.F. Gentleman (Mrs.), B.S.Math., M.S.Stat.(Chicago), Ph.D.(Waterloo)
R.L. Prentice, B.Sc.(Waterloo), Ph.D.(Toronto)
J.C. Robinson, M.A.Sc., P.Eng., Ph.D.(Waterloo)
T.G. Waller, M.A.(Southern Mississippi), Ph.D.(Vanderbilt)
J.B. Whitney, M.A.(Western), Ph.D.(Toronto)

Lecturers  R.L. Brown, B.Math.(Waterloo)
F. Reynolds, M.Sc.(Manitoba) F.S.A., F.C.I.A.
C. Springer, M.Sc.(McGill)

Instructor  K.S. Brown, Ph.D.(Waterloo)
Postdoctoral Fellows

J. Jackson, M.A. (Cambridge), M.B., B.Chir. (Cambridge)
R.R. Knispel, M.Sc. (Toledo), Ph.D. (Montana State)
P.A. McBride-Warren, B.A. Chemistry (Dallas), Ph.D. Biochemistry (Kansas State Univ.)
I. Rabinovitch, B.Sc. (McGill), Ph.D. (Dartmouth)

Adjunct Professors

I.P. Fellegi, Ph.D. (Carleton), F.A.S.A.
R.C. Frecker, B.Sc. (Memorial), M.D. (Dalhousie)
M. Zelen, B.Sc. (City College, New York), M.A. (North Carolina), Ph.D. (American)
J.G. Spiro, P.Eng. (Budapest), M.S. (Carnegie Mellon University), Ph.D. (McGill)

Faculty members holding cross appointments as shown:
1 Statistics and Economics
2 Applied Mathematics and Statistics and A.A.C.S.
3 Philosophy and Statistics
4 Chemical Engineering and Statistics
5 Psychology and Statistics
6 A.A.C.S. and Statistics

Division of Mathematical Research

The Division of Mathematical Research is a trans-departmental organization within the Faculty of Mathematics which is responsible for the general direction, encouragement and co-ordination of research and related activities. It arranges Colloquium lectures for the Mathematics Faculty (as distinct from research seminars), and organizes the Distinguished Lecturer Series in which individuals, outstanding both for their lecturing ability and research, are invited to present a series of lectures to undergraduates as well as graduates. It also brings mathematicians from other institutions to the University as Visiting Professors.

Faculty members working on related mathematical fields are encouraged to coordinate their activities through the formation of a Research Section. At present, they are nine such Research Sections, namely, Combinatorics, Computer Communication Networks, Differential Geometry and Relativity, Functional Equations, Information Theory, Numerical Analysis, Quantum Theory, Statistics and Biometry, and Theory of Computing. Each of these holds regular research seminars. Graduate students should keep these seminars in mind when planning their graduate programme.

Distinguished Lecturers (1973-74)

<table>
<thead>
<tr>
<th>Name</th>
<th>University</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. Birkoff</td>
<td>Department of Mathematics, Harvard Universtiy, Cambridge, Massachusetts</td>
<td>Mathematics</td>
</tr>
<tr>
<td>F.W. Dykstra</td>
<td>Department of Mathematics, Technological University Eindhoven, The Netherlands</td>
<td>Computer Science</td>
</tr>
</tbody>
</table>
## Visiting Professors (1973-74)

<table>
<thead>
<tr>
<th>Name</th>
<th>University</th>
<th>Research Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Hibbert</td>
<td>Queen's University, Belfast, Northern Ireland</td>
<td>Quantum Theory</td>
</tr>
<tr>
<td>D. Klarner</td>
<td>Stanford University, Stanford, California</td>
<td>Combinatorics and Optimization</td>
</tr>
<tr>
<td>J. Ladik</td>
<td>M Technische Universität, München, Germany</td>
<td>Quantum Theory</td>
</tr>
<tr>
<td>A. Lundberg</td>
<td>Stockholm University, Stockholm, Sweden</td>
<td>Functional Equations</td>
</tr>
<tr>
<td>J.B. Miller</td>
<td>Monash University, Clayton, Victoria, Australia</td>
<td>Functional Equations</td>
</tr>
<tr>
<td>J. Morris</td>
<td>University of Dundee, Dundee, Scotland</td>
<td>Numerical Analysis</td>
</tr>
<tr>
<td>A.G. Walker</td>
<td>University of Liverpool, Liverpool, England</td>
<td>Differential Geometry and Relativity</td>
</tr>
</tbody>
</table>

### Electives for Mathematics Students

The following courses may be counted as non-mathematics electives by mathematics students. Mthel 206 may be taken only by students in the Co-operative Mathematics Teaching Option.

**Mthel 100 Commercial Law for Mathematics Students**

**Mthel 101 (a) Applications of Mathematics**
- Mathematics Electives 101, 201, 301 and 401 are a sequence of courses designed to illustrate the representation of a real situation by a mathematical model. The mathematical techniques necessary to formulate the model and to discuss its behaviour are developed as required. Examples will be taken from diverse fields since one of the aims of the course is to formulate models to describe unfamiliar situations.
- First term: Models using difference equations will be formulated for examples drawn from biology, ecology, economics and psychology.
  - 3 hours lectures, 1 hour tutorial. Fall term

**Mthel 101 (b) Applications of Mathematics**
- See preamble to Mthel 101 (a).
- b) Sets of difference equations, probability and matrix theory will be used to describe models from biology, ecology, economics, psychology and physiology.
  - 3 hours lectures, 1 hour tutorial. Winter term.

**Mthel 201 (a) Applications of Mathematics**
- See preamble to Mthel 101 (a).
- Ordinary differential equations will be used in models drawn from biology, ecology, economics, physiology and physics.
- 2 hours lectures, 1 hour tutorial
- Prerequisite: M101, 120, 130 or consent of instructor
Mthel 201 (b) Applications of Mathematics

See Mthel 201 (a).

Other examples from biology, ecology, economics, physiology and physics are described using sets of differential equations.

2 hours lectures, 1 hour tutorial
Prerequisite: M201 (a)

Mthel 206 (a) Introduction to Mathematics Education

A consideration of secondary school Mathematics education under the following headings:

Current trends in education, professional practices and administration, the role of the department head, lesson planning, techniques of teaching, evaluation of students, special students, extra-curricular activities, the relationship between elementary and secondary school mathematics, audio-visual materials, current textbooks.

This course is offered to those students in the Co-op Mathematics Teaching option.

Mthel 301 (a) Applications of Mathematics

See preamble to Mthel 101 (a).

Partial differential equations are applied to diffusion processes, blood flow, and wave phenomena.

2 hours lectures, 1 hour tutorial.
Prerequisite: M217 or equivalent, or consent of instructor

Mthel 301 (b) Applications of Mathematics

See Mthel 301 (a).

Laplace transforms are applied to problems in ecology, physiology and other fields.

2 hours lectures, 1 hour tutorial
Prerequisite: M217 or equivalent, or consent of instructor

Mthel 302 Applications of Mathematics to the Biological Sciences

Since individual enrolling in Mthel 302 will not usually have a Science background, the course material has been selected with particular reference to some of the fundamentals of Medical Science including Macromolecular processes, Environmental Health, Genetics and Genetic Engineering, aging processes and theories and quantitative models which describe events in these areas. Subjects such as types of distributions, data processing and simple differential equations, as they relate to Biological phenomena, will also form part of the course.

2 hours lectures. Two terms
(Cross listed as Health Studies 302*/303*)
302 may not be counted as Mathematics credit but may be counted as an elective credit.

Mthel 304 (a) Foundations of Mathematics

An introduction to the problems of the foundations of mathematics. This course will normally be taken in third or fourth year.
It will be an elective credit for mathematics students.

3 hours lectures
Prerequisite: Consent of instructor

Mthel 304 (b) Foundations of Probability Theory

An introduction to the problems of the foundations of probability theory. This course will normally be taken in third or fourth year.
It will be an elective credit for mathematics students.

3 hours lectures
Prerequisite: Consent of instructor
Mthel 401 (a) Applications of Mathematics
See preamble to Mthel 101 (a).
Integral equations and integral transforms will be applied to systems with memory.
2 hours lectures, Fall term
Prerequisite: Consent of instructor

Mthel 401 (b) Applications of Mathematics
See Mthel 401 (a).
Students will construct a model and interpret it as a project.
2 hours lectures, Winter term
Prerequisite: Consent of instructor

Mthel 402 Topics in Mathematical Aspects of Chemistry, Biology, and the Medical Sciences
Subjects will be selected from areas such as epidemiology and mathematical models of disease processes including heart disease, cancer of aging. Consideration will be given to the quantitative evaluation of the role of environmental factors important in human disease processes.
2 hours lectures
Prerequisites: M302 or consent of the instructor

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
2 hours lectures, 1-½ hours problems.

21 Algebra and Vector Geometry
2 hours lectures, 1-½ hours problems

22 Calculus 2 (for Chemical Engineers)
Partial differentiation, the gradient, multiple integrals with applications, line and surface integrals, divergence and curl, Theorems of Green and Stokes. Applications to physical problems.
3 hours lectures, one term
*Prerequisite: M12 or equivalent*

*3 hours lectures*

32 Numerical Analysis A survey of numerical procedures with emphasis upon computer implementation using the FORTRAN IV programming language. In particular, the following topics are introduced: interpolation, curve fitting, solution of non-linear equations, numerical integration, numerical solution of ordinary differential equations, matrix algebra and solution of systems of linear equations, and problems in the solution of partial differential equations. 
*2 hours lectures, 2 hours problems, one term*

Offered in the Fall and Spring terms 
*Prerequisite: An introductory programming course*

Note Credit will not be granted for both M32 and M240 (a)


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*

*3 lectures, 2 hours problems, one term*

*3 hours lectures, 1 hour tutorial, one term*

Note This course is cross listed in Management Science as MS21.
61 Applicable Mathematics for Systems Design 1 (Also Listed as Systems Design 211)

First order differential equations, integrating factor, higher order differential equations. Complex variables, forced and free solutions to differential equations, transient and steady state solutions, applications. Fourier series, Fourier transforms and applications.

62 Applicable Mathematics for Systems Design 2 (Also listed as Systems Design 212)


72 (a) Introduction to Computer Science in Business and Economics

The purpose of Math 72 (a) is to introduce the student to the basic concepts of programming electronic digital computers. Students are taught to write computer programmes in two of the most widely used computer languages in the business world, namely COBOL and FORTRAN. The first part of the course deals with the COBOL language and uses this language to write programmes to simulate a large-scale credit card system. Students are shown how computers are employed to write invoices, process customer accounts and mail out credit cards. The second half of the course uses FORTRAN to handle problems involving inventory control, simulation of business problems and plotting.

2 hours lectures, 1 hour tutorial, one term

Offered in the Full and Winter terms

Note Credit will only be granted for one of M72, M112, M122 or M132. M72 cannot be counted as a credit towards a B.Math degree.

72 (b) Advanced Topics in Computer Science in Business and Economics

Topics discussed will include:

a) An introduction to machine hardware – CPU's, channels, tape drives, disk drives, main memory, slow core, drums, etc. Basic machine configurations will also be discussed. The relative costs involved will be covered whenever possible.

b) The concept of an operating system, JCL, compilers and system software packages.

c) Some of the basic terminology such as multiprogramming, batch processing, timesharing, telecommunications and data bases.

d) The general organization of a computing centre and the position of computer centres in corporate structures.

2 hours lectures, 1 hour tutorial, one term

Offered in the Winter term

Prerequisite: M72 (a) or the equivalent

Note Credit will only be granted for one of M72, M112, M122 or M132. M72 cannot be counted as a credit towards a B.Math degree.

81 Introduction to Functions Analytic Geometry, and Calculus


2 hours lectures
82 Introduction to Algebra
2 hours lectures

83 Introductory Mathematics for Sociology
Set Theory, Permutations and Combinations, Vectors and Matrices, Probability Theory, Solution of Linear Equations, Game Theory, Linear Programming.
2 hours lectures, 2 hours problems lab (alternate weeks)
2 terms

84 Algebra
A special course designed for students in Psychology and related subjects.
2 hours lectures, 2 hours problems lab (alternate weeks)
Winter term only

85 Mathematics for Environmental Studies
2 hours lectures, one term
Winter term only

100 Fundamental Concepts of Modern Mathematics
A course for non-mathematicians to provide some insight into the many aspects of modern mathematics. The "human interest" point of view will be stressed in order to reveal mathematics as an endeavor holding a strong place in man's culture. Emphasis will be on twentieth century ideas. To integrate the traditional with the modern, material will be organized in a conceptual rather than a chronological manner.
112 (a) Introduction to Computers

The purpose of Mathematics 112 is to provide students in programmes of study which do not emphasize Mathematics with an appreciation of the capabilities and limitations of machine computing, together with a reasonable capability for programming in one or more programming languages. Topics covered in Mathematics 112a will include: concept of an algorithm, representation of information, programming in a higher level language, concept of a compiler, applications in business, the social sciences and other areas.

2 hours lectures, 1 hour tutorial, Fall term
Prerequisite: None although Grade 12 Mathematics is recommended

Note Credit will only be granted for one of M72, M112, M122 or M132. M112 cannot be counted as a credit towards a B.Math Honours degree.

112 (b) Applications and Implications of Computers

A continuation of the concepts introduced in Mathematics 112a – the applications of computers to several fields and the impact (past, present and future) of computing on society.

Topics discussed will include: computer applications, various programming languages (their assets and liabilities), the concepts of compilers, assemblers, interpreters, interactive systems and text editors, computer simulation, computers and society (including data banks, privacy, employment, etc.) artificial intelligence, and other directions of computer science, the limitations of computing devices.

2 hours lectures, 1 hour tutorial, Winter term
Prerequisite: M112 (a)

Note Credit will only be granted for one of M72, M112, M122 or M132. M112 cannot be counted as a credit towards a B.Math Honours degree

119 Algebra and Geometry

Functions and permutations, Elementary number theory. Real and complex number systems. Polynomial functions. Linear geometry and algebra in 2 and 3 space.

3 hours lectures, 1 hour tutorial

Note M119 is not a course for Honours Mathematics students

120 Calculus


3 hours lectures, 1 hour tutorial

Note M120 is not a course for Honours Mathematics students.
122 (a) Introduction to Computer Programming
An introduction to algorithms with emphasis on the solution of problems of a scientific nature. Concept and properties of an algorithm, language and notation for describing algorithms. Analysis of scientific problems, development of algorithms for their solution and their implementation in a procedure oriented language (FORTRAN IV). Other topics will include: enumerative and iterative algorithms, nature of errors and uncertainty, use of existing library routines for manual procedures and graph plotting.
2 hours lectures, 2 hours tutorial
Offered in the Fall and Winter terms
Prerequisite: Grade 13 Mathematics is recommended
Only one of M72 (a), 112 (a), 122 (a) and 132 (a) can be taken for credit.

129 Algebra and Geometry
Functions and permutations. Elementary number theory. Real and complex number systems. Polynomial functions. Linear geometry and algebra in 2 and 3 space. Algebraic systems.
3 hours lectures, 1 hour tutorial

130 Calculus
Functions and limits, the derivative, differentiation of algebraic and other functions, applications of the derivative.
The integral, theorems on the integral, applications of the integral.
Sequences, convergence of series, power series. Some elementary differential equations.
3 hours lectures, 1 hour tutorial

131 (a) Algebra and Solid Geometry
The real and complex number system, Mathematical Induction, the Binomial Theorem, Monotone sequences and the Cauchy criterion, polynomial functions, Theory of equations.
3 hours lectures

131 (b) Algebra and Solid Geometry
Determinants Vector and Matrix notation, Elementary Solid Geometry, Linear transformations, Eigenvalues and Eigenvectors.
3 hours lectures

132 (a) Introduction to Computer Science - Programming
A thorough introduction to the use of computers. Concept and properties of an algorithm, language and notation for describing algorithms. Analysis of problems of both a scientific and business nature, and development of algorithms for their solution. Introduction to procedure-oriented languages (COBOL and FORTRAN IV). The preparation, implementation, and debugging of programs in these languages. Students are expected to spend considerable time running programmes on the computer.
2 hours lectures, 2 hours tutorial (laboratory), one term
Normally offered in the Fall term
Prerequisite: Grade 13 mathematics

Note Credit will only be granted for one of M72, M112, M122 or M132.
132 (b) Introduction to Computer Science - Characteristics of Computers

A general introduction to the nature and concepts of Computer Science. Basic machine architecture. Introduction to machine and assembly-language programming. The representation of data in a computer. Address modification, indexing and indirection. Character manipulation, floating point operations and subroutine linkage. Characteristics of peripheral devices. The logical design of basic machine components. A brief survey of software which assists user programmes: Compilers, loaders, input-output routines, operating systems. Applications of a computer in various segments of society.

3 hours lectures, 1 hour tutorial (laboratory), one term. Normally offered in the Winter and Spring terms

Prerequisite: Grade 13 mathematics

Note Credit will only be granted for one of M72, M112 or M132.

217 Advanced Calculus

Differential calculus of functions of several variables. Multiple integrals. Line and Surface integrals; Green's Theorem, Divergence Theorem, Stokes' Theorem. Infinite Series.

3 hours lectures, 1 hour tutorial

Note M217 is not a course for Honours Mathematics students

219 Linear Algebra


3 hours lectures

Note M219 is not a course for Honours Mathematics students

223 (a) Introduction to Statistical Methods (Descriptive)

Descriptive statistics, graphical methods, model fitting; correlation, regression and the method of least squares; an introduction to time series and forecasting.

3 hours lectures

Prerequisites: M120 or M130; one of M112 (a), M122 (a), M132 (a).

223 (b) Introduction to Statistical Methods (Inferential)

Probability theory, discrete and continuous random variables; tests of significance, maximum likelihood estimation and large sample theory; estimation and testing in the normal distribution.

3 hours lectures

Prerequisite: M223 (a)

Notes M223 is not a course for Honours Mathematics students.
Credit will be given for only one of M223, M233 and M243.

228 Introduction to Pure Mathematics

Examples and results in modern geometry, number theory, and algebra. Logical foundations of Mathematics (Hilbert's proof theory and Brouwer's intuitionism).

2 hours lectures

229 Linear Algebra


3 hours lectures
233 Probability and Statistics
An introduction to probability theory and statistics, with emphasis on applications to practical problems, and on the logical principles involved. Several examples to be discussed require use of the computer. Topics from probability theory include the laws of probability; discrete and continuous random variables; expectation; and the central limit theorem. Topics from statistics include the use of relative likelihood in estimation; sufficiency; tests of significance; contingency tables; normal distribution theory; simple linear regression.
3 hours lectures, 2 hours tutorial
Prerequisites: M120 or M130; M122 (a) or M132 (a).

234 Introduction to Applied Mathematics

234 (a) Differential Equations
First order equations; second order equations with constant coefficients. Applications to problems in the physical and biological sciences. Solution of differential equations by series.
2 hours lectures, one term
Prerequisite: M237 (may be taken concurrently)

234 (b) Mathematical Modelling
Mathematical models from various disciplines. Introduction to Newtonian mechanics will also be included in the course.
2 hours lectures, one term
Prerequisites: First year Physics or Consent of Instructor M31 or M234 (a) or M 236

Note M 234 (a) and M 236 may not both be taken for credit

235 (a) Actuarial Mathematics
The theory of rates of interest and discount, annuities and sinking funds; application to financial problems, including the determination of mortgage payments and the price and yield of bonds.
2 hours lectures, 1 hour problems

235 (b) Basic Life Insurance Mathematics
Applications of probability to problems of life and death. The determination of single and annual premiums for assurances and annuities. Reserves. Company expenses and their incorporation into premium and cash value calculations.
2 hours lectures, 1 hour problems

236 Elementary Differential Equations
2 hours lectures

Note M236 is not a course for Honours Mathematics students
3 hours lectures, 2 hour tutorial  
Prerequisite: First year algebra (M119/129)

239 Introduction to Combinatorics and Optimization

2 hours lectures, 2 hours tutorial  
Prerequisite: First year algebra (M119/129)

239 (b) An Introduction to Optimization Convex sets. Linear programming. Directed graphs. Applications of Boolean Algebra to Combinatorial Circuits. Probability; Markov chains; random walks. Theory of Games. Recommended for students wishing an introduction to optimization, and for students intending to pursue a course of study in combinatorics or optimization.  
2 hours lectures, 2 hours tutorial, one term  
Prerequisites: First year algebra (M129); Note that 239 (a) is not a prerequisite, but is highly recommended.

240 (a) Numerical Applications in Computer Science An introduction to Numerical Procedures with emphasis upon computer implementation using the FORTRAN IV programming language. In particular, the following topics are introduced: concept of numerical errors, interpolation, curve fitting, solution of non-linear equations, numerical integration, matrix operations and solution of systems of linear equations, numerical solution of ordinary differential equations. Offered in the Fall, Winter and Spring terms.  
P prerequisite: M132 (a) or equivalent, and M120 or M130 and M119 or M129.  
There is a special section for non-mathematics students.

240 (b) Principles of Programming Languages and Data Structures This course is intended to cover a number of basic principles of programming languages and data structures. The emphasis will be on basic principles with motivation for programming languages arising from practical examples. The following programming will be covered: ALGOL, SNOBOL, L6, PL/1.  
2 hours lectures, 2 hours tutorial. Offered in the Fall and Winter terms.  
P prerequisite: M132(a) and M132(b)
243 Statistics for the Sciences

The topics of Mathematics 233 with particular emphasis on the analysis and interpretation of experimental data and the design of experiments in the Sciences. The more difficult mathematical techniques associated with these problems will be omitted and many examples from Physics, Chemistry, Biology and other natural Sciences will be considered.

2 hours lectures, 1 hour laboratory.

Note: M243 and 233 can not both be taken for credit. Honours Mathematics students must take M233.

300 (a) Mathematical Discovery and Invention

A study of about 100 challenging problems taken from many areas of elementary mathematics, number theory, combinatorics, geometry, probability, logic. Emphasis is placed on student participation.

This course was designed for those planning to go into high school teaching. However, the problems have universal appeal to all who like mathematics. This is a "do" course, and is not recommended for passive students.

2 hours lecture, one term.

Prerequisite: No formal prerequisites are demanded. However, the broader and deeper one's mathematical experience the better. This course focuses on applying one's knowledge and ingenuity.

300 (b) Mathematical Discovery and Invention-B

A study of about 100 challenging problems taken from many areas of elementary mathematics - number theory, combinatorics, geometry, probability, logic. Emphasis is placed on student participation.

This course was designed for those planning to go into high school teaching. However, the problems have universal appeal to all who like mathematics. This is a "do" course, and is not recommended for passive students.

2 hours lectures, one term.

Prerequisites: No formal prerequisites are demanded. However, the broader and deeper one's mathematical experience the better. This course focuses on applying one's knowledge and ingenuity.

Note: 300(a) is not a prerequisite to 300(b).

307 Combinatorial Geometry

A study of combinatorial properties of plane figures, covering problems, addition of figures, maxima and minima problems, curves of constant breadth and delta-curves.

This course is designed for the student who particularly likes geometry and for the serious student of combinatorics. Occasionally brief contact is made with the subject of analysis. Thus a concurrent course in real variables would be helpful, but not essential.

2 hours lectures.

Prerequisite: First year calculus (M120/130).
312 (a) Elements of Real Variable Theory
Metric properties of $\mathbb{R}^n$, functions from $\mathbb{R}^n$ to $\mathbb{R}$; differentials; Riemann integrals; and one of:
   a) an introduction to the Lebesgue integral;
   b) an introduction to metric spaces;
   c) orthogonal systems.
3 hours lectures.

Note: Emphasis will be on applications rather than theory.

Note: M312(a) is not a course for Honours Mathematics students.

312 (b) An Introduction to Complex Variable Theory
Complex numbers: continuity, differentiability, analyticity of functions; the Cauchy-Riemann equations; solutions of Laplace's equation; conformal mapping by elementary functions, and applications; the Cauchy and allied theorems; Taylor and Laurent expansions; uniform convergence and power series; the residue calculus, and applications.
3 hours lectures.

Note: Emphasis will be on applications rather than theory.

Note: M312(b) is not a course for Honours Mathematics students.

319 Abstract Algebra
Rings, integral domains, fields, groups. Quotient groups and quotient rings.

Note: Emphasis will be on examples rather than proofs of theorems.

Note: M319 is not a course for Honours Mathematics students.

329 Abstract Algebra
Relations and operations in sets. Rings, integral domains, fields, groups. Quotient structures. Linear maps of inner-product spaces.

330 (a) Projective Geometry
Projective spaces over fields, collineations and correlations, quadric curves and surfaces. Reference to non-euclidean geometries.
3 hours lectures, one term.
Prerequisite: M229

330 (b) Geometry of the Complex Numbers
The plane of complex numbers. The group of circle preserving mappings and its subgroups. Connections with non-euclidean geometries. Other number systems and their geometries (Laguerre, Minkowski).
3 hours lectures, one term.
Prerequisite: M229

330 (c) Euclidean Geometry
Concurrent lines, collinear points, the Euler line, the Simson line, the nine point circle. Cross ratio, projection, Harmonic range, the quadrilateral and the quadrangle. Properties of circles.
3 hours lectures, one term.
332 (a) Real Variables  Description of real numbers by means of a few fundamental properties (l.u.b. axiom, principle of Archimedes, etc.); proof of some theorems on continuous functions using l.u.b. axiom; functions of bounded variation and the Riemann Stieltjes integral; Cesaro summability of series; derivation, discussion and applications of Cauchy-Schwartz and Minkowski inequalities for series and integrals; inner product spaces and normed linear spaces with examples; orthonormal systems with examples including Legendre, Tschebyscheff, and trigonometric systems; Fourier series; ordinary differential equations and Picard existence Theorem (by means of fixed point theorem).
3 hours lectures.

332 (b) An Introduction to Complex Variable Theory  Complex numbers; continuity, differentiability, analyticity of functions; the Cauchy-Riemann equations; solutions of Laplace's equation; conformal mapping by elementary functions, and applications; the Cauchy and allied theorems; Taylor and Laurent expansions; uniform convergence and power series; the residue calculus, and applications.
3 hours lectures.

3 hours lectures, 2 hours problems, one term.
Offered in the Spring and Fall terms.
Prerequisite: M240(a). Also recommended are M219 or 229 and M217 or 237.

3 hours lectures. 2 hours tutorial. Winter term.
Prerequisite: M240(a). Also recommended are M219 or 229 and M217 or 237.

335 (a) Finite Differences  A course in the calculus of finite difference, to include: summation, numerical integration and differentiation, relation between integration and summation; and error theory.
2 hours lectures.

335 (b) Graduation of Tables  Applications of finite differences to actuarial problems in graduation of statistical tables.
2 hours lectures.
Prerequisites: M235(a), M235(b).

336 (a) Life Contingencies  An advanced course on problems with single lives, including population theory.
3 hours lectures, one term.
Prerequisite: M235(b).
336 (b) Life Contingencies
An advanced course on problems with multiple lives; multiple decrement theory; accidental death and disability benefits.
3 hours lectures, one term.
Prerequisite: M235(b).

338 (a) Mathematical Statistics
Continuous random variables; moments and moment generating function; distribution of t, chi-squared, and F, and their applications. Large sample theory.
3 hours lectures
Prerequisites: M233, M237

338 (b) Mathematical Statistics
The multivariate normal distribution, its properties and uses; quadratic forms and Cochran’s theorem; multiple regression; introduction to the analysis of variance.
3 hours lectures
Prerequisites: M229, M338 (a)

339 (a) Probability and Stochastic Processes
Probability distributions, joint variation, central limit theorem. Introduction to continued time stochastic processes. Poisson process and application to simple congestion situations.
3 hours lectures, Fall or Spring term
Prerequisite: One of M223, M233 or M243

339 (b) Probability and Stochastic Processes
3 hours lectures, Winter term
Prerequisite: One of M223, M233 or M243

Parts (a) and (b) may be taken in either order

340 (a) Machine, Data and Programme Structures
3 hours lectures, one term
Offered in the Fall, Winter and Spring terms
Prerequisite: M240 (b)

340 (b) Implementation Schemes for Programming Structures
3 hours lectures, one term
Offered in the Fall and Winter terms
Prerequisite: M340 (a)

341 Algebra
Fundamentals of group, ring, and field theory.
3 hours lectures
Corequisite: M229

342 Real Analysis 1
Theory of functions of real variables. The notions of compactness, connectedness, and uniformity are used in a study of continuity, differentiation, and integration.
2 hours lectures
Prerequisite: M237
343 Complex Analysis 1  
Analysis of complex numbers; fundamental theorems of holomorphic functions; meromorphic functions.
2 hours lectures  
Prerequisite: M237

344 Topology (a)  
Intuitive set theory, metric spaces, point set topology.
3 hours lectures, one term  
Consent of instructor

345 (a) Topics in Pure Mathematics for Combinatorial Mathematicians – A  
(Not offered in 1974-75)

345 (b) Topics in Pure Mathematics for Combinatorial Mathematicians – B  
(Not offered in 1974-75)

349 (a) Applied Statistical Analysis  
Review of Normal, t, Chi squared and F distributions and their applications. Introduction to the design and analysis of experiments and surveys. Analysis of variance, multiple regression.
3 hours lectures, Spring and Full terms  
Prerequisite: One of M223, M233 or M243

349 (b) Statistical Decision Theory  
The decision problem; utilities and subjective probabilities; decision rules; decision trees, normal and extensive analyses; conjugate prior distributions and associated distribution theory; applications to business decisions. Loss functions, risk functions, admissibility, minimax rules, tests of hypotheses. An introduction to statistical quality control and control charts.
3 hours lectures, Winter term  
Prerequisites: M223, M233, or M243; M217 or M237  
Note M349 (a) is not a prerequisite for M349 (b). M349 and M338 may not both be taken for credit

351 Introduction to Graph Theory and Combinatorial Analysis

351 (a) Introduction to Graph Theory  
Basic concepts; Konigsberg bridge problem, Euler trails and Hamiltonian cycles; marriage problem, maximum matchings, Hall’s theorem; planar graphs, four colour problem, chromatic number; Ramsey’s theorem.
Stress will be on problem solving. Recommended for students interested in learning the basics of graph theory and for those intending to take higher level courses in graph theory.
2 hours lectures, one term  
Prerequisites: No formal prerequisites. M239 recommended

351 (b) Applied Graph Theory  
Applications of graph theory to communication networks, timetabling, ranking, and other combinatorial problems.
2 hours lectures, one term  
Prerequisite: M351 (a)
352 (a) Fundamentals of Optimization

Introductory study of optimization techniques common to a wide variety of operations research and engineering problems, and of fundamental theoretical interest. Linear programming, simplex method, duality; integer and non-linear programming; convexity; branch and bound, network programming, optimal paths and trees, transportation problems, flows, PERT, replacement policies, knapsack problems.

Recommended for students desiring mathematical background for operations research, industrial engineering, computer science and for those wishing to pursue advanced courses in mathematical programming and combinatorics.

2 hours lectures, one term

Prerequisite: Completion of M229, 237, 239 or consent of instructor

352 (b) Fundamentals of Optimization

Introductory study of optimization techniques complementary to those studied in 352 (a). Extrema of functions of n-variables, implicit functions and Lagrange multipliers, inventory problems; difference methods; queuing, recurrent events and replacement policies; games; job-sequencing in problems; dynamic programming.

Recommended for students desiring mathematical background for operations research and industrial engineering and for those wishing to pursue advanced courses in mathematical programming and queuing theory.

2 hours lectures, one term

Prerequisites: Same as M352 (a)

353 Applications of Combinatorics

353 (a) Combinatorial Mathematics in Information Retrieval

Brief survey of information retrieval and its applications; discrete models; representation problems; semantic adequacy; matching problems; partitioning of aggregates of elements; generalized distance measures; application of classification techniques; graph theoretic techniques; hierarchical techniques; minimization techniques; local and global methods; retrieval performance; measures of effectiveness; problems of retrieval relevance judgements.

2 hours lectures, One term

353 (b) Modelling Techniques in Optimization

Theory of mathematical modelling, deterministic and stochastic. Methods for optimization including standard analysis, steepest descent, probabilistic methods. Applications to business problems such as inventory theory, capital budgeting, reliability, queuing, etc.

2 hours lectures, one term

360 (a) Tensor Analysis

Elementary introduction to classical differential geometry and tensor analysis. Curves and surfaces in Euclidean spaces, coordinate transformation, invariance of length, introduction of tensors and metric, Riemannian spaces, covariant differentiation, geodesics, curvature and Einstein tensors.

2 hours lectures, + 1 hour tutorial, Fall term

Prerequisites: M237, consent of instructor
Faculty of Mathematics

360 (b) Differential Geometry
2 hours lectures + 1 hour tutorial, Winter term
Prerequisites: M237, M360 (a) or consent of instructor

361 (a) Calculus of Variations
2 hours lectures + 1 hour tutorial, Fall term
Prerequisites: M237 or consent of instructor

361 (b) Mechanics
2 hours lectures + 1 hour tutorial, Winter term
Prerequisites: M237, M361 (a) or consent of instructor

362 (a) Introduction to Continuum Mechanics
2 hours lectures, 1 hour tutorial, Winter term
Prerequisites: M234, M237 or consent of instructor

362 (b) Partial Differential Equations of Applied Mathematics
Vector Integral Calculus, derivation of the equations of heat flow, the vibrating membrane and the electro-magnetic field equations by various elementary techniques and illustrations of the use of the calculus of variations in the derivation of equations; solutions of the above equations by separation of variables; Fourier analysis and Fourier Integral.
2 hours lectures, 1 hour tutorial, Fall term
Prerequisites: M234, M237 or consent of instructor

363 Differential Equations
2 hours lectures, + 1 hour tutorial
Prerequisites: M234, M237 or equivalent, M332 (Real Variables) may be taken concurrently
371 (a) Switching Circuits
3 hours lectures, one term
Offered in the Fall, Winter and Spring terms
Prerequisite: M132. Recommended Corequisite: M319 or M329

371 (b) Architecture of Computers
This course is intended to prepare the students to choose a suitable computer for a given application. Review of combinatorial and sequential logic circuits. Discussion of modules or "building blocks" – central processing units, stores, input/output systems, and bus structures. Case studies of machines.
3 hours lectures
Offered in the Fall and Winter terms
Prerequisite: M371 (a)

372 (b) Introduction to Automata Theory
3 hours lectures, Winter term
Prerequisite: M371 (a) or consent of the instructor
Recommended Corequisite: M319 or M329

380 Introduction to Information Theory with Applications

398 Undergraduate Seminar 2 hours lectures

399 Reading in Mathematics

406 Linear Algebra 2
Continuation of linear algebra. Main topics; representations of endomorphisms, structures of bilinear forms, multilinear products. 2 hours lectures
Prerequisite: M329 or M341

407 Algebraic Geometry
An introduction to the theory of algebraic varieties. Special topics such as the Theorem of Riemann-Roch.
2 hours lectures
Prerequisite: M329 or M341

408 Mathematical Logic
First order languages and theories. A treatment of at least one of the following: set theory, model theory, undecidability. This course is more specialized and at a more advanced level than Mathematics 436.
2 hours lectures
409 Foundations of Geometry
An axiomatic treatment of geometry. Geometrical structures, such as projective planes and inversive planes.
2 hours lectures

410 Ring Theory
Continuation of the theory of rings and modules.
2 hours lectures
Prerequisite: M329 or M341

411 Group Theory
Continuation of group theory.
2 hours lectures
Corequisite: M329 or M341

412 Field Theory
Field extensions and Galois theory.
2 hours lectures
Prerequisite: M329 or M341

413 Non-Linear Differential Equations
Non-linear mechanics, stability, quasi-linear and strongly non-linear systems, linear periodic systems, non-linear integral equations.
2 hours lectures
Prerequisite: M363 or consent of instructor

417 (a) Optimizational Combinatorics-A
Recommended for students interested in theoretically advanced study in Combinatorics and Optimization or Computer Science.
2 hours lectures, one term
Prerequisite: M352 (a) or consent of instructor

417 (b) Optimizational Combinatorics-B
Recommended for students interested in theoretically advanced study in Combinatorics and Optimization or Computer Science.
2 hours lectures, one term
Prerequisite: M417 (a) or consent of instructor

418(a) Combinatorial Applications of Computers – A
General topics: methods of data storage for combinatorial problems, representation of sets, etc. Algorithms for permutations, combinations, partitions, etc. The use of generating functions, and methods of handling them on a computer. Enumeration problems: Polya's theorem and variations. Applications.
Useful for students wishing to specialize in the more computationally-oriented aspects of graph theory or operations research.
2 hours lectures, one term
Prerequisites: Practical knowledge of at least one computer programming language. Algebra (M319)

*Prerequisites:* Practical knowledge of at least one computer programming language. Algebra (M329). M418 (a) is a prerequisite for M418 (b)

419 (a) Applications of Graph Theory – A (not offered in 1974-75)

419 (b) Applications of Graph Theory – B (not offered in 1974-75)

420 (a) Combinatorial Methods and Probability Models – A (not offered in 1974-75)

420 (b) Combinatorial Methods and Probability Models – B (not offered in 1974-75)


*2 hours lectures*

*Corequisite:* M329 or 341

426 Topology Continuation of general topology; selected topics from other branches of topology.

*2 hours lectures*

*Prerequisite:* M344

428 Lattice Theory Ordered sets, lattices, and Galois connections. Applications in algebra, geometry and logic.

*2 hours lectures*

*Consent of instructor*


*2 hours lectures*


*2 hours lectures*

*Corequisite:* M330 (a) Projective Geometry

432 Complex Analysis 2 Further properties of holomorphic and meromorphic functions. Riemann surfaces.

*2 hours lectures*

*Prerequisite:* M332 (a) or M343
433 Real Analysis 2
An introduction to integration and measure theory with emphasis on the real lines.
2 hours lectures
Prerequisite: M332 (a) or M342

434 Differential Equations
2 hours lectures
Prerequisite: M363 or equivalent, or consent of instructor

435 Laboratory
a) Numerical problems arising in actuarial science and statistics.
2 hours laboratory, one term
Prerequisite – Corequisite: M335b, M461a, M437a, or consent of instructor

b) Numerical problems arising in actuarial science and statistics.
2 hours laboratory, one term
Prerequisite: M336a and b or consent of instructor

Note Only advanced actuarial students are advised to take this course.

436 Introduction to Logic
An introduction to the logic of sentences and predicates with some emphasis on familiar algebraic structures. At first informal, then leading to a formal axiomatic treatment with proofs of consistency and completeness.
2 hours lectures
Prerequisite: Consent of instructor

437 (a) Measurement of Mortality
Methods of analysis of data to produce raw rates for mortality and other tables.
2 hours lectures, one term
Prerequisite: M235 or consent of instructor

437 (b) Risk Theory
2 hours lectures, one term
Prerequisite: M233 or consent of instructor

438 (a) Topics in Estimation and Hypothesis Testing
Discussion of general inference problems under the headings of point and interval estimation, hypothesis testing, and decision theory. Large sample normal likelihoods, maximum likelihood estimation, theory of UMV estimation, least squares, Neyman-Pearson theory of hypothesis testing.
2 hours lectures, one term
Prerequisite: M338 (a)

438 (b) Statistical Inference with Small Samples
Logic of tests of significance; exact tests and confidence intervals; normal approximations accurate for small samples and relationship to the normality of the likelihood function. Introduction to problems involving more than one parameter.
2 hours lectures, one term
Prerequisite: M438 (a) or permission of instructor
439 (a) Theory of Experimental Design – A
The logical requirements of designed experiments. The design and analysis of basic complete designs with fixed effects or both. The analysis of covariance, The latin square. An introduction to sampling theory. Applications.
3 hours lectures, one term
Prerequisite: M338 (b) or consent of instructor

439 (b) Theory of Experimental Design – B
Construction and analysis of incomplete designs: latin square, confounded, fractional factorial, incomplete block. Applications.
3 hours lectures, one term
Prerequisite: M439 (a)

441 Quantum Mechanics
2 hours lectures

442 Theory of Relativity
Flat space-time and special relativity, curved space-time and the Einstein gravitational field equations. The Schwarzschild solutions and the experimental tests of relativity. Maxwell's equations in space time and the Reissner-Nordstrom solution. Selected topics from cosmology, Petrov classification, spinors, gravitational waves, special solutions, mathematical aspects of the Einstein field equations.
2 hours lectures, Winter term
Prerequisite: M360 (a). Consent of instructor

443 Electromagnetism
Applications of the Maxwell equations. Reflection and refraction. Introduction to wave guides and antennae.
2 hours lectures, Winter term
Prerequisite: Consent of instructor

444 Elasticity
Basic equations of elasticity for homogeneous isotropic bodies; bending of beams; plane elastic waves; Rayleigh surface waves, Love waves. Solution of problems by potentials, variational methods and Saint Venant's principle.
2 hours lectures + 1 hour tutorial, Winter term
Prerequisite: M455 (a)

445 (a) Fluid Mechanics
Fundamental equations of inviscid fluids, compressibility, vorticity; two and three dimensional irrotational, incompressible flow, Blasius' theorem, Joukowski hypothesis.
2 hours lectures, 1 hour tutorial, Fall term
Prerequisite: M363 (b)

445 (b) Fluid Dynamics
Shock wave theory, supersonic flow around a corner, Prandtl-Meyer flow. Dynamics of real fluids, Navier-Stokes equations, exact solutions, Stokes and Oseen flow; introduction to boundary layer theory.
2 hours lectures, 1 hour tutorial, Winter term
Prerequisite: M445 (a)
Faculty of Mathematics

446 (a) History of Mathematics – A
A study of selected topics from Greek geometry. Some related work of post-renaissance scholars is included. Topics include: famous construction problems, pythagorean arithmetic, regular solids, four discoveries of Archimedes, the problem of Apollonius; selected works of Archimedes, Euclid, Apollonius, Euler, Steiner, and many others. Emphasis is placed on the mathematics, with little attention to non-technical historical aspects.

This course was designed as a final-year course for those planning to go into high school teaching. However, it may appeal to anyone interested in mathematics.

2 hours lectures, one term
Prerequisites: No formal prerequisites are demanded. However, it is recommended that a student have a working knowledge of elementary geometry (e.g. the material contained in "A Modern Geometry for High Schools" by Lougheed and Workman)

446 (b) History of Mathematics – B
A study of selected topics from post-renaissance mathematics. Topics include material on prime numbers, Fermat's Last Theorem, the Gaussian Integers, the Fibonacci Sequence, other topics for elementary number theory, a collection of outstanding problems in geometry (Fagnano, Steiner-Lehmus, Morley, and several miscellaneous items such as the Cantor ternary set and Ramanujan’s Highly Composite Numbers. Emphasis is placed on the mathematics, with little attention to non-technical historical aspects.

This course was designed as a final-year course for those planning to go into high school teaching. However, it may appeal to anyone interested in mathematics.

2 hours lectures, one term
Prerequisites: No formal prerequisites are demanded. However, it is recommended that the student possess a reasonable mathematical maturity

447 Statistical Mechanics
Applications of probability theory to theoretical Physics.
2 hours lectures, Fall term

448 Differential Geometry
Differentiable manifolds, Tensors and Forms, Connexions, Riemannian manifolds.
2 hours lectures
Prerequisites: M229 and M237

449 (a) Experimental Design – A
The requirements for a good experimental design prior to the accumulation of data. The concepts of randomization, replication and experimental error is applied to basic designs; the completely randomized, randomized block and latin square designs. Analysis of variance.

2 hours lectures, one term
Prerequisite: One of M223 or M233 or M243 or consent of instructor

449 (b) Experimental Design – B

2 hours lectures, one term
Prerequisite: M449 (a)

Fourier Series. Vector and matric methods. Calculus of variations. Other topics in advanced calculus.
2 hours lectures

Note  This course is not for Honours Mathematics students.

451 (a) Nonlinear Optimization – A  Recent algorithms for constrained and unconstrained differentiable optimization problems will be presented with stress on practical implementation. Topics will include first and second order Newton methods, quasi-Newton methods, conjugate gradient directions, feasible direction methods, and penalty algorithms. Computational concepts will include aspects of scaling variables, nonlinear transformations, nonlinear equality constraints, roundoff and computer size. Applications will be given to problems such as production planning and engineering design.

Recommended for students interested in operations research, industrial engineering, computer science and for those wishing to pursue graduate courses in mathematical programming.
2 hours lectures, one term

451 (b) Nonlinear Optimization – B  Recent mathematical programming algorithms not requiring differentiability or continuity will be presented with the stress on practical implementation. Topics will include the Simplex and Complex algorithms, Powell’s conjugate direction method, difference approximations to differentiable methods. Computational aspects will include evaluating gradients by difference methods, reliability of answers, stopping criteria, and problem formulation. Applications will be given to problems such as warehouse utilization and automated machine controls industry.

Recommended for students interested in operations research, industrial engineering, computer science and for those wishing to pursue graduate courses in mathematical programming.
2 hours lectures, one term
Prerequisite: M451a
452 Linear Programming
(Theory, Applications, and Related Topics)

Comments: Throughout this course an attempt will be made to indicate the various areas in which the techniques mentioned above may be applied. These areas include: inventory control, production scheduling, optimal product mix problems, blending problems, game theory, economic input-output models, project scheduling (Critical Path, Decision C.P.M., etc.), bottleneck problems, cost-benefit analysis, cutting stock problem, etc.

Students will be required to use the computer to solve "semi-practical" problems, and some knowledge of computer programming is a definite asset.

2 hours lectures, one year
Prerequisites: M229 (or equivalent). Students will be required to use the computer on occasion and M132 (or its equivalent) would be a definite asset.

453 (a) Queueing Theory – A
Introductory study of queueing models from simple queues with Poisson arrival and Exponential service distributions to multi-server queueing models including: homogeneous and heterogeneous parallel servers; servers in series; and phase type service. Methods of analysis introduced include differential-difference equations, probability generating functions and simulation.

Recommended as a prerequisite for Math 453 (b). Recommended for operations research and computer science students.

2 hours lectures, one term
Prerequisite: Introductory Probability

453 (b) Queueing Theory – B
Study of advanced queueing models including single server models with balking and reneging; jockeying between queues; pre-emptive and non-pre-emptive priority queues; queueing models with batch arrival or service processes. Also included: advanced simulation models and the algebraic analysis of complex queueing systems.

Recommended as a prerequisite course for Math 885. Recommended for students interested in modelling techniques.

2 hours lectures, one term
Prerequisite: M453 (a)
454 (a) Game Theory
A mathematically-oriented course on the basics of game theory, with applications to economics, bargaining, and strategy.
Classification of games; solution of matrix games and their relationship to linear programming; infinite zero sum games; utility theory; bimatrix games and the bargaining problem; n-person games; Shapley value; metagames.
2 hours lectures, one term
Prerequisites: Formal Second year linear algebra (M229); fundamentals of linear programming and probability theory.

454 (b) Selected Topics in Game Theory
(not offered in 1974-75)

455 (a) Mathematical Programming – A
Dynamic Programming; deterministic decision process problems, monotonic path problems, equipment replacement, resource allocation, reduction of dimension by use of Lagrange multipliers, shortest path problems, cargo loading problem, the travelling salesman problem; introduction to optimal control.
Convex functions; first and second order characterization of convex functions.
2 hours lectures, one term
Prerequisites: M352 or consent of instructor

455 (b) Mathematical Programming – B
Non-linear Programming; convergence conditions and convergence rates for some unconstrained optimization methods, introduction to the Kuhn-Tucker conditions and duality theory for non-linear programmes, optimality conditions for a quadratic programme
Quadratic Programming; Lemke’s complementary pivot scheme to solve a quadratic programme.
2 hours lectures, one term
Prerequisites: M455 (a) or consent of the instructor

456 Combinatorial Methods in Operating Research

456 (a) Combinatorial Systems
Production scheduling including finite sequencing for a single machine, parallel machines, flow-shop scheduling, the general n/m job-shop processes. Capital budgeting with time-shared experience.
Non-differentiable optimization techniques used in warehouse design and automated machine control.
Primarily for students interested in applying mathematics to problems of business, industry and operations research.
2 hours lectures, one term
Prerequisites: M352 is recommended but not required

456 (b) Boolean Methods

457 Applied Combinatorial Mathematics
(Not offered in 1974-75)
457 (a) Applied Combinatorial Mathematics - A
A selection of combinatorial problems from the applied sciences. Topics which might be included are: Markov chains, random walk, the Poly problem, the dimer (and monomer-dimer) problem, the Ising problem, percolation processes, probabilistic graphs, electrical network theory.
2 hours lectures, one term
Prerequisites: M351 (a) and M233

457 (b) Selected Topics in Applied Combinatorics
Brief recapitulation of information retrieval and the use of classificatory methods; formal models of classification methods; necessary conditions; equivalence of structure; quantification of equivalence; order independence; stability; training methods and their implication in information retrieval; optimization problems; perturbation functions and their algebraic structure; heuristics.
2 hours lectures, one term
Prerequisite: M353 (a)
(not offered in 1974-75)

458 (a) Graph Theory - A
Topics in graph theory. These may include symmetry in graphs, planarity, bipartite graphs, minimax theorems, directed graphs, enumeration, algorithms, colouring problems, matrices and graphs.
Recommended for students who have taken a course in graph theory and wish to study additional topics not normally covered in an introductory course.
2 hours lectures, one term
Prerequisite: M351 (a) or consent of instructor

458 (b) Graph Theory - B
Continuation of topics covered in 458 (a).
2 hours lectures, one term
Prerequisite: M458 (a)

459 (a) Algebraic Graph Theory - A
(not offered in 1974-75)

459 (b) Algebraic Graph Theory - B
(not offered in 1974-75)

460 (a) Combinatorics - A
Enumerative Mathematics Combinatorial identities, generating functions, counting of labelled and unlabelled objects, theorems of Polya, Redfield-Fead, and de Bruijn.
Recommended as a useful preliminary for M785 "Planar graphs".
2 hours lectures, one term
Prerequisite: A knowledge of elementary group theory (M329)

460 (b) Combinatorics - B
The existence and construction of error correcting codes, projective geometries, orthogonal Latin squares, balanced incomplete block designs and other combinatorial configurations.
Recommended for M780, Combinatorial Analysis.
2 hours lectures, one term
Prerequisite: Theory of finite groups, rings and fields (M329)

461 (a) Demography
Mathematical applications in demography.
2 hours lectures, one term
Prerequisite or Corequisite: M335
461 (b) Topics in Actuarial Mathematics
A selection of topics for the advanced actuarial student.
3 hours lecture, one term

462 (a) Measure and Integration
The theory of measure and the Lebesgue integral.
2 hours lectures, Fall term

462 (b) Linear Operators
Linear operators in Hilbert spaces. Compact operators. Introduction to functional analysis.
2 hours lectures, Winter term

463 Control Theory
2 hours lectures, Fall term
Prerequisite: Consent of Instructor

464 Topics in Mathematical Physics
A selection of topics given by members of the Applied Mathematics Department. Topics covered in previous years have included continuum mechanics (elasticity, fluid mechanics), electromagnetic theory, statistical mechanics.
2 hours lectures, two terms
Prerequisite: Consent of Instructor

466 (a) Statistical Data Analysis
2 hours lectures, Winter term
Prerequisites: (1) A course in FORTRAN Programming or equivalent. (2) M338 (b) or M349 (a)

466 (b) Topics in Statistics
An introduction to several areas of Statistics, such as multivariate analysis, time series, data analysis, non-parametric theory, decision theory.
2 hours lectures, Winter term
Prerequisite: M338 (b) or consent of instructor

467 (a) Sampling Theory and Practice
Introduction to sample theory and practice. Elementary sampling designs and estimation procedures. Statistical inference in survey sampling. Interrelationships between survey sampling and the design of experiments.
2 hours per week, Fall term
Prerequisite: One of M223, M233 or M243

467 (b) Sample Survey Design
Procedures for construction of sampling designs commonly used in agricultural, economic and scientific surveys, and corresponding estimation techniques. Validation of survey results.
3 hours lectures, Winter term
Prerequisite: M338 (a) or M349 (a)

Note M467 (a) is not a prerequisite.
468 (a) Introduction to Linear equations and inequalities; convex sets, cones and Convexity and Extrema, functions; goods and transformation possibilities; linear activities, and Economics Applications axiomatic characterization; production functions and correspondences; cost and profit functions.

Linear and convex programming; marginal values and shadow prices; centralization and decentralization.

Von Neumann production model.

Demand analysis; index construction.

468 (b) Introduction to Convexity and Extrema, and Economic Applications

Sperner's Lemma; Brouwer's fixed point theorem, von Neumann's intersection theorem; Gale's theorem on supply and demand equilibrium.

Games, equilibria.

Theory of exchange and general economic equilibrium; Scarf's algorithm. Stability theory.

Prerequisite: M352 (a) or equivalent.

469 (a) Statistical Methods Review of single equation linear models, Gauss-Markov with Socio-Economic theorem of least squares; testing independence of regression Applications disturbances, Durbin-Watson and Theil-Nagar tests; serial correlation and heteroscedastic disturbances; serial correlation and heteroscedastic disturbances, Aitken's generalized least squares method. Zellner's multi-regression estimator.

Introduction to simultaneous equation models, identification problem, two stage and three stage least squares estimation, asymptotic properties.

Prerequisite: M338 or equivalent

469 (b) Statistical Methods Simultaneous equation estimation continued, full information with Socio-Economic with limited information maximum likelihood, simultaneous least Applications squares, asymptotic properties; forecasting with simultaneous equation models.

Exact sampling distribution of the two stage least-squares estimator and its exact moments; approximations to exact moments.

Prerequisite: M338 or equivalent


3 hours lectures, Fall term

Prerequisite: Consent of the instructor


3 hours lectures, Winter term

Prerequisite: Consent of the instructor
472 (b) Introduction to Turing Machines and Computability Theory


3 hours lectures, one term

Prerequisite: M371 (a) or consent of the instructor

472 (c) Formal Languages


3 hours lectures, one term

Prerequisite: M371 (a) or consent of the instructor

474 (a) Scientific Applications Software

The practical computing problems which are encountered in scientific applications. An overview of batch operating systems; the importance of loaders and overlays; Check points, post mortems and operating system services; FORTRAN as a programming language; Programming techniques including modularity, performance evaluations, no GO TO's, documentation, portability; Design and use of programme libraries and human engineering of input and output; Magnetic tapes and bulk storage; Selected topics such as finite precision arithmetic, graphical output, analog to digital conversion, language interfacing.

3 hours lectures, one term

Prerequisites: Two of M334 (a), M334 (b), M340 (a) and M340 (b)

474 (b) Principles of Operating Systems

Topics in operating systems will include: basic concepts of computer hardware programme translation; programme loading and linking; cooperating sequential processes – computational and data structures, critical section problem, process synchronization primitives (semaphores, etc.), parallel programming; Introduction to multiprogramming; Operating system nucleus – process control and communication, system resource managements, input/output control systems, traps and trap handling routines; File system; Reliability; Protection; System performance, measurement and evaluation. Normal course requirements include a project.

3 hours lectures, one term

Prerequisite: M340 (a) and M340 (b)
Survey of organization and management theory, including the following topics: Organizations, management, information systems in organization; Systems theory and the systems approach including the following topics: Definition of system, role of the systems analyst within an organization, the problems of communications within an organizational framework, the analysis phase of systems development, the role of management within the systems approach; systems design: the nature of design, the design phase of systems development, design aids e.g. software packages and “packaged” documentation systems, the data base concept; implementation of computer based information systems, including the following topics: File structures, input and output design, forms design, implementation planning and control, some developments in information retrieval systems.  
3 hours lectures, one term  
Prerequisites: M340 (a) and fourth year standing

Simulation techniques are used to study systems which do not lend themselves to analysis. This course is intended to introduce the basic notions of simulation as well as introduce the student to programming languages for simulation. The course contents will be: An introduction to simulation; Random number generators; Stochastic Processes; Modelling; Simulation programming languages; the GPSS language.  
3 hours lectures, one term  
Prerequisites: M340 (a) and fourth year standing

Cauchy's, Pexider's and similar equations. Equations for polynomials and for trigonometric functions. Reduction to differential equations. General methods and theorems. Iteration. Applications. Further topics, such as equations for functions of several variables, or equations for analytic functions, or equations on algebraic structures.

2 hours lectures, one term
Department of Mechanical Engineering

Professor and Chairman of the Department
D.J. Burns, B.Sc., Ph.D.(Bristol)

Professor, Associate Dean
T.A. Brzustowski, B.A.Sc(Toronto), A.M., Ph.D(Princeton)

Engineering Graduate Studies
M.M. Yovanovich, B.Sc.(Queen's), M.S.(Burl.), M.E., Sc.D. (M.I.T.)

Professor, Associate Chairman Graduate Studies
E.L. Holmes, B.Sc.(Bristol), M.A.Sc., Ph.D.(Toronto)

Professor, Associate Dean
G.F. Pearce, B.A.Sc.(British Columbia), M.A.Sc.(Toronto)

Engineering Undergraduate Studies

Professor, Associate Chairman Undergraduate Studies

S.A. Alpay, Dipl. Ingr., Dr. Ing.(Berlin)
E. Brundett, B.S.A.(O.A.C.), B.A.Sc., M.A.Sc., Ph.D.(Toronto)
M.B. Danard, B.A.Sc.(British Columbia), M.A.(Toronto), Ph.D. (Chicago)
D. French, B.Sc., C. Eng.
C.E. Hermance, B.E.(Yale), M.A., M.S.E., Ph.D.(Princeton)

J.H.G. Howard, B.Sc.(Queen's), M.Sc., Ph.D.(Birmingham)
W.B. Nicoll, S.M. (M.I.T.), Engineer(Stanford), Ph.D.(London)
P. Niessen, B.Sc.(McMaster), M.A.Sc., Ph.D.(Toronto)

D.M.R. Taplin, B.Sc.(Aston), D Phil.(Oxford)

Associate Professors
G.M. Bragg, B.A.Sc.(Toronto), Ph.D.(Cambridge)
R.N. Dubey, B.Sc.(Hons) (Patna), B.Sc.(Eng.) (Bihar), Ph.D. (Waterloo)
A.M. Hale, B.Sc., M.A.(New Brunswick), B.A.Sc.(Toronto), M.A.Sc., Ph.D.(Waterloo)
K.G.T. Hollands, B.A.Sc.(Toronto), Ph.D.(McGill)
H.W. Kerr, B.A.Sc., Ph.D.(Toronto)
W.M. Mansour, B.Sc.(Cairo), M.A.Sc., Ph.D.(Toronto)
H.R. Martin, B.Sc., M.Sc.(Queen's Belfast), Ph.D.(Nottingham)
S.V. Patankar, B.E.(Mechanical) (Poona), M.Tech.(Bombay, Ph.D.(Imperial College, London)
K.R. Piekarshi, Dipl. Ing.(London), Ph.D.(Cambridge)
A Plumtree, B.Sc., Ph.D.(Nottingham)
G.D. Raithby, B.E.Sc., M.E.Sc.(Western), Ph.D.(Minnesota)
R.F. Scrutton, B.Sc., M.Sc.(Melbourne)
R. Skarecky, Ing.(Prague), C.Sc.(Brno)
P.K. Slawson, B.A.Sc., M.A.Sc., Ph.D.(Waterloo)
A.B. Strong, B.A.Sc.(Waterloo), M.Sc.(Imperial College, London), Ph.D.(Waterloo)
T.M.I. Wigley, B.Sc.(Hons. Math & Phys), Ph.D.(Adelaide)

Assistant Professors
K.G. Adams, B.Sc.(Queen's), M.A.Sc., Ph.D.(Waterloo)
G.C. Andrews, B.A.Sc., M.A.Sc.(British Columbia), Ph.D. (Waterloo)
U.H. Mohaupt, B.A.Sc., M.A.Sc., Ph.D.(Waterloo)
R.J. Pick, B.A.Sc.(British Columbia), M.Sc.(Imperial College, London), Ph.D.(Waterloo)
H.F. Sullivan, B.A.Sc.(Waterloo), A.M., Ph.D.(Princeton)
Undergraduate Programmes

Details of the undergraduate programme in Mechanical Engineering are to be found in chapter 9. All courses extend over one term only, and consist of 3 hours of lectures per week unless otherwise specified. The hours of the core courses are listed in chapter 9. In general, the only prerequisites are the core courses, unless otherwise specified.

Undergraduate Course Descriptions

1 Advanced Calculus

*Infinite series:* Tests for absolute, conditional, uniform convergence; power series; series expansions; differentiation and integration. *Partial differentiation:* total derivatives; estimation of errors; chain rule; geometry; maxima and minima; taylor series; jacobians. *Multiple integration:* areas, centroids, moments of inertia, centres of gravity. *Vector analysis:* gradient, divergence, curl, Laplacian; integral theorems.

2 Statistics for Engineers


3 Ordinary Differential Equations


4 Numerical Analysis

A survey of numerical procedures with emphasis upon computer implementation using the Fortran 4 programming language. In particular, the following topics are covered: Interpolation, curve fitting, solution of non-linear equations, numerical integration, numerical solution of Ordinary Differential Equations, matrix algebra and solution of systems of linear equations, and problems in the solution of partial differential equations.

5 Partial Differential Equations

8 Review of Engineering Mathematics
A revision course in engineering mathematics. Topics include:
a review of elementary differential and integral calculus;
series; partial derivatives; selected ordinary differential equations; Laplace transforms; Fourier series.

12 Dynamics

15 Structure and Properties of Materials 1
Interatomic bonding, crystal and amorphous structures including typical polymers and ceramics, structural defects, phase diagrams, diffusion, transformations in metals, corrosion. Some aspects of electrical, magnetic and optical properties.

19 Mechanics of Deformable Solids 1

20 Mechanics of Deformable Solids
A general treatment of the behaviour of structural components from the study of stress and strain in solids. Topics include super-position, energy theorems, theories of failure, elastic and inelastic analysis of unsymmetrical bending, torsion of circular members, columns and stability, and virtual work.

21 Kinematics and Dynamics of Machines

22 Mechanical Design 1
Analysis and synthesis of machine elements. Factors affecting working stresses, fatigue, creep and impact considerations. Design of shafting, springs, screws, clutches, brakes and gear.

30 Structure and Properties of Materials 2
The general principles of stress-strain relationships in all types of materials, including the effects of temperature, strain rate, alloying and microstructure. Different fracture mechanisms and the factors which influence them.

32 Physical Metallurgy 2

33 Experimental Materials Science
This course is designed to acquaint students with materials phenomena using an experimental approach. Microstructural changes and their effects on the mechanical properties in various materials will be studied using such techniques as optical and scanning electron microscopy together with electron probe microanalysis and X-ray analysis. The student may work on a project of his own choice provided it meets the objectives of this course.
35 Industrial Metallurgy This course is intended for those students interested in acquiring a working knowledge of metallurgy. It will cover: Metals and alloy systems, iron-carbon alloys, heat treatment and the function of alloying elements in steel, corrosion and scale resistant alloys, copper and nickel base alloys, light metals and their alloys; casting, hot and cold working of metals; soldering, brazing and welding; corrosion and oxidation; metal failure analysis.


46 Manufacturing Science 7 Introduction of polymer processing for mechanical engineers. Elements of polymer science; plastics as a design material. Screw extrusion; elements of non-Newtonian flow and viscometry. Injection moulding. Parameters of polymer conversion operations and their estimation.
47 Analysis and Design of Manufacturing Systems I

48 Analysis and Design of Manufacturing Systems 2
Analysis and design of the plant layout and materials handling systems as basic components of a manufacturing facility and system. Product range and mix and their effect on these systems. Proven systematic analysis and synthesis and evaluation techniques for efficient and effective plant design.

49 Metrology
Theory and practice of high precision mechanic measurements under strict control conditions – super micrometry; measurements by comparators; protiometry; surface profilography; environmental effects on measurements accuracy; theodolite techniques in the measurements of large structures; collimator applications in machine installation. Tolerances and quality control.

50 Thermodynamics

51 Fluid Mechanics 1
Physical properties of fluids and fundamental concepts in fluid mechanics. Hydrostatics. Conservation laws for mass, momentum and energy. Flow similarity and dimensional analysis as applied to engineering problems in fluid mechanics. Laminar and turbulent flow. Engineering applications such as flow measurement, flow in pipes and fluid forces on moving bodies. Introduction to compressible flow.

52 Air Conditioning
Thermodynamic properties of moist air; psychrometric charts; humidity measurements; direct water contact processes; heating and cooling of moist air by extended surface coils; solar radiation; heating and cooling of loads on buildings; effects of the thermal environment; air conditioning calculations; air flow in and around buildings, diffusers.
Prerequisite: ME 54.

53 Heat Transfer 1
Introduction to heat transfer mechanisms. The formulation and solution of steady and transient heat conduction. Radiant heat transfer including exchange laws and view factors. Introductory convective heat transfer.

54 Thermodynamics 2
Emphasis on applications of thermodynamics to flow processes, real fluids, evaluation of state functions of real fluids. Thermodynamic analysis of selected devices.
55 Refrigeration Engineering  Methods of refrigeration, refrigerants and their thermodynamic properties, vapour compression systems; actual cycles, simple and complex; survey of refrigeration applications such as preservation of food by quick freeze and long term deep freeze techniques; cooling load calculations; calculation of thermal capacities of components such as evaporators, compressors and condensers; refrigerant controls; piping and accessories; defrost methods; miscellaneous processes, cryogenics.  
Prerequisite: ME 54.

56 Heat Transfer 2  Forced and free laminar and turbulent convection heat transfer in internal and external flows. Special topics selected from current applications.

58 Internal Combustion Engines  Reciprocating SI and CI engines, gas turbines, jets, rockets.  
Prerequisite: ME 54.

59 Energy Conversion  Applications of fundamental principles of thermodynamics, fluid mechanics, combustion and heat transfer to the design of power plants using fossil and nuclear fuel heat sources. Economic and pollution problems associated with power equipment. Other energy conversion devices such as batteries, fuel cells, solar cells, thermionic and thermoelectric devices and MHD generators.  
Prerequisite: ME 54.


63 Lubrication Mechanics  A) Lubrication Principles: dry friction, boundary lubrication, hydrodynamic lubrication, rolling elements, squeeze films, metal working lubrication, wear, failure modes.  
B) Lubrication applications: sources and types of lubricants, their composition and selection; sliding bearings, rolling bearings, gears, wire rope, hydraulic fluids, metalworking.  
C) Project: related to a specific topic in Parts A and B. Lab or theoretical evaluations will be involved in the design of a suitable lubrication system for a specific industrial application.  
To be offered in Fall and Spring terms.
69 Introduction to the Environmental Sciences

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 projects, particular account is taken of the students' field of specialization. Projects, in general, involve technical disciplines beyond the strictly mechanical engineering field.
5 hours Laboratory.

100 Introductory Survey of Law
The rights and responsibilities of the engineer as a citizen of Ontario and Canada under the law; brief history of Canadian law differentiating between Civil and Criminal Law, the rights and duties of citizens and police, a review of Domestic Law, Real Estate Law, Landlord and Tenant Law. The law as it may pertain to the engineer in his profession, brief reviews of the Law of Contracts, Patents, Trade marks, industrial design, and copy-right, Bills of Exchange, Company Law, incorporation of companies, Common and Preferred shares, the Law of Master and Servant, surveying law, Constitutional Law, Private International Law, and other topics.

200 Introduction to Mechanical Engineering 1
Discussion of structure of Mechanical Engineering curriculum, operation of Department, Faculty, University, technical societies.
1 hour, non-credit.

300 Introduction to Mechanical Engineering 2
Technical specialities in Mechanical Engineering, discussion of options in Mechanical Engineering curriculum, seminars and technical topics in the various options.
1 hour, non-credit.

400 Introduction to Mechanical Engineering 3
Research frontiers in Mechanical Engineering, specific discussion of research done at Waterloo, seminars by members of research groups.
1 hour, non-credit.

523 Mechanical Design 2
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. Introduction to value engineering and reliability.
Prerequisite: ME 22.

524 Advanced Dynamics
A second course in engineering dynamics, inertia tensor and Euler's Equations, energy methods, gyroscopic motion, generalized co-ordinates and Lagrange Equations, vibrations.
525 Mechanical Vibrations in Machines  

527 Mechanics of Deformable Solids 3  

528 Experimental Mechanics  
Experimental methods of static and dynamic stress analysis; strain gauges, brittle coatings, photo-elasticity, moire fringes, analogues. Selected related topics: flaw detection, vibration measurement, use of statistical methods, error analysis and curve fitting.

531 Physical Metallurgy 1  

534 Properties of Polymers  

537 Ceramics  
The study of glasses and the crystallography of ionic and covalent compounds. The mechanical thermal, magnetic and optical properties of amorphous and crystalline ceramics. Properties of special ceramic materials. Forming and thermal treatments of ceramic products.

544 Manufacturing Science 5  

547 Statistical Quality Control and Reliability Engineering  

548 Numerical Control of Machine Tools 1  
555 Thermodynamics 3 Chemical equilibrium, multiconstituent fluid phases, additional topics in statistical thermodynamics, introduction to thermodynamics of irreversible processes.

557 Combustion 1 Phenomenological description of flames of various types, flashback, blow off, inflammability limits, premixed flames, diffusion flames, burner design, flame holding, laminar flame theory, quasisteady droplet burning theory.


565 Gas Dynamics Basic laws of compressible fluid flow. Wave propagation in compressible fluids, isentropic flow of a perfect gas, normal and oblique shock waves, Prandtl-Meyer flow. Flow in ducts and over bodies, flow with frictions (Fanno) and heat transfer (Rayleigh). Imperfect gas effects, measurement of compressible flows, use of formulae, charts and tables.

567 Aerodynamics of Flight
Kinematics and dynamics of fluid flow; vorticity and circulation; vortex dynamics; theorems of Kelvin and Helmholtz and Biot-Savart law. Potential theory with circulation; Kutta-Joukowski theorem. Theory of infinite wing; effects of angle of attack, camber and profile shape on lift. Thin airfoil theory; aerodynamic devices for improving performance. Finite subsonic wing; downwash and induced drag. Stability and control of airplanes. Theory of supersonic wing; aerodynamic problems of supersonic flight.

568 Noise Analysis and Control

569 Industrial Fluid Mechanics
A study of industrial aspects of fluid Mechanics. Unsteady flow, pipe and duct systems, two and three-dimensional flow techniques, practical calculation of boundary layers, separation, base pressures, jets, wakes and shear layers, diffusers and flow distribution devices, flow control, two-phase flow, instrumentation, wind tunnel modelling, wind loading. The course will be oriented to practical design techniques for flow systems, reactors, air pollution control equipment, etc.

570 Geophysical Fluid Dynamics 1
Hydrodynamic equations of motion on a rotating earth. Geostrophic balance in the atmosphere and oceans, vertical variation of wind and pressure fields in the atmosphere, mechanisms of pressure change, vorticity equation.

571 Air Pollution 1
Nature and sources of air pollution, chemical and biological aspects, effects on health and environment. Physical aspects of the atmosphere, thermodynamics, vertical variation of wind and temperature, stability, convection, atmospheric turbulence, diffusion equations, plumes, thermals, jets in stratified flow, radioactive plumes, particulate dispersion, instrumentation (micrometeorological), air pollution control techniques and equipment monitoring instrumentation.

572 Ocean Engineering
This course will deal with a number of topics from the broad spectrum of engineering problems in the aquatic environment. Subjects discussed may include: structures (open, solid, floating, submerged), vehicles (surface, substructure, bottom) and shore processes. Treatment of the phenomena and the particular properties of the medium which make its solution of engineering problems in this area more challenging will be treated (mainly from the descriptive point of view). Usually a seminar and/or essay will be an important part of the course work-load.
Medieval Studies

Students interested in an interdisciplinary approach to university education and to an examination of the Middle Ages may take either a General or an Honours B.A. in Medieval Studies. Such a degree is designed to provide a general awareness of our cultural heritage. In addition, the programme is flexible enough to prepare students for careers in teaching, or for the pursuance of a graduate degree.

The Medieval Studies Programme is administered jointly by the English Department at St. Jerome's College (Dr. D. Letson) and by the Department of Classics and Romance Languages (Dr. P. Forsyth). Interested students may contact either of these advisors for further information.

The General Programme

For the core of his Medieval Studies Programme, each student must take seven courses from the following, at least one course from each of four of the seven subject fields specified:

**Latin**
- 190 Literature of the Republic
- 265* Letters of Cicero and Pliny
- 266* Epic
- 395* Medieval Latin Literature 1
- 396* Medieval Latin Literature 2

**English**
- 261 Old English
- 270 Middle English

**History**
- 258 History of Medieval Europe
- 353 Medieval Church History from 312 to 1449
- 363 Medieval English History
- 397 History of Public and Private Law to 1500
- 401 Medieval History (senior seminar)

**Philosophy**
- 280* History of Ancient Philosophy 1
- 281* History of Ancient Philosophy 2
- 390* Medieval Philosophy 1
- 391* Medieval Philosophy 2

**Religious Studies**
- 103G* Origins of the Judaeo-Christian Tradition 1
- 104G* Origins of the Judaeo-Christian Tradition 2
- 201J* Introduction to the Old Testament
- 202J* Introduction to the New Testament
- 239* Islamic Theology, Philosophy and Mysticism
- 325* The Orthodox Church

**Medieval (Classical) Civilization**
- 255* Medieval Civilization 1
- 256* Medieval Civilization 2
Modern European Language

French 190 French Language
French 200 French Literature
French 409* Medieval French Language
French 411* Medieval Literature

German 121*/122* Introduction to German Literary Movements
German 341* The Age of Goethe (Classicism)
German 342* The Age of Goethe (Romanticism)
German 461* Introduction to the History of the German Language
German 462* Middle High German Literature

Spanish 191*/192* Intermediate Spanish
Spanish 325* Don Quijote
Spanish 326* The Picaresque Novel
Spanish 440 Medieval Spanish Literature and Linguistics

Note 1 Each student must take at least three courses in one of the subject fields listed in the above.

Note 2 The remaining courses may be used to fulfill the Arts Faculty requirements and to broaden the student's knowledge as he desires.
Students wishing to attend O.C.E and teach are advised to take other courses in their proposed teaching area to satisfy O.C.E. requirements.

Note 3 A total of 15 courses must be successfully completed before graduation.

The Honours Programme

For the core of his Medieval Studies Programme, each student must take eight courses from the list given above, at least one course from each of five of the seven subject fields specified.

Note 1 Each student must take at least five courses in one of the subject fields listed above.

Note 2 The remaining courses may be used to fulfill the Arts Faculty requirements and to broaden the student's knowledge as he desires. Students wishing to attend an Ontario College of Education and teach are advised to take other courses in their proposed teaching area to satisfy the appropriate College of Education requirements.

Note 3 A minimum of 20 courses must be successfully completed before graduation.
School of Optometry

Professor and Director
E.J. Fisher, B.A., M.A.(Toronto), D.Sc.(Hon.), (Penn. College of Optometry)

Professors
C.W. Bobier, O.D.(College of Optometry of Ontario), B.A. (Toronto), M.S.(Ohio State)
W.S. Long, O.D.(College of Optometry of Ontario), B.A.(Toronto)
W.M. Lyle, O.D.(College of Optometry of Ontario), M.S., Ph.D. (Indiana)
M.E. Woodruff, O.D.(College of Optometry of Ontario), Ph.D. (Indiana)

Associate Professors
J.D. Moreland, B.Sc.(London), D.I.C., Ph.D.(Imperial College)

Assistant Professors
R.D. Beauchamp, B.A.(McMaster), M.A., Ph.D.(Brown)
M.G.E. Callender, O.D.(College of Optometry of Ontario), B.Sc. (S.G.W.U.), M.Sc.(Waterloo)
A. Remole, O.D.(College of Optometry of Ontario), B.F.A. (Manitoba), M.S., Ph.D.(Indiana)
J.G. Sivak, L.Sc.O.(Montreal), M.S.(Indiana), Ph.D.(Cornell)
T.D. Williams, O.D.(College of Optometry of Ontario), M.S. (Indiana)
G.C.S. Woo, O.D.(College of Optometry of Ontario), M.S., Ph.D.(Indiana)

Adjunct Professors
D.E. Andrew, B.A., M.D.(Toronto)
I. Baker, O.D.(College of Optometry of Ontario)
D.H. Lamont, B.A.(Toronto), Q.C.
C.W. Schwenger, M.D., D.P.H.(Toronto)
G.W. Wyszecki, Dipl. Ing., Dr. Ing.(Tech. Univ., Berlin)

Clinical Associates
W.R. Andrews, O.D.(College of Optometry of Ontario)
A.J. Baldock, O.D.(College of Optometry of Ontario)
R.R. Bock, O.D.(College of Optometry of Ontario)
D.B. Buck, O.D.(College of Optometry of Ontario)
R.R. Chen, O.D. College of Optometry of Ontario)
A. Fruman, B.A., O.D.(Waterloo)
G.A. Grant, O.D.(College of Optometry of Ontario)
Y. Grant, O.D.(College of Optometry of Ontario)
F. Jaggard, O.D.(Waterloo)
A.J. MacKinnon, O.D.(College of Optometry of Ontario)
P. Martinello, O.D.(Waterloo)
M.S. Munn, Dip. Opt.(College of Optometry of Ontario)
H. Naftolin, O.D.(College of Optometry of Ontario)
C.G. Nicol, O.D.(College of Optometry of Ontario)
M.I. Osler, O.D.(College of Optometry of Ontario)
R.D. Pellowe, O.D.(College of Optometry of Ontario)
S. Peta, O.D.(Waterloo)
J.M. Robertson, Dip. Opt.(College of Optometry of Ontario)
W.M. Rowe, O.D.(College of Optometry of Ontario)
S.A. Salsberg, O.D.(College of Optometry of Ontario)
J.R. Shankman, O.D.(College of Optometry of Ontario)
W. Shilman, O.D.(College of Optometry of Ontario)
School of Optometry

H. Thompson, B.A.(Toronto), O.D.(College of Optometry of Ontario)
P. Tracey, O.D.(College of Optometry of Ontario)
J. Turnbull, B.A., O.D.(College of Optometry of Ontario)
G.R. Virgin, O.D.(College of Optometry of Ontario)
A. Williams, O.D.(College of Optometry of Ontario)
B.S. Winter, O.D.(College of Optometry of Ontario)
E.J. Wylie, O.D.(College of Optometry of Ontario)
V.S. Zuccaro, O.D.(College of Optometry of Ontario)

Course Descriptions

Students in other disciplines may register for Optometry courses only upon the approval of the Director of the School of Optometry.

200* History and Orientation
A brief history of the profession; a review of the development of visual science; a consideration of legal and organizational development of optometry; the role of professional associations. The scope and nature of optometrical practice and the relationship of the profession to other professions and the community.
2 lectures, Fall term

206* Geometrical Optics
Prerequisites: a course in first year Physics; Mathematics 125 or 130
4 lectures, 3 hours laboratory, Fall term

211* Physiological Optics
The eye as an optical instrument. The refracting mechanism; accommodation, pupil action and lid action; the passage of light in the eye; stray light in the eye; analysis of the retinal stimulus pattern.
3 lectures, 3 hours laboratory, Winter term
Prerequisite: Optometry 206*

224* Anatomy of the Eye and Associated Structures
The gross, microscopic and ultra structure of ocular tissues will be examined in detail. Extensive dissection of various eyes will be completed. Bone and other supportive structure will be studied in the laboratory with emphasis directed toward application of anatomical knowledge to related courses in pathology and clinical optometry. Embryology and Comparative Anatomy are included. No credit will be given for this course until the student has successfully completed Optometry 234*
3 lectures, 3 hours laboratory, Fall term
Corequisite: Biology 201

234* Anatomy of the Eye and Associated Structures
A continuation of Optometry 224*.
3 lectures, 3 hours laboratory, Winter term
Prerequisite: Optometry 224*
301* Physiological Optics  Oscular motility: description and analysis of eye movements, measurement of eye movements, the innervational systems of the extraocular and intraocular musculature.
3 lectures, 3 hours laboratory
Prerequisite: Optometry 211*

302* Clinical Optometry  Lectures on clinical techniques for examination of the optical properties of the eye. Included will be – measurement of the visual acuity, theory and practice of retinoscopy, ophthalmoscopy, keratometry, subjective sight testing, measurement of amplitude of accommodation, and calculation of reading addition. A laboratory course in which these techniques will be demonstrated and practised will run concurrently.
3 lectures, 3 hours laboratory, Fall term
Prerequisite: Optometry 211*

305* GeneralPathology  A study of the basic disease processes including inflammation, degeneration, neoplasia. The properties of pathogenic microorganisms and the specific diseases with which they are associated. Resistance, immunity, hypersensitivity. Diseases caused by physical agent other than microorganisms. Principal diseases affecting each organ system.
3 lectures, 1 hour tutorial, Fall term
Prerequisite: Biology 201, Optometry 224*-234*.

306* Optometrical Optics  The history and manufacture of optical glass, ophthalmic lens surfacing and design, classification and performance of single vision ophthalmic lenses, prismatic effects, transposition, absorptive lenses and lens coating, problems and solutions in fitting ophthalmic lenses to the eyes. The laboratory course deals with processing all types of ophthalmic material, as well as optical bench experiments.
3 lectures, 2 hours laboratory, Fall term
Prerequisite: Optometry 206*

311* Physiological Optics  The visual process: retinal structure; photopigments; photoreception; electrophysiology of the retina and higher centres.
3 lectures, 3 hours laboratory
Prerequisite: Optometry 301*

312* Clinical Optometry  Clinical techniques for the examination of the binocular relations of the non-strabismic patient, with particular emphasis on the study of the relationship between accommodation and convergence; techniques of phorometry, prism vergence tests, relative accommodation tests, dynamic retinoscopy, and monocular and binocular cross cylinder tests.
3 lectures, 3 hour laboratory, Winter term
Prerequisite: Optometry 301*, 302*

315* GeneralPathology  A continuation of 305*.
4 lectures, 1 hour tutorial, Winter term
Prerequisite Optometry 305*
316* Optometrical Optics
A continuation of 306*, dealing with problems peculiar to bifocal and multifocal lenses. Aberrations of thin lenses and the design of lenses for ophthalmic use.
3 lectures, 2 hours laboratory, Winter term
Prerequisite: Optometry 306*

401* Physiological Optics
Psychophysics of vision: light and dark adaptation; spatial and temporal light discrimination; normal and defective colour vision.
3 lectures, 3 hour laboratory
Prerequisites: Optometry 301*, 311*

402* Clinical Optometry
The sequence of testing in the clinical examination will be outlined. Stress will be on case history, tests of the integrity of the visual system, tests of the refractive properties, and tests of binocular relations. The integration of these tests into a satisfactory clinical analysis and modes of treatment will constitute a large part of the course.
3 lectures, 2 hours laboratory, Fall term
Prerequisites: Optometry 302*, 312*

404* Physiology of the Visual Systems
The physiology of the smooth muscles of the eye, the extraocular striate muscles, the lacrimal apparatus, the cornea, the iris, the lens, the ciliary body and the vitreous body. Production and drainage of aqueous and related influences on intraocular pressure. The vascular supply of the eye.
2 lectures, 2 hours laboratory, Fall term
Prerequisite: Optometry 224*

405* Ocular Pathology
A detailed study of the diseases which involve the eye and related structures with emphasis on early recognition. Symptomatology, differential diagnosis. Evidence of systematic disease as manifest in the eye. A study of headaches.
3 lectures, 1 hour lab bacteriology, Fall term
Prerequisite: Optometry 305*, 315*

406* Optometrical Optics
The lecture course will deal with the problems involved in the selecting, preparing and fitting ophthalmic materials. Consideration of cosmetic and comfort requirements. The laboratory course will give the student experience in working with lenses and frames as he prepares ophthalmic materials for clinic patients.
2 lectures, 4 hours laboratory, Fall term
Prerequisites: Optometry 306*, 316*

407* Optometric Specialties: Contact Lenses
A series of lectures and laboratories on the principles and procedures of prescribing and fitting contact lenses.
2 lectures, 2 hours laboratory, Fall term
Prerequisites: Optometry 401*, 402*

408* Optometry Clinic
The student is assigned to the Visual Analysis Clinic and under the direct supervision of optometrists of the clinic staff, carries out routine clinical investigations of patients who attend the public clinic.
No credit will be given for this course until the student has successfully completed Optometry 418*
8 hours clinic, Fall term
Prerequisite: Permission of Clinic Director
409* Light and Illumination  Light sources, transmitting and reflecting surfaces; principles of radiometry and photometry; illumination and related factors involved in the control of the visual environment.  
2 lectures, 2 hours laboratory, Fall term

411* Physiological Optics  Binocular vision and perception: The binocular system; binocular integration and interaction; effects of disparate stimulation; perceived size, shape, direction, distance, motion, colour, illusions.  
3 lectures, 3 hour laboratory  
Prerequisite: Optometry 401*

412* Clinical Optometry  A continuation of 402*. The detection of strabismus and techniques for testing the sensory and motor characteristics of the strabismic patient. The aim will be to allow the student to evaluate the likelihood of achieving a cure by non surgical means. The techniques of orthoptics and visual training by which a rehabilitation of vision can be attempted will be described and demonstrated.  
3 lectures, 2 hours laboratory, Winter term  
Prerequisites: Optometry 302*, 312*, 402*

414* Physiology of the Visual Systems  The neural processing of an image by the retina. Transmission of colour, brightness borders, and movement to the lateral geniculate, superior colliculus and cortex. Neural basis of binocular depth perception, accommodation, convergence and other eye movements. The effects of deprivation on development of the visual nervous system.  
2 lectures, 2 hours laboratory, Winter term  
Prerequisite: Optometry 404*

415* Ocular Pathology  A continuation of 405*.  
3 lectures, 1 hour lab bacteriology, Winter term  
Prerequisite: Optometry 405*

418* Optometry Clinic  A continuation of 408*.  
8 hours clinic, Winter term  
Prerequisite: Optometry 408*

427* Optometric Specialties: Aniseikonia and Low Vision Aids  A series of lectures and labs on the principles and procedures involved in fitting patients with low vision aids and in detecting and correcting aniseikonia.  
2 lectures, 2 hours laboratory, Winter term  
Prerequisites: Optometry 401*, 402*

428* Summer Clinic  Each student is required to complete 120 hours of clinical practice during the summer term. Times will be arranged by the student with the approval of the clinic staff. This is a 1.0 credit course.  
Prerequisite: Permission of Clinic Director
School of Optometry

500* Optometrical Jurisprudence and Praxis Lectures on laws governing the practice of Optometry in Canada and laws relating to the rights and responsibilities of the optometrist in his relations with his patients; the establishment and management of optometric practice; economics, taxes, insurance, accounting, office design, mode of practice, professional organization and societies.
2 lectures, Fall term

501* Physiological Optics Assignments will include preparing for seminars on topics of interest, reviews, library and laboratory researches by individuals or small groups. Consideration will be given to the individual student's special interests. Students who have demonstrated a particular interest in research in this area may elect this course as an alternative to Psychology 357*; Optometry 513*.
3 hours, Fall term
Prerequisites: Optometry 401*, 411*

502* Advanced Clinical Optometry The lecture portion of this course will deal with special techniques of clinical optometry for examination of refractive properties and binocular relations; techniques of binocular refraction, prism adaptation; etiology of refractive errors and change of refraction with age; seminars and the presentation of clinical case reports by the student for defense and criticism will constitute a part of the course.
3 lectures, Fall term
Prerequisites: Optometry 302*, 312*, 402*, 412*

504* Ocular Pharmacology Neurohumoral theory, responses to drugs, sterile techniques, disinfectants. Drugs used in contact lens practice, drugs used topically on the eye, drugs used as diagnostic aids. Side effects of all drugs on the eye and vision.
2 lectures, 1 hour laboratory, Fall term
Prerequisites: Optometry 404*, 405*, 415*

508* Optometry Clinic The clinic is the culmination of the optometry student's educational career. Emphasis will be placed on vision care to patients of all ages and walks of life. The clinical intern performs the total work of an optometrist under the supervision and counsel of clinical faculty. Specialty clinics will be operated within the clinic organization to obtain facility of application of appropriate skill in pathology detection, orthoptics and vision training, contact lens application, the detection and rehabilitation of perceptual-motor problems, the problems associated with the low-vision patient.
No credit will be given for this course until the student has successfully completed Optometry 518*. 24 hours clinic, Fall term
Prerequisite: Permission of clinic director

509* Community Health Optometry The role of optometry in providing vision care to society and the community. Optometrical services to industry, in schools, the role of vision in the safe operation of highway vehicles and airplanes as well as the role of optometry in private and government programmes of vision care and health insurance. Epidemiology.
4 lectures, Fall term
School of Optometry

510* Optometrical Jurisprudence and Praxis
A continuation of 500*.
2 lectures, Winter term
Prerequisite: Optometry 500

511* Physiological Optics
A continuation of 501*.
3 hours, Winter term
Prerequisite: Optometry 501

513* Optometric Communication
This course deals with aspects of communication, control and motivation in optometric clinical practice. Verbal communication with the patient during and at the conclusion of the visual examination will be emphasized along with intra- and inter-professional referral methods. Special problems arising with elderly patients and children will be reviewed. The student will be asked to evaluate his own aims and skills in these matters.
2 lectures, Winter term

514* Genetics for Optometrists
A brief review of Mendelian genetics, and the molecular basis of modern genetics. Inherited conditions of particular interest, e.g., colour vision, albinism, aniridia, refractive error, retinoblastoma, etc. Genetic counseling, and the detection of carriers.
2 lectures, Winter term
Prerequisites: Optometry 405*, 415*

518* Optometry Clinic
A continuation of 508*.
24 hours clinic, Winter term
Prerequisite: Optometry 508*

519* Community Health Optometry
A continuation of 509*.
4 lectures, Winter term
Department of Philosophy

Associate Professor and Chairman of the Department
J.R. Horne, B.A., M.A. (Western Ontario), B.Th. (Huron), Ph.D. (Columbia)
J.W. Van Evra, B.A. (Valparaiso), M.A., Ph.D. (Michigan State)

Associate Professor, Associate Chairman
R.A. George, M.A., Ph.D. (Michigan State)
L.L. Haworth, B.A. (Rollins), M.A., Ph.D. (Illinois)
J.S. Minas, B.A. (Wayne), Ph.D. (Illinois)
T.M. Penelhum, M.A. (Edinburgh), B.Phil. (Oxford) (Visiting 1973-74)
P. Seligman, B.A., Ph.D. (London)
J.W. Tucker, B.Sc., B.A., Ph.D. (London)

Associate Professors
W.R. Abbott, B.A. (Kenyon), Ph.D. (Ohio State)
E.J. Ashworth (Miss), B.A., M.A. (Cambridge), Ph.D. (Bryn Mawr)
F. Centore, B.Sc. (Canisius), M.A. (Maryland), Ph.D. (St. John's)
B.P. Hendley, B.A. (Marquette), M.A., Ph.D. (Yale)
J. Huertas-Jourda, B.A. (Florida), M.A., Ph.D. (New York)
A.C. Minas (Mrs), B.A. (Radcliffe), M.A., Ph.D. (Harvard)
D.D. Roberts, B.A. (Roosevelt), M.A., Ph.D. (Illinois)

Assistant Professors
D.T. DeMarco, B.S. (Stonehill, Mass.), Ph.D. (St. John's, N.Y.)
A. Dobos, B.A. (Western), M.A., Ph.D. (St Louis)
R.H. Holmes, B.A., M.A. (Montana), Ph.D (Washington)
M. McDonald, B.A. (Toronto), M.A., Ph.D. (Pittsburgh)
J. Wubnig (Miss), B.A. (Swarthmore), M.A., Ph.D. (Yale)

Courses 370* to 372*; 380* to 389*; 435* to 439*; 440* to 444*; 471* to 473*; 480* to 489*; are special courses offered in response to student demand or special interests of the faculty. The Department will publish each Spring a list of the courses offered under these numbers for the following academic year. This list will include descriptions of those courses whose content is not specified below and names of instructors for each course.

Any full course or two half courses in Philosophy can be used to satisfy the group A(i) requirement.

Courses suffixed with 'J' are administered by St. Jerome's College; those suffixed with a 'P' are administered by St. Paul's College; and those suffixed with an 'R' are administered by Renison College.

Note 1

Five full course equivalents in Philosophy are required for the General Degree in Philosophy, including 140* (or 240), 221* and one full-course equivalent from 280* / 281*, 282* / 283*, 390* / 391*. (St. Jerome's students: see p. 582 for further information.)

A minor in Philosophy consists of any five full courses (or equivalent) in Philosophy.

Departmental Recommendation

The Department of Philosophy recommends that its Honours and Majors take at least one course in Mathematics or Science.
Undergraduate Courses

Note Concerning Introductory Courses
It is Departmental policy to have small sections of each introductory course staffed by regular faculty. In addition there are weekly seminar-sized discussion groups in each course.

100 Introduction to Philosophy
A broad selection of the main problems in philosophy will be considered. For example: How can we know whether anything is right or wrong? How can we know about things we cannot directly observe? Can we know whether there is a God? Is mind in any sense distinct from matter? Original texts of both classical and contemporary thinkers are employed.
No prerequisite
3 hours
Offered annually

110 Problems
An introduction to philosophical thinking through an examination of problems that concern the student. The course will begin with a general discussion of problematic aspects of contemporary life. We will then focus in on specific topics and consider them in light of relevant philosophical approaches. Readings to be used will depend on the topics emerging from the discussion.
No prerequisite
3 hours
Offered annually

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
Offered annually; Fall and Winter

135* Fundamentals of the Philosophy of Religion
A philosophical consideration of problematic aspects of religious belief. Topics to be discussed will include: attempts to prove the existence of God, the problem of evil, faith and reason, religious experience, and religious language. Classical and contemporary readings will be used.
No prerequisite
3 hours
Offered annually; Fall and Winter

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
Offered annually; Fall and Winter
150* Knowledge and Reality
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
Offered annually; Fall and Winter

201* Love
A philosophical analysis of different forms and functions of love. Among the topics to be considered: love and sexuality, religious love, love and knowledge. Classical and contemporary sources will be treated.
No prerequisite
3 hours
Offered annually; Fall

210* Philosophical Literature
The study of specific philosophic problems as illustrated in appropriate literary works. Choice of selections will be determined by their relevance to the philosophical theme or themes under consideration. Themes such as free will and determinism, the nature of the universe, the problem of knowledge, the nature of justice, the state and the individual, the nature of man, and the problem of beauty may be studied singly or in combination.
Prerequisite: Consent of instructor
3 hours
Offered annually; Fall

221* Ethics 1
The classic literature of ethics will be analyzed, and the principal problems brought to light.
No prerequisite
3 hours
Offered annually; Fall

222* Ethics 2
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
Offered annually; Winter

223 Moral and Social Philosophy
An investigation of what constitutes the good life and the good society through the study of different theories. Such topics as the role of reason, the nature of the good, right and wrong, justice, individual rights, ecology, human nature and animal behaviour will form the principal subject-matter. Both classical and contemporary readings are employed.
Prerequisite: Second year status or consent of instructor
3 hours
Offered annually
225* Problems in Social and Political Philosophy in Canada

This course is a philosophical study of various Canadian social and political problems using the theory developed in Philosophy 125*. Among the problems discussed will be the Criminal Code's regulation of moral matters; the provision of public support for the promotion of religious ideals; the right of self-determination in Confederation; foreign control of Canada's economy and culture; and the proper distribution of wealth to various citizens. Students also will be encouraged to discuss arguments of particular interest to them.

Prerequisite: Philosophy 125* or consent of instructor

3 hours

Offered annually; Winter

235* Philosophy and Mysticism

A critical examination of mystical writings, with regard to the nature of the experience reported, their typology, and their implications for epistemology, ethics, and philosophy of religion.

Prerequisite: Consent of instructor

2 hours

Offered alternate years; Fall

Not offered 1974-75

236* Philosophy of Religion: The Occult

A critical philosophical discussion of reports of several kinds of extraordinary experiences, such as magic, extra-sensory perception, mysticism, and divination. Our consideration of rival explanations of such experiences will lead us to discussions of such concepts as insanity, irrationality, the supernatural, and the miraculous.

Prerequisite: Consent of instructor

2 hours

Offered alternate years. Winter

240 Logic

A systematic development of the propositional calculus and of the first-order functional calculus. Some attention will be devoted to extensions to, and interpretations of, such formal systems.

Prerequisite: None for second-year students and above; consent of instructor for others

3 hours

Offered annually

250* Knowledge and Reality (French)

As 150*, but this course will be taught in French. (Cross-numbered as French 385*)

Prerequisite: Consent of instructor

3 hours

Offered annually; Winter
258* Introduction to the Philosophy of Science
A discussion of the fundamental concepts on which science is based. Thus, for example, consideration is given to such topics as scientific explanation, the structure of scientific theories, the nature of law-likeness, and the grounds for scientific confirmation. Using the discussion of these fundamental concepts as a basis, the course then goes on to consider an issue of current importance: e.g., Is science (as Thomas Kuhn suggests) basically rationalistic, i.e., does the adoption of a theory determine the nature of scientific reality, or is science basically empirical, i.e., does it consist in the “discovery” of public, immutable, scientific “facts”? No prerequisite
3 hours
Offered annually; Fall

265* The Existentialist Experience
An introduction to the existentialist view of man using both literary and philosophic texts from such authors as Kierkegaard, Unamuno, Nietzsche, Ortega y Gasset, Camus, Sartre, Heidegger and others. Some of the topics considered will be existential ethics, freedom, responsibility, the existential view of man, the existentialist critique of society, marxist existentialism, the existential answer to the problem of philosophic expression and the like.
Prerequisite: One full or two half philosophy courses, or consent of instructor.
3 hours
Offered annually; Fall

280* History of Ancient Philosophy 1
From the beginnings to Plato.
Prerequisite: Second year status or above; or consent of instructor
3 hours
Offered annually; Fall

281* History of Ancient Philosophy 2
From Aristotle to the close of classical antiquity.
Prerequisite: Philosophy 280*.
3 hours.
Offered annually; Winter

282* History of Modern Philosophy 1
Earlier period beginning with Descartes.
Prerequisite: One full or two half Philosophy courses, preferably 280* 281*, or consent of instructor
3 hours
Offered annually; Fall

283* History of Modern Philosophy 2
Later period including Kant.
Prerequisite: Philosophy 282*.
3 hours
Offered annually; Winter

285* 20th Century Philosophy
A course intended to introduce the student to the dominant themes of 20th century philosophy, centering on the major figures of this century, such as Bertrand Russell, Ludwig Wittgenstein, G.E. Moore, Edmund Husserl, and Jean-Paul Sartre.
No prerequisite
3 hours.
Offered annually; Winter
300* The Philosophy of Games
An introduction to philosophical issues relating to sports and other games. Among the issues examined will be the nature of games, games and sports, and the relevance of games and sports to other philosophical interests: e.g., ethics and aesthetics.
No prerequisite
3 hours
Offered annually; Winter

301* Moral Issues
Discussion of several specific moral issues which are subjects of widespread disagreement, e.g., abortion, population control, civil disobedience, euthanasia, pre- and extra-marital sex, etc. Choice of issues largely determined by student interest. The differing views on each issue will be explored via class discussion, and effort will be made to reach agreement on what methods and information, if any, would be relevant to resolving disagreement about them. Reflection on what constitutes a moral belief, a moral attitude, and a moral disagreement is expected to be a principal by-product of the discussions. No “point of view” is presupposed by the course — only a lively interest in the issues.
Prerequisite: One full or two half philosophy courses, or consent of instructor
3 hours
Offered alternate years; Winter

311* Philosophy of Education 1
A philosophical analysis of classical and contemporary theories of education, with a view to formulating a clear workable concept of education, its aims and methods.
Prerequisite: One full or two half Philosophy courses, or consent of instructor
3 hours
Offered annually; Winter

312* Philosophy of Education 2
Critical evaluation of selected problems of education in an attempt to relate theory to practice. Recent studies, such as the Hall-Dennis Report, will be among those considered.
Prerequisite: Philosophy 311*, or consent of instructor
3 hours
Offered annually; Fall

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
See Note 1

325* Political Philosophy 1
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
Not offered 1974-75
326* Political Philosophy 2  A detailed discussion of contemporary theories.
Prerequisite: Philosophy 325*, or consent of instructor
3 hours
Not offered 1974-75

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
Offered annually; Fall

328* The Philosophy of Karl Marx  A systematic, critical study of Marx's philosophical ideas. There will be a considerable amount of reading of Marx's own writings, including part or all of much of the following: The Economic and Philosophical Manuscripts; The Notebooks of 1884-45; Theses on Feuerbach; The Poverty of Philosophy; Wage, Labor and Capital; Preface to a Contribution to the Critique of Political Economy; The Grundrisse; Capital (vol.1) Critique of the Gotha Programme and German Ideology.
Prerequisite: One full or two half philosophy courses, or consent of instructor
3 hours
Offered alternate years, Winter
Not offered 1974-75

331 Aesthetics  Philosophical consideration of works of art and the problems of beauty using selected readings to enable the student to recognize and formulate his own views in a philosophic manner.
Prerequisite: One full or two half Philosophy courses
3 hours
Offered alternate years; Fall
Not offered 1974-75

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
Offered annually; Fall

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.
Prerequisite: Philosophy 140*, or (preferably) Philosophy 240, or consent of instructor
3 hours
Offered alternate years
341* Decision and Value Theory
A systematic study of the basic concepts in decision-making theories and their associated value theories. Special emphasis will be devoted to the definition and measurement of utility functions and to the various criteria employed in models of decision-making under uncertainty and under risk. Extensive use will be made of literature from Economics, Political Science, Psychology, and Mathematical Statistics.
Prerequisite: Consent of instructor
3 hours
Offered alternate years; Winter
Not offered 1974-75

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 apriori, 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
Offered annually

359* Philosophy of the Formal Sciences
A study of philosophical problems concerning mathematics. Topics discussed include formalism, intuitionism, logicism, the mathematical paradoxes, and other topics in foundations and metamathematics.
Prerequisite: Consent of instructor.
3 hours
Offered alternate years; Winter

362* Philosophy of Social Science
Problems about the fundamental methods and aims of the social sciences generally, and problems specific to Psychology, Sociology, Political Science, etc., and their relations to one another will be considered. (Cross-numbered as Sociology 371*)
Prerequisite: Some previous work in a social science or in Philosophy
3 hours
Offered alternate years; Winter
Not offered 1974-75

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
Offered alternate years

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
Offered alternate years
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
See Note 1

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
See Note 1

390* Medieval Philosophy 1

The early period to the 13th century. Among those considered will be: Augustine, Boethius, Anselm, and Abaillard.

Prerequisite: Philosophy 280*/281*
3 hours
Offered alternate years; Fall
Not offered 1974-75

391* Medieval Philosophy 2

The later period, from the 13th century. Among those considered will be: Bonaventure, Aquinas, Scotus, and Ockham.

Prerequisite: Philosophy 390*
3 hours
Offered alternate years; Winter
Not offered 1974-75

398(a-b)* Directed Reading in Special Areas

Prerequisite: Consent of Instructor

Offered annually

399 Tutorial for Honours Students

Students wishing to enrol in 399 should consult the Department.

425* Philosophy of the City

Analysis and evaluation of the philosophical points of view that underlie current criticism of urban life and prevalent schemes for its reconstruction.

Prerequisite: One half Philosophy course.
3 hours
Offered alternate years; Fall

435*-439* 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
See Note 1

440*-444* Studies in Logic

Various half courses dealing with specific topics; one or more of these will be offered each year as announced by the Department.

Prerequisite: Philosophy 240 or Mathematics 436
3 hours
See Note 1
446* Philosophy of History
Consideration of various possible views about ultimate nature of history and historical knowledge. Offered in sequence with History 466*.
Prerequisite: One full course equivalent in Philosophy, or consent of instructor
3 hours
Offered annually: Winter

455 Metaphysics
Theories of reality, historical and contemporary, with emphasis on metaphysical problems in the light of recent studies.
Prerequisite: Two full courses (or-equivalent) in Philosophy
3 hours
Offered alternate years
Not offered 1974-75

465 Existential Philosophy
An in depth study of the thought of some major existentialist figures such as Kierkegaard, Unamuno, Nietzsche, Hcidegger, Sartre, Camus, Marcel, Jaspers, Ortega y Gasset.
Prerequisite: Consent of instructor
3 hours
Offered alternate years

470 Phenomenology
A critical examination of the issues and methods of phenomenology. The basic writings of phenomenologists such as Husserl and Merleau-Ponty will be the main texts. Such a critique will include the attempt to understand the uses and ramifications of phenomenological methods through the working out of a particular analyses.
Prerequisite: One full or two half courses in Philosophy, or consent of instructor
3 hours
Offered alternate years
Not offered 1974-75

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
See Note 1

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
See Note 1

498(a-b)* Directed Reading in Special Areas
Prerequisite: Consent of instructor
Offered annually

499 Tutorial and Honours Essay
Students wishing to enrol in 499 should consult the Department.
The following courses are administered by St. Jerome's College

A student may register through St. Jerome's College in either the General Programme or Honours Programme in Philosophy.

**General Programme:**
Phil 200J* or 140* or 240, 218J* or 221*, one full course equivalent from 280*-1*, 282*-3*, 390*-1, plus 2.5 to 3 other philosophy electives, comprising 5 courses.

**Honours Programme:**
Phil 218J* or 221*, 222*, 240, 280*-1*, 282*-3*, 499J or 499, plus 5 other philosophy electives. College students are expected to take 450J.

100J Introduction to Philosophy
A broad selection of the main problems in philosophy will be considered. For example: How can we know whether anything is right or wrong? How can we know about things we cannot directly observe? Can we know whether there is a God? Is mind in any sense distinct from matter? Original texts of both classical and contemporary thinkers are employed.

*No prerequisite*
*3 hours*
*Staff*

200J* Intentional Logic
Are you a logical person? What does it mean when someone says “that's not logical,” or “from the logical point of view...”? This course regards logic as a tool in guiding our penetration of various substantive issues in philosophy. It will systematically cover the main common logical fallacies, term logic, propositional logic, some logical paradoxes, syllogistic (categorical and compound) logic, variations on the syllogism, and reasoning by example, induction, etc. The difference between intentional logic and mathematical logic will be discussed.

*No prerequisite*
*3 hours*
*Winter term, A. Dobos*

205J* Elements of the Philosophy of Science
An examination through conceptual analysis and historical reference of the explanatory principles underlying the material world. Various main doctrines (e.g. pythagoreanism, atomism, hylo-morphism) will be compared and contrasted. Germane discoveries in physics (especially the work of Planck, Einstein, de Broglie, Heisenberg) and chemistry will be brought in.

*No prerequisite*
*3 hours*
*Fall term, A. Dobos*

206J* Special Problems in the Philosophy of Science
This course will take up various key topics with respect to the constitution and operation of the natural universe. Issues such as the definition of change, space and place, time, purpose in nature, the infinity of the universe, anti-matter, action-at-a-distance, etc. will be discussed.

*No prerequisite*
*3 hours*
*Winter term, A. Dobos*
210J* Philosophy of Man

What is man? What is man's place among other creatures? How is the human race unified? Are there inferior races? Where did man come from? Is man an accident of evolution? Is there any positive evidence to show otherwise? Are being free and being bound by the conditions of matter mutually exclusive? What are the major views on man as a species? How are love and sex aspects of man's life? Can ESP be used to prove there is life after death; These are some of the questions this course will attempt to answer.

No prerequisite
3 hours
Fall term, F. Centore

218J* Philosophy of Human Acts

A normative approach, employing several of the classic Western traditions of rational thought, to general ethics. The various schools of ethical thought will be discussed.

No prerequisite
3 hours
Fall term, Evening, D. DeMarco

219J* Practical Ethics

This course will discuss the applications of general ethics to the more specific areas of human endeavour e.g., family, government, warfare, work, recreation, education and religion. Among the topics discussed will be abortion, contraception, sex and marriage, obscenity, violence, drugs, egoism, dishonesty, various forms of human exploitation, genetic surgery, biological cloning, and genetic pollution.

No prerequisite
3 hours
Winter term, Evening, D. DeMarco

230J* God and Philosophy

An investigation of several aspects concerning the meanings and existence of God. Is God-talk possible? Can faith and reason be reconciled? Is religious experience a meaningful argument? A wide range of different views will be considered.

No prerequisite
3 hours
Fall term, F. Centore

237J* Ethics and Society

How does one achieve the good society? How can the results of ethical conclusions be applied to the laws of society? The course will concentrate on the various main alternatives open to someone interested in acting rationally with respect to his particular social situation, with an emphasis upon modern influences such as science.

No prerequisite
3 hours
Fall term, A. Dobos

260J* Issues in Higher Education

Why go to college? What are the present realities in education today in Canada? What is the future role of the liberal arts? The primary interest of the course will be upon what can be done in practice rather than upon ideal schemes.

No prerequisite
3 hours
Winter term, F. Centore
300J* The Western Philosophical Tradition (to 1600)

An intensive overview of the major recurring themes in Western intellectual history from both an historical and a philosophical viewpoint.

Prerequisite: Second Year standing
3 hours
Fall term, D. DeMarco

301J* The Western Philosophical Tradition (1600-present)

A continuation of 300J*.

Prerequisite: Second year standing. 300J* is not a necessary prerequisite
3 hours
Winter term, F. Centore

333J Contemporary Philosophical Problems in Art

An examination and discussion of some problems, especially in the areas of music, painting, and poetry, with which today's artist as well as his audience are confronted. Information Theory, computerized techniques, mass art, "Pop Art," the psychology of creative invention, art as an expression of reality, the morality of art, the responsibility of the artist, and art's function as a reflection of society or as a symbol of human integration are possible topics for discussion.

Prerequisite: One other philosophy course or consent of instructor
3 hours
D. DeMarco

349J Philosophy of Human Cognition

The problems of human knowledge have been in the foreground of philosophical discussions for three centuries. This course will cover such topics as the principles of all human knowledge, types and degrees of probability and certitude, Realism and Idealism, the problem of universal predication, various meanings of truth, criteria of truth, historiography.

Prerequisite: One other philosophy course or consent of instructor
3 hours
Not offered 1974-75

396J*-397J* Special Topics/Directed Readings

A series of readings and/or seminars on one or two topics or thinkers, with periodic reports and discussion.

Prerequisite: Consent of instructor
3 hours
Winter 1975: Phil. 397J* Aesthetics in the 19th and 20th Centuries, D. DeMarco

399J Tutorial for Honours Students

Students wishing to enrol in 399J should consult the College Department.

450J Philosophy of Being

An advanced course for the serious student, delving into the notions of reality, being, essence, existence, analogy, etc. The existence and nature of God, as far as can be determined without any kind of revelation, will be examined. The techniques of linguistic analysis to be employed. Also, the very possibility of any kind of metaphysics will be thoroughly discussed.

Prerequisite: Third year standing or consent of instructor
3 hours
F. Centore
496J*-497J* Special Topics/Directed Readings

A series of readings and/or seminars on one or two topics or thinkers, with periodic reports and discussion.

Prerequisite: Consent of instructor
3 hours

499J Tutorial and Honours Essay

Students wishing to enrol in 499J should consult the College Department.

The following course is administered by Renison College

100R Introduction to Philosophy

A broad selection of the main problems in philosophy. How can we know whether anything is right or wrong? How can we know about things we cannot directly observe? Can we know whether there is a God? Is mind in any sense distinct from matter? Original texts of classical and contemporary thinkers will be considered.
### Department of Physics

**Professor and Chairman of the Department**

**Professor and Associate Dean Graduate Affairs, Faculty of Science**
F.W. Boswell, B.A., M.A., Ph.D.(McMaster)

**Professor and Dean of the Faculty of Science**

**Professor and Academic Vice-President**
H.E. Petch, B.Sc.(McMaster), M.Sc., Ph.D.(U.B.C.), F.R.S.C.

<table>
<thead>
<tr>
<th>Professors</th>
<th>R.A. Aziz, B.A., M.A., Ph.D.(Toronto)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G.A. Bakos, B.A.(Trnava), M.A.(Bratislava), M.A., Ph.D.(Toronto)</td>
</tr>
<tr>
<td></td>
<td>D.E. Brodie, B.Sc., M.Sc., Ph.D.(McMaster)</td>
</tr>
<tr>
<td></td>
<td>J.A. Cowan, B.Sc.(Manitoba), M.A., Ph.D.(Toronto)</td>
</tr>
<tr>
<td></td>
<td>I.R. Dagg, B.Sc. (Manitoba), M.S.(Penn State), Ph.D.(Toronto)</td>
</tr>
<tr>
<td></td>
<td>J. Grindlay, B.Sc.(Glasgow), D.Phil.(Oxon)</td>
</tr>
<tr>
<td></td>
<td>N.R. Isenor, B.Sc.(Acadia), M.Sc., Ph.D.(McMaster)</td>
</tr>
<tr>
<td></td>
<td>J.L. Ord, B.A.Sc.(Toronto), M.S., Ph.D.(Illinois)</td>
</tr>
<tr>
<td></td>
<td>G.E. Keesor, B.A., M.A.(McMaster), Ph.D.(Toronto)</td>
</tr>
<tr>
<td></td>
<td>G. Scoles, B.Sc., Ph.D.(Genova)</td>
</tr>
<tr>
<td></td>
<td>R.A. Snyder, B.Sc., Ph.D.(Western)</td>
</tr>
<tr>
<td></td>
<td>S.F. Wang, D.Sc.(Nagoya)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adjunct Professors</th>
<th>J.A. Barker, D.Sc.(Melbourne), F.A.A.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P.A. Egelstaff, B.Sc., Ph.D.(London)</td>
</tr>
<tr>
<td></td>
<td>D.J. Henderson, B.A.(U.B.C.), Ph.D.(Utah), F.Inst.P.</td>
</tr>
<tr>
<td></td>
<td>J.D. Poll, Cand, Doc Leiden, Ph.D.(Toronto)</td>
</tr>
</tbody>
</table>

| Research Associate | I.A.A. Read, B.A., M.Sc.(McMaster), Ph.D.(Waterloo) |

<table>
<thead>
<tr>
<th>Associate Professors</th>
<th>A. Anderson, M.A., D.Phil.(Oxon)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>J.M. Corbett, B.A.Sc.(Toronto), M.Sc., Ph.D.(Waterloo)</td>
</tr>
<tr>
<td></td>
<td>A.E. Dixon, B.Sc.(Mt. Allison), M.Sc.(Dalhousie), Ph.D. (McMaster)</td>
</tr>
<tr>
<td></td>
<td>P.C. Eastman, B.Sc., M.Sc.(McMaster), Ph.D.(U.B.C.)</td>
</tr>
<tr>
<td></td>
<td>H.K. Ellenton, B.Sc.(Western), M.A.(Toronto)</td>
</tr>
<tr>
<td></td>
<td>M.P. FitzGerald, B.Sc., M.Sc.(Toronto), Ph.D.(Case)</td>
</tr>
<tr>
<td></td>
<td>D. Hemming, B.Sc., Ph.D.(Bristol)</td>
</tr>
<tr>
<td></td>
<td>J. Kruuv, B.A.Sc., M.Sc.(Waterloo), Ph.D.(Western)</td>
</tr>
<tr>
<td></td>
<td>J.D. Leslie, B.A.Sc.(Toronto), M.S., Ph.D.(Illinois)</td>
</tr>
<tr>
<td></td>
<td>C.C. Lim, B.A.(DePauw), M.A.(Nebraska), Ph.D.(Toronto)</td>
</tr>
<tr>
<td></td>
<td>R.A. Moore, B.Sc., M.Sc.(McMaster), Ph.D.(Alberta)</td>
</tr>
<tr>
<td></td>
<td>H.M. Morrison, B.Sc., Ph.D.(Edinburgh)</td>
</tr>
<tr>
<td></td>
<td>R.K. Pathria, B.Sc., M.Sc.(Panjab), Ph.D.(Delhi)</td>
</tr>
<tr>
<td></td>
<td>M.M. Pintar, B.Sc., M.Sc., Ph.D.(Ljubljana)</td>
</tr>
<tr>
<td></td>
<td>A.D. Singh Nagi, B.A., B.Sc.(Panjab), Ph.D.(Delhi)</td>
</tr>
<tr>
<td></td>
<td>H.J.T. Smith, B.Sc., Ph.D.(London)</td>
</tr>
<tr>
<td></td>
<td>B.H. Torrie, B.A.Sc.(Toronto), Ph.D.(McMaster)</td>
</tr>
<tr>
<td></td>
<td>K.A. Woolner, B.Sc.(London)</td>
</tr>
</tbody>
</table>
Assistant Professors J.K. Brandon, B.Sc., Ph.D.(McMaster), M.A.(Cantab.)
H.E. Frey, B.S., M.S., Ph.D.(Penn. State)
D.R. Rayburn, B.Sc.(Calgary), Ph.D. (Queen's)
D.L. Roberts, A.B.(Bowdoin College), Ph.D.(Case)
J. Vanderkooy, B.Eng., Ph.D.(McMaster)

Senior Demonstrators A.B. Haner, B.Sc., M.Sc.(Waterloo)
D.S. McVicar, B.Sc.(Waterloo)
L.J. Young, B.Sc.(Waterloo)

Faculty members holding cross appointments as shown
1 Chemistry and Physics
2 Physics and Biology

Undergraduate Course Descriptions

Note 1 Details of the undergraduate programmes offered by the Faculty of Science are to be found in Chapter 15.
Note 2 All courses described are one-term courses unless otherwise designated. Such one-term courses are marked * and are .50 course credit unless otherwise specified.
Note 3 Prerequisites are given as a guide to the student and may be waived with the consent of the instructor.

001* Pre-University Physics
A pre-University or Remedial Physics course that covers the topics in Grades 11 to 13 which are considered essential for first year university physics courses. The course includes Kinematics, Dynamics, Energy, Momentum, Conservation Laws, Circular Motion, Gravitation, Vibrations and Waves, Heat and Temperature, Electricity, Light and Optics.
Successful completion of this course fulfills the University admission requirements where high school Physics is necessary. Offered by correspondence only, one term.
No University Credit.

11* Mechanics
For students registered in the Year 1 Engineering Programme.
3 lectures, 1 hour tutorial, Fall term.

101* General Physics
3 lectures, and a tutorial period on alternate weeks, Fall term.
102* General Physics
Electric fields and potential, D.C. circuits, magnetic fields, A.C. generators and circuits, elementary electronics. The thin lens equations, diffraction, resolution of optical instruments, the eye; camera, telescope and microscope, coherent light, colour, polarization, birefringence and photometry.
3 lectures, and a tutorial period on alternate weeks, Winter term.

Note The one year-sequence Physics 101*-102* is primarily intended for students who plan to proceed in Biology, Biology and Chemistry, or Earth Sciences.

103* Mechanics in Human Movement
An introduction to the physical principles required for the analysis of the mechanics of human movement. A course for Kinesiology students.
3 lectures, 3 hours laboratory alternate weeks, tutorials to be arranged.

Note Normally students who have completed Grade 13 Physics should select Physics 104* instead of 103*.

104* Mechanics in Human Movement
An introduction to the physical principles required for the analysis of mechanics of human movement. A course for Kinesiology students.
Prerequisite: Grade 13 Physics.
3 lectures, 3 hours laboratory alternate weeks, tutorials to be arranged.

111* General Physics (with laboratory)
For the course description see Physics 101*. The lectures are common to both courses but are supplemented with laboratory sessions in Physics 111*.
3 lectures, 3 hours laboratory and a tutorial period on alternate weeks, Fall term.

112* General Physics (with laboratory)
For the course description see Physics 102*. The lectures are common to both courses but are supplemented with laboratory sessions in Physics 112*.
3 lectures, 3 hours laboratory and a tutorial period on alternate weeks, Winter term.

Note Physics 111*-112* is recommended for students who plan to proceed in the Optometry programme.
Physics 111*-112* is recommended rather than Physics 101*-102* for those students who want some practical laboratory experience to complement their theoretical studies or to fulfill entrance requirements of certain medical or dental schools.

121* Introductory Physics 1
Introduction to mechanics, including special relativity, motion of particles, conservation of energy and momentum, fluid statics and dynamics, rotational kinetics.
Prerequisite: Grade 13 Mathematics – Functions and Relations, Calculus. Grade 13 Physics recommended.
3 lectures, 3 hours laboratory or 2 hours tutorial, Fall term.
Laboratory optional for non-Science students.
122* Introductory Physics 2  This course is a continuation of Physics 121*. Rotational
dynamics, vibrations, waves, gravitation, heat and thermo-
dynamics, properties of materials.
Prerequisite: Physics 121*.
3 lectures, 3 hours laboratory or 2 hours tutorial, Winter and
Spring terms. Laboratory optional for non-Science students.

Note  The one-year sequence Physics 121*-122* is primarily intended
for students who plan to proceed in Physics and in Mathematics.

162* Mechanics, Wave
Motion and Heat 1  Vectors, rectilinear motion, plane motion, dynamics of particles,
work and energy, linear momentum, rotational motion, angular
momentum, statics, additional enrichment topics such as special
relativity.
Prerequisites: At least 75% average in Grade 13 Physics,
Mathematics - Functions and Relations, and Calculus.
3 lectures, 3 hours laboratory or 2 hours tutorial, Fall term.
Laboratory optional for non-Science students.

163* Mechanics, Wave
Motion and Heat 2  This course is a continuation of Physics 162*. Harmonic motion,
gravitation, wave motion, sound waves, temperature, heat, first
and second laws of thermodynamics, kinetic theory of gases,
additional enrichment topics such as quantum concepts.
Prerequisite: Physics 162*.
3 lectures, 3 hours laboratory or 2 hours tutorial, Winter term.
Laboratory optional for non-Science students. Cooperative
students wishing to take this sequence must have their 1B term
in the Winter.

Note  The one-year sequence Physics 162*-163* is an enriched version
of the Physics 121*-122* sequence intended for students regis-
tered in the Year 1 Science programme or the Year 1 Mathe-
matics programme.

222* Electricity and
Magnetism 1  Coulomb's law, electric field, Gauss's law, potential, capacitance,
properties of dielectrics, current, resistance, electromotive force,
D.C. circuits and instruments.
Prerequisites: A course in first year physics and in calculus or
consent of instructor.
2 lectures, 1 hour tutorial, Fall term.
Physics Majors must take 222L* with this course.

222L* Electricity and
Magnetism 1 Laboratory  3 hours alternate weeks, 0.25 course credit, Fall term.

223* Electricity and
Magnetism 2  Magnetic fields, induced electromotive forces, magnetic properties
of matter, alternating currents, electromagnetic waves.
Prerequisite: Physics 222*.
2 lectures, 1 hour tutorial, Winter and Spring terms.
Physics Majors must take 223L* with this course.

223L* Electricity and
Magnetism 2 Laboratory  3 hours alternate weeks, 0.25 course credit, Winter and
Spring terms.
226* Optics 1 Reflection and refraction at plane and curved surfaces, thin and thick lenses, optical instruments. Reading assignments on various topics in modern optics.

Prerequisites: A course in first year physics and in calculus or consent of instructor.
2 lectures, Fall term.

Physics Majors must take Physics 226L* with this course.

226L* Optics 1 Laboratory For students taking Physics 226*.
3 hours alternate weeks, 0.25 course credit, Fall term.

227* Optics 2 The wave nature of light, interference, diffraction, slits and gratings, resolution, polarization, photometry. Reading assignments on lasers and the uses and properties of laser light.

Prerequisite: Physics 226*.
2 lectures, Winter term.

Physics Majors must take Physics 227L* with this course.

227L* Optics 2 Laboratory For students taking Physics 227*.
3 hours alternate weeks, 0.25 course credit, Winter term.

243* Electricity and Magnetism Electrostatics, D.C. circuits, magnetic fields, electromagnetic induction, A.C. circuits, electrical measurements.

Prerequisite: A course in first year physics and in calculus or consent of instructor.
3 lectures, 3 hours laboratory alternate weeks, offered in Fall and Spring terms if sufficient demand

243L* Electricity and Magnetism Laboratory For students taking Physics 243*.
3 hours alternate weeks, 0.25 course credit, offered in Fall and Spring terms if sufficient demand

244 Quantum Physics Background of quantum physics: special relativity, Bohr atom, wave-particle properties, uncertainty and wave packets. Introduction to quantum mechanics: equation for travelling wave, Schrodinger equation, solutions with potentials, correspondence principle, brief description of transitions and radiation processes. Kinetic theory, basic statistical mechanics, Boltzmann distribution, elementary X-ray diffraction.

(Not for General Students)
2 lectures, for 2 terms


Prerequisites: A course in first year physics and in calculus or consent of instructor.

Corequisite: Physics 246L*

This course is primarily intended for students registered in the Optometry programme
3 lectures, 1 hour tutorial, Winter term

246L* Physical Optics Laboratory For students taking Physics 246*.
3 hours alternate weeks, 0.25 course credit, Winter term
250* The Solar System  
An introduction to the astronomy and astrophysics of the solar system for students with a background in elementary (University) physics and Mathematics. Astronomical coordinate systems, gravitational astronomy, astronomical measurements and instruments, physical nature of the planets, satellites, etc. which comprise the solar system.  
Prerequisites: First year courses in physics and mathematics, or consent of instructor  
3 lectures, Fall term

251* The Stellar System  
An introduction to the astronomy and astrophysics of objects beyond the solar system for students with a background in elementary (University) physics and mathematics. The Sun, a typical star, observational methods and interpretation in stellar astronomy, structure of stars, distribution and motion of stars, structure of the Milky Way galaxy, external galaxies, cosmology.  
Prerequisites: First year courses in physics and mathematics, or consent of instructor  
3 lectures, offered in Winter and Spring terms

252* Electricity and Magnetism 1  
Coulomb's Law, electric fields, Gauss' theorem, divergence theorem, potential, capacitance, dielectric theory, resistivity, DC circuits, transient currents, AC circuits, measuring instruments.  
Physics Majors must take Physics 252L* with this course  
Prerequisites: A course in first year Physics and in Calculus or consent of instructor  
2 lectures, 1 hour problems, Fall term  
Recommended for students in Honours Programmes  
This course is a good basis for the understanding of practical circuits and of electrostatic forces in matter

252L* Electricity and Magnetism 1 Laboratory  
For students taking Physics 252*.  
3 hours alternate weeks, 0.25 course credit, Fall term

253* Electricity and Magnetism 2  
Magnetic Fields, Ampere's Law. Induced electromotive forces, inductance motors, magnetic properties of materials, magnetic devices, displacement currents, Maxwell's equations, electromagnetic waves.  
Physics Majors must take Physics 253L* with this course  
Prerequisites: Physics 252*, Mathematics 31*.  
2 lectures, 1 hour problems, offered in Winter and Spring terms  
Recommended for students registered in Honours programmes  
This course with Physics 252* forms a basis for the understanding of most of today's electronic and electrical technology

253L* Electricity and Magnetism 2 Laboratory  
For students taking Physics 253*.  
3 hours, alternate weeks, 0.25 course credit, offered in Winter and Spring terms
**255* Quantum Physics**

Background of quantum physics: special relativity, Bohr atom, wave-particle properties, uncertainty and wave packets. Introduction to quantum mechanics: equation for travelling wave, Schrödinger equation, solutions with potentials, correspondence principle, brief description of transitions and radiation processes.

*Prerequisites: A course in first year physics and in calculus or consent of instructor*

3 lectures, offered in Winter and Spring terms

**Recommended for students registered in Honours programmes**

---

**256* Optics**

Reflection and refraction at plane and curved surfaces using the matrix method, thin and thick lenses, optical instruments. The wave nature of light, interference, diffraction, slits and gratings, resolution. Polarization, optical activity, photometry.

*Prerequisites: A course in first year physics and in calculus or consent of instructor*

3 lectures, offered in Fall term

**Physics Majors must take Physics 256L* with this course**

**Recommended for students registered in Honours programmes**

---

**256L* Optics Laboratory**

For students taking Physics 256*.

3 hours, alternate weeks, 0.25 course credit, offered in Fall term

---

**259* Crystallography and X-Ray Diffraction**

An introduction to solid state physics from a structural point of view. Space lattices, symmetry, crystal structure, crystal geometry and stereographic projections. Electronic structure of atoms and atomic bonding in solids. Theory of X-ray diffraction, X-ray methods and the reciprocal lattice. Crystal formation, crystal defects and physical properties of crystals.

*Prerequisites: A course in first year physics and in calculus or consent of instructor*

Corequisite: Physics 259L*

3 lectures, Winter and Spring terms

---

**259L* Crystallography and X-Ray Diffraction Laboratory**

For students taking Physics 259*.

3 hours, alternate weeks, 0.25 course credit, offered in Winter and Spring terms

---

**265* Introduction to Physical Mathematics**

Some mathematical techniques used in solving problems in the areas of physics familiar to second-year students i.e. mechanics, thermodynamics and electromagnetism. The use of differential equations, partial derivatives, vectors, polar coordinates and matrices. Elementary statistics for the analysis of experimental data.

*Prerequisites: A course in first year physics and in calculus or consent of instructor*

3 lectures, offered in Winter and Spring terms

---

**270* Laboratory**

Further experiments in optics for students taking Physics 256L*.

3 hours, alternate weeks, offered in Fall term, 0.25 course credit

---

**271* Laboratory**

Further experiments in electricity and magnetism for students taking Physics 253L*.

3 hours, alternate weeks, offered in Winter and Spring terms, 0.25 course credit
301* Physical Instrumentation for Biologists 1
Ultra-centrifugation, spectroscopy, microscopy, use of radioactive tracers.

Prerequisites: A course in first year physics and in calculus or consent of instructor
2 lectures, Fall term

302* Physical Instrumentation for Biologists 2
Detection and measurement of ionizing radiation, read out devices, transducers and other techniques.

Prerequisite: Physics 301*, or consent of instructor
2 lectures, Winter term

324* Atomic and Nuclear Physics 1
Fundamentals of modern physics, special theory of relativity, quantization of electromagnetic radiation, wave properties of particles, the hydrogen atom.

Prerequisites: Physics 222*, 223*, 226* and 227*, or consent of instructor
3 lectures, offered in Fall term
Recommended for students registered in General programmes

325* Atomic and Nuclear Physics 2
Many electron atoms, atomic and X-ray spectra, nuclear structure, nuclear reactions, molecular and solid state physics.

Prerequisite: Physics 324*
3 lectures, Winter term
Recommended for students registered in General programmes

350* Astrophysics 1

Prerequisites: none, however, familiarity with the contents of Physics 250*-251* will be assumed
3 lectures, offered in the Fall term of odd-numbered years to third and fourth year students.

351* Astrophysics 2

Prerequisites: none, however, familiarity with the contents of Physics 250*-251* will be assumed
3 lectures, offered in the Winter and Spring of even-numbered years to third and fourth year students.

Note: Physics 450*, Astrophysics 3, and Physics 451*, Astrophysics 4, are also open to third and fourth year students. Physics 350* alternates with Physics 450* and Physics 351* alternates with Physics 451*.
352* Electronics 1 Basic A.C. circuit theory. A survey of tubes, transistors and solid state devices, equivalent circuits, power supplies, amplifiers and feedback.

Prerequisites: Physics 222*-223* or equivalent and Mathematics 31*
Corequisite: Physics 352L*.
3 lectures, offered in Fall and Spring terms and if sufficient demand in the Winter term

352L* Electronics 1 Laboratory For students taking Physics 352*.
3 hours, alternate weeks, 0.25 course credit, offered in the same terms as Physics 352*

353* Electronics 2 Applications of feedback to oscillators, operational amplifiers, analogue computers and multi-vibrators. Introduction to digital circuits.

Prerequisite: Physics 352*
Corequisite: Physics 353L*
2 lectures, Winter term

353L* Electronics 2 Laboratory For students taking Physics 353*.
3 hours, alternate weeks, 0.25 course credit, offered in Winter term

354* Atomic and Molecular Physics The Schrödinger equation applied to simple one- and three-dimensional potentials. Hydrogen atoms, angular momentum and spin, molecular vibrations and rotations, many electron atoms, radiation processes.

Prerequisite: Physics 255*
2 lectures, offered in Fall and Spring terms

355* Nuclear and Particle Physics Nuclear structure, interactions of nuclear radiations with matter, radioactive decay, nuclear reactions, nuclear force, elementary particles.

Prerequisite: Physics 255*
3 lectures, Winter term

358* Thermodynamics Thermodynamic systems, equation of state, the laws of thermodynamics with applications. Change of phase.

Prerequisites: Mathematics 237 and a first year Physics course.
3 lectures, offered in Fall and Spring terms


Prerequisite: Physics 358*
3 lectures, Winter term

360A* Intermediate Laboratory Selected experiments in mechanics, atomic physics, solid state physics, optics and electronics.

18 hours of experiments, offered in Fall and Spring terms
0.25 course credit

360B* Intermediate Laboratory Continuation of 360A*.
18 hours of experiments, offered in Winter term
0.25 course credit

Prerequisites: A first year Physics course, Mathematics 130, 237 and 31*
3 lectures, offered in Fall and Spring terms


Prerequisite: Physics 362* or Mathematics 234
3 lectures, Winter term

364* Physical Mathematics 1 Vector and tensor analysis with applications.

Prerequisites: Mathematics 237 and 31*
3 lectures, offered in Fall and Spring terms


Prerequisites: Mathematics 237 and 31*
3 lectures, Winter term

368* Geophysics 1 Introductory topics on the physics of the earth. Seismology and the earth's interior. Thermal history of the earth, gravity and isostasy. Origin of the continents and continental drift. (Identical to Earth Sciences 368*).

Prerequisite: A course in first year Physics and in calculus or consent of instructor
2 lectures, Fall term

369* Geophysics 2 The geology of the ocean basins. Topics in physical oceanography. Physical properties of ocean water, heat budget of the world oceans. Oceanic circulations. Coriolis effects. Some idealized current regimes. (Identical to Earth Sciences 369*).

Prerequisite: Physics 368* or consent of instructor
2 lectures, Winter term

371A* Intermediate Laboratory Further experiments in atomic, nuclear and solid state physics, optics and electronics. For honours students who are taking Physics 360A*.
18 hours of experiments, offered in Fall and Spring terms
0.25 course credit

371B* Intermediate Laboratory Continuation of 371A*.
18 hours of experiments, offered in Winter term
0.25 course credit

380* Molecular Biophysics Energy production, transport and release in cells, structure of large molecules and their replication, genetic code, control of intracellular processes.

Prerequisites: First year Chemistry, Mathematics 31*, Physics 252* and 253* or consent of instructor
3 lectures, Fall term
381* Cell Biophysics
Structure and behaviour of cell membranes, diffusion problems, selective ion transport, electrical activity and nerve conduction, cilia and flagella, muscle cells, sensory receptor cells, synthesis of cell components and cell division.

Prerequisite: Physics 380*
3 lectures, Winter term

431* Classical Mechanics 3
Review of Lagrangian formulation, Hamiltonian formulation, variational principles, canonical transformations, Hamilton-Jacobi theory, Poisson brackets, application to continuous media, relativistic mechanics, classical theory of fields.

Prerequisites: Physics 362*, 363*, 364* and 365*
3 lectures, Fall term

432* Physics and Solid State Devices
The theories of solid state physics are applied to explain the operation and use of several modern electronic devices, including the p-n junction, transistors, thyristors, tunnel diodes, field effect devices, optical devices, etc.

Prerequisite: Physics 435*
3 lectures, Winter term

433 Experimental Research Project
An experimental research project. This course is designed for students in the Honours Physics Programme and in the Co-operative Applied Physics Programme.

It is strongly recommended that Students in these programmes take either Physics 433 or Physics 437*
Enrolment may be limited. Two terms, Fall and Winter, 1.00 course credit

434A* Introductory Quantum Mechanics

Prerequisite: Physics 354*
2 lectures and 1 tutorial hour, Fall term

434B* Quantum Mechanics

Prerequisite: Physics 434A*
2 lectures and 1 tutorial hour, Winter term

435* Solid State Physics
Crystal structure, crystal diffraction and the reciprocal lattice, crystal binding, phonons, thermal properties of insulators, free electron theory of metals, band theory.

Prerequisite: Physics 255* or equivalent
3 lectures, Fall term
436 Physical Mathematics
Functions of a complex variable. Integral transforms (Fourier, Laplace). Integral equations, Green's functions.
Prerequisites: Physics 364*-365*
2 lectures and 1 tutorial hour for two terms, Fall and Winter
The first term of this course, 436A*, may be taken as a 0.50 credit if desired.

437* Theoretical Physics Project
Selected subjects for advanced study by theoretically inclined students, topics in relativistic, quantum, and statistical physics
It is strongly recommended that students in the Honours Physics Programme or the Co-operative Applied Physics Programme take either Physics 433 or Physics 437*
Enrolment may be limited, 3 hours per week, Winter term

438 Geophysics 3
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 for two terms, Fall and Winter

441 Electromagnetic Theory
A generalized treatment of the basic laws of electricity and magnetism, mathematical techniques for the problems of electrodynamics, solution of Maxwell's equation in free space and the study of plane waves, theory of waveguides and introduction to radiation.
Prerequisites: Physics 222*-223* or Physics 252*-253*, Physics 364*-365* or equivalent
2 lectures and 1 hour tutorial for two terms, Fall and Winter

442* Structure of Solids
A survey with emphasis on the physical properties and behaviour of metals and alloys. Elastic and plastic deformations of crystals. Solidification, structure of alloys, free energy of alloy systems, equilibrium diagrams, diffusion, solid state phase transformations.
Prerequisite: Physics 435*
3 lectures, Winter term

443* Classical Field Theory
An introduction, with applications in the areas of elasticity and hydrodynamics. (The electromagnetic field is discussed in Physics 441). Topics covered are the conservation laws, field equations, boundary conditions. Equations of state, invariance, material symmetry. Methods of solution, application to fluid and elastic systems with simple geometries.
Prerequisites: Physics 364*-365* or equivalent
3 lectures, Winter term

444* Nuclear Physics
Elements of nuclear structure and systematics. Alpha emission, beta decay, gamma emission, two-body systems and nuclear forces, nuclear reactions. Neutron physics. Sub-nuclear particles.
Prerequisite: Physics 355*
3 lectures, Winter term
445* Modern Optics  
Optical coherence, spontaneous and stimulated radiation processes.  
Particular attention will be given to lasers.  
*Prerequisites: Physics 256*, Physics 354*  
3 lectures, Fall term

449* Radio Astronomy  
Radio telescopes. Radio sources including the sun, H II regions, H I regions. The galactic centre, pulsars, quasars, other extragalactic sources, cosmological implications.  
*Prerequisites: none, however, familiarity with the contents of Physics 250*-251* will be assumed.  
3 lectures, offered in the Fall term of even-numbered years to third and fourth year students

450* Astrophysics 3  
Solar system astrophysics. The application of the observational and theoretical techniques of physics to the study of the solar system (excluding the sun). The physical nature of planetary (and satellite) surfaces, atmospheres and interiors. Asteroids, meteoroids and comets. The interplanetary medium (solar wind). Solar interactions with the interplanetary medium and the earth's magnetosphere.  
*Prerequisites: none, however, familiarity with the contents of Physics 250*-251* will be assumed  
3 lectures, offered in the Fall term of even-numbered years to third and fourth year students

451* Astrophysics 4  
The structure of stellar interiors, nuclear reaction and energy sources in the stars of the main sequence, early evolution of stars from the main sequence. Lifetimes of the stars.  
*Prerequisites: none, however, familiarity with the contents of Physics 250*-251* will be assumed  
3 lectures, offered in the Winter and Spring terms of odd-numbered years to third and fourth year students

452* Digital Electronics  
Fundamentals and advanced concepts of digital logic stressing practical uses of modern integrated circuit technology.  
*Prerequisites: Physics 352*-353*  
2 lectures, a total of 18 hours of experiments, Fall term

453* Analogue Circuits  
A variety of topics in the operation of systems. Transistor, modern circuit techniques, noise, stability under feedback, information theory, and possible student motivated topics. Includes laboratory demonstrations.  
*Prerequisites: Physics 352*-353*  
3 lectures, Winter term

480* Radiation Biophysics  
The effect of radiation of various kinds on cells and tissues, exposure calculations, mechanism of damage, repair theories, genetic effects, target theory, isotopic tracers in biophysical research.  
*Prerequisites: Physics 222*-223* and Mathematics 236 or equivalent, or consent of instructor  
3 lectures, Fall term
**481* Biophysics of Organ Systems**

Physics of homeostasis, interactions with the environment, circulation of blood, temperature regulation, respiration, transport problems and special organ systems.

*Prerequisites: Physics 222*-223* and Mathematics 236 or equivalent, or consent of instructor

3 lectures, Winter term

**482* Biophysics of Nervous Systems**

Neurons; nerve conduction; sensory transducers; coding, processing and storage of information; control of muscles and other effector organs.

*Prerequisites: Physics 252* and Mathematics 31*, or equivalent or consent of instructor

3 lectures, Fall term

*Recommended for third or fourth year students in Mathematics, Engineering or Science*
Department of Political Science

Associate Professor and Chairman of the Department

J.M. Wilson, B.A., M.A. (Toronto)

Professors

J.E. Kersell, B.A., M.A. (Queen's), Ph.D. (London)
T.H. Qualter, B.A. (New Zealand), Ph.D. (London)

Associate Professors

C.H. Grant, B.A., M.A. (Leicester), Ph.D. (Edinburgh)
A.D. Nelson, A.B., A.M., Ph.D. (Chicago)

Assistant Professors

J.D. Fraser, B.A. (Cantab.), Ph.D. (Leicester)
R.J. Williams, B.A., M.A. (McMaster), Ph.D. (Toronto)
R.P. Woolstencroft, B.A. (Alberta)

Lecturers

S.D. Burt, B.A., M.A. (Waterloo)
A. Kapur, B.A. (Panjab), M.A. (George Washington)
J.E. Surich, B.A., M.A. (Waterloo)

Undergraduate Programmes

The Department of Political Science offers a series of undergraduate programmes designed to meet the needs of students with varying interests. Requirements for each programme are restricted to the completion of a specified number of courses in different fields of the discipline before graduation. For these purposes Political Science courses above the 100 level are numbered according to the field within which they fall. The key to this scheme is the second digit of the course number as follows:

2 - theory and methodology
3 - public administration, public law, and public policy
4 - local and regional politics
5 - comparative politics (more than one country)
6 - comparative politics (specific countries)
7 - the political process
8 - international politics

with the number 9 reserved for special courses which are not regarded as dealing with a particular field of the discipline.

1 General Programme

Students choosing a three-year General programme in Political Science (see the University's requirements for the General Programme in Chapter 8) will normally complete, before graduation, the equivalent of five full courses in Political Science beyond the 100 level, of which three must be from three different fields of the discipline as defined above.

2 Honours Programme

Students choosing an Honours programme in Political Science (see Chapter 8) must complete, before graduation, the equivalent of nine full courses in Political Science beyond the 100 level, of which four must be from four different fields of the discipline as defined above. Honours students may elect to pursue a series of connected courses as a minor programme in a related discipline such as Anthropology, Economics, Geography, History, Philosophy, or Sociology in consultation with the departments involved.
3 Joint Honours Programme

Students who wish to combine a study of Political Science with a broad training in a related discipline such as Sociology or History, or in fact in any other discipline in which they are interested, can do so in a joint honours programme.

It is possible to combine the Political Science joint honours requirements (see Chapter 8) with the requirements made by Anthropology, Economics, English, French, Geography, History, Philosophy, Psychology or Sociology. For a joint honours programme in any other discipline, please consult the Political Science Department and the other department concerned.

Students choosing a joint Honours programme involving Political Science must complete, before graduation, the equivalent of six full courses in Political Science beyond the 100 level of which three must be from three different fields of the discipline as defined above.

4 Minor Programme

The Department will be glad to recommend a connected series of courses in Political Science beyond the 100 level for students majoring in other disciplines such as Sociology, History, or Planning. In addition, it is now possible for students in co-op studies in Math, Science, Engineering or Recreation to add a wide range of Political Science courses to their programmes.

Note  Students who have completed no fewer than six full courses in Political Science in a joint honours programme or 9 full courses in Political Science in an honours Political Science programme are now eligible to enter studies leading to an Ontario secondary school 'Type A' teaching certificate in Political Science.

Graduate Programme

The Department of Political Science offers a programme leading to the degree of Master of Arts. The programme consists of the equivalent of two full courses and a thesis. Highly personalized, flexible instruction is also offered in the form of reading courses. The equivalent of four full courses will be offered in 1974-75. These are in Canadian Politics, Political Theory, Comparative Politics, and International Relations. For more information, please consult the Graduate Calendar or the Political Science Department.

Undergraduate Courses

Note  Extensive descriptions of the content of Political Science courses are available in the Department at the time of pre-registration.

115* Introduction to Politics I

An introduction to the origin and development of some of the leading political ideas of the modern world, and their relationship to contemporary society.

Fall term
116* Introduction to Politics 2
A study of selected aspects of government and politics.
Prerequisite: Political Science 115*, or consent of instructor

Winter term

221* The History of Political Theory 1: The Classical Period
The first part of a history of the development of western political theory from the time of Socrates to the present day. An examination in depth of a few political theories of central importance in the emergence of modern political theory from its ancient origins.
No prerequisite for students in the second year and above
Fall term

222* The History of Political Theory 2: The Modern Period
The second part of a history of the development of western political theory from the time of Socrates to the present day. An examination in depth of a few political theories of central importance in the emergence of modern political theory from its ancient origins.
No prerequisite for students in the second year and above
Winter term

224* Quantitative Analysis
An introduction to the use of quantitative methods in Political Science. Only a rudimentary understanding of mathematics is required.
Open only to Political Science majors
Winter term
Not offered in 1974-75

Note Political Science majors who wish to take a course in quantitative analysis in 1974-75 are advised to take Sociology 202* or Sociology 231*. Please consult the Political Science Department about the details.

225* Political Theory 1
A survey of the principal ideas of the leading political thinkers in the development of western political theory from the earliest times to the seventeenth century, based on an examination of their implicit and explicit assumptions about the nature of the different societies in which they lived.
No prerequisite for students in the second year and above
Fall term

226* Political Theory 2
A survey of the principal ideas of the leading political thinkers in the development of western political theory from the seventeenth century to the present, based on an examination of their implicit or explicit assumptions about the nature of the different societies in which they lived.
No prerequisite for students in the second year and above
Winter term

251* Comparative Politics 1
An examination of the concepts employed in comparative political analysis with special reference to organic, mechanistic, geometric, and dialectical models.
No prerequisite for students in the second year and above
Fall term
252* Comparative Politics 2  The application of the concepts studied in Political Science 251* to specific political systems. The areas studied may vary from year to year.  
Prerequisite: Political Science 251*  
Winter term

260 Canadian Government and Politics  A critical examination of the institutions and practices of the Canadian political system. (Students in co-operative programmes may take either or both halves of this course as 260A in the Fall and Spring terms and 260B in the Winter term).  
No prerequisite for students in the second year and above

262* Soviet Government and Politics  A survey of the development of Soviet political structures with analysis of the relative influence of ideological goals on the one hand and social forces on the other.  
No prerequisite for students in the second year and above  
Winter term

264* American Government and Politics  The theory and practice of the American political system as revealed by the institutions and operations of American national government.  
No prerequisite for students in the second year and above  
Winter term

268* British Government and Politics  An examination of the uniquely British characteristics of the British political system.  
No prerequisite for students in the second year and above  
Winter term

281* International Politics 1  Sovereignty and interdependence. The concept of the International System. Political change in the contemporary world.  
No prerequisite for students in the second year and above  
Fall term

282* International Politics 2  Development of the concept of system especially with reference to conditions and patterns of international politics.  
Prerequisite: Political Science 281* or consent of instructor  
Winter term

321* Marxist Theory  An examination of the formation of Marx’s method and of its significance for the proletariat.  
No prerequisite for students in the third year and above  
Fall term

322* Marxism and Revolution After Marx  A selective study of developments in Marxist theory and political movements after Marx.  
Prerequisite: Political Science 321*  
Winter term

323* Ancient Political Philosophy  A selective examination of political philosophy during the classical period in Greece.  
Fall term
324* Modern Political Philosophy  
A selective examination of political philosophy in the modern period.  
*Winter term*

327* Political Science and Political Values  
An examination of the relationship of "values" to a proper science of politics.  
*Admission by the consent of instructor*  
*Fall term*

330 Public Administration  
A study of selected public institutions and policies interpreted in the light of empirical and normative theory.  
*Prerequisite: At least one previous course in Political Science*  

341* Provincial Politics  
A comparative analysis of the political systems of the Canadian provinces which explores the possibility that as many as ten political cultures exist in Canada.  
*Prerequisite: Political Science 260*  
*Fall term*

343* Urban Politics 1  
This course deals with structural responses to the process of urbanization, with special reference to metropolitan and regional form of government in Canada.  
*Open to students in the third year and above with at least one previous course in Political Science*  
*Winter term*

344* Urban Politics 2  
This course deals with the study of community power, leadership, and the decision-making process.  
*Prerequisite: Political Science 343* or consent of instructor  
*Winter term*

350 The Politics of the Developing Areas  
An analysis of political systems and processes in the developing societies of Africa, Asia, the Caribbean and Latin America.  
*No prerequisite for students in the third year and above*

365* Studies in Soviet Politics  
Selected topics in the theory and practice of Soviet politics, with some discussion of comparative Communist studies.  
*Prerequisite: Political Science 262*  
*Fall term*

371* Political Culture  
An analysis of the development of the concept of political culture as an analytical tool.  
*Prerequisite: Political Science 251*  
*Fall term. Not offered in 1974-75*

372* The Political System  
An examination of the concept of system as applied to the study of politics.  
*Admission by consent of instructor*  
*Winter term*

373* Political Parties  
An analytical and comparative study of the development, organization, activity and function of political parties, and the nature of contemporary party systems.  
*Prerequisite: At least one of Political Science 252*, 260, 264*, 262* or 268*  
*Fall term*
374* 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.  
Prerequisite: At least one of Political Science 252*, 260, 264*, 262* or 268*  
Winter term

377* Political Socialization  
A study of the processes and agents of political socialization and their effect on political stability or change in liberal-democratic societies.  
Admission by consent of instructor  
Fall term

380 Theory and Practice of International Politics  
Various theories and analytical approaches used in the study of international politics will be examined, and their application to the practice of foreign policy and international politics will be studied through consideration of specific important problems facing regimes as they interact.  
Open only to students in the third year and above

391*-398* Special Studies  
From time to time courses of special study may be added to the programme at the third year level. Students wishing to add such courses should, in the first instance, consult the Department's Undergraduate Officer.

424* Contemporary Socialist and Communist Thought  
This course examines recent trends in Marxist theory and its contribution to the analysis of capitalist and socialist societies.  
Admission by consent of instructor  
Winter term

426* Selected Subjects in Political Philosophy  
A selective treatment of basic themes in political philosophy in the modern and pre-modern periods.  
For third year Political Science students, but open to others with prerequisites Political Science 221*, 222*, 323* or 324*, or consent of instructor  
Winter term

427* Special Topics in Political Philosophy  
A selective examination of basic problems in political philosophy in the modern and pre-modern periods.  
Prerequisite: Political Science 221*, 222*, 323* or 324*  
Fall term

428* 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.  
Admission by consent of instructor  
Winter term

431* Canadian Public Policy 1  
An examination of the policy initiatives as taken, for example, by the cabinet and the bureaucracy itself, how policy initiatives and related information are processed at the federal level by departments, the Privy Council Office, cabinet committees, etc.  
Prerequisite: Political Science 260 or 330 or consent of instructor  
Fall term
432* Canadian Public Policy 2  A study of the internal controls and external influences on the federal bureaucracy in its role of policy implementation.
Prerequisite: Political Science 431* or consent of instructor
Winter term

442* Politics in Ontario  A critical examination of the distinctive elements of government and politics in the Province of Ontario.
Prerequisite: Political Science 260 or 341* or consent of instructor
Winter term

443* Politics in Western Canada  A critical examination of the distinctive elements of government and politics in the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia.
Prerequisite: Political Science 260 or 341* or consent of instructor
Fall term

444* Politics in Quebec  A study of the principles, practices and personalities of Quebec politics.
Prerequisite: Political Science 260 or 341* or consent of instructor
Winter term

445* Politics in the Atlantic Provinces  A critical examination of the distinctive elements of government and politics in the provinces of Newfoundland, Prince Edward Island, Nova Scotia, and New Brunswick.
Prerequisite: Political Science 341*
Fall term

451* Comparative Parliamentary Systems  An analytical comparison of parliamentary institutions and processes as they have developed in various political systems influenced by Britain.
Prerequisite: Political Science 251* or consent of instructor
Fall term

458* The Third World  This course deals with the Third World primarily in the international context. As the problems of this group of countries are on a very large scale and very diverse, they will be examined on a comparative basis.
Prerequisite: Political Science 350 or consent of instructor
Winter term

461* Problems in Canadian Politics 1  A critical examination of various problems of Canadian politics, with an emphasis on political integration, federalism and political parties.
Admission by consent of instructor
Fall term

462* Problems in Canadian Politics 2  A senior research course on selected aspects of Canadian political life, with emphasis on the preparation of a major and original research paper.
For fourth year Political Science students but open to others with prerequisite Political Science 461*
Winter term
471* Public Opinion and Propaganda
A detailed study of the nature of public opinion and the attempt to control it through propaganda.
Admission by consent of instructor
Fall term

473* Voting Behaviour
Prerequisite: Political Science 224* or 373* or consent of instructor
Fall term

478* Research Seminar in Political Socialization
This course is designed to follow the introductory work undertaken in Political Science 377* and will focus on the content of the socialization process, particularly in liberal-democratic societies.
Prerequisite: Political Science 377*
Winter term

487* Theories of International Politics
A critical examination of alternative approaches to the study of international politics.
Admission by consent of instructor
Fall term

491*-498* Special Subjects
From time to time courses of special study may be added to the programme at the fourth year level. Students wishing to add such courses should in the first instance consult the Department's Undergraduate Officer.

499 Senior Honours Essay
Students wishing to undertake a senior honours essay in their fourth year should, in the first instance, consult the Department's Undergraduate Officer.
Department of Psychology

Professor and Chairman of the Department
R.K. Banks, B.A., M.A., Ph.D.(Toronto)

Professor, Associate Chairman Graduate Affairs

Associate Professor, Associate Chairman Graduate Affairs
G.A Griffin, B.A.(Colgate), M.A., Ph.D.(Wisconsin)

Undergraduate Affairs
P.M. Rowe, B.A.(Toronto), M.A.(Dalhousie), Ph.D.(McGill)

Dean of Arts (Acting)
M.D. Vogel-Sprott, B.A.(McMaster), M.A., Ph.D.(Toronto)

Professor, Associate Dean Graduate Affairs
J.M. Butler,1 B.S., Ph.D.(Minnesota)
W.C. Corning, B.A.(Heidelberg), Ph.D.(Rochester)
D.P. Crowne, B.A. (Antioch College), Ed.M.(Rochester), Ph.D. (Purdue)
J.A. Dyal, B.A.(Oklahoma), Ph.D.(Illinois)
W.D. Fenz, B.A.(Southern Missionary), M.A., B.D.(St. Andrew's)
M.Sc.(Hawaii), Ph.D.(Massachusetts)
H.M. Lefcourt, B.A.(Antioch), M.A., Ph.D.(Ohio State)
M. Lerner, B.A., M.A.(Ohio State University), Ph.D.(New York University)
R.K. Penney, B.Sc.(Wayne State), Ph.D.(Iowa)
S. Reins, M.D., C.Sc.(Charles University)
S.D. Saleh, B.A.(Cairo), M.A., Ph.D.(Case Western Reserve)
D.A. Sprott, B.A., M.A., Ph.D.(Toronto), F.S.S.

Associate Professors
K.S. Bowers, B.A., Ph.D.(Illinois)
M. Breidenbaugh (Mrs.), B.A.(Wittenberg), Ph.D.(Vienna)
M. Brown, B.Sc., M.Sc.(McGill), Ph.D.(Michigan)
T.E. Cadell, B.A.(British Columbia), M.A.(Massachusetts), Ph.D.(Wisconsin)
J.M. Cornell, B.A., M.S., Ph.D.(Washington)
G.R. Engel, B.A., M.A., Ph.D.(Queen's)
G.E. MacKinnon, B.A.(Queen's), Ph.D.(Johns Hopkins)
D. Meichenbaum, A.B. (City College of New York), M.A., Ph.D. (Illinois)
P.M. Merkle, B.A.(Knox), M.A., Ph.D.(Virginia)
R.R. Ross, B.A., M.A., Ph.D.(Toronto)
R.A. Steffy, B.A.(Albright), M.A., Ph.D.(Illinois)
R.V. Thysell, B.A.(Montana), M.A., Ph.D.(Iowa)
T.G. Waller, B.S., M.S.(Southern Mississippi), Ph.D.(Vanderbilt)
E.E. Ware, B.A., M.A.(Richmond), Ph.D.(Illinois)

Assistant Professors
D.M. Amoroso, B.A., M.A.(Toronto), Ph.D.(Waterloo)
R.F. Asarnow, B.S.(Rutgers), M.A., Ph.D.(Illinois)

Assistant Professors (part-time)
R.A. Cole, B.A.(Rochester), M.A., Ph.D.(Univ. of California)
J.A. Cheyne, B.A.(Waterloo Lutheran), M.A., Ph.D.(Waterloo)
J.G. Holmes, B.A., M.A.(Carleton), Ph.D.(North Carolina at Chapel Hill)
Faculty members holding cross appointments as shown
1 Human Relations and Psychology
2 Management Sciences and Psychology
3 Statistics and Psychology
4 St. Jerome's and Psychology
5 Renison and Psychology

Undergraduate Programmes

Introductory Psychology Psychology 101* is a prerequisite for all subsequent courses in Psychology. To achieve a better understanding of experimentation in Psychology, all students in introductory courses are required to participate in two hours of appropriate psychological research.

General Programme Students choosing a three-year General programme in Psychology must complete Psychology 101*, 102*, 275, a minimum of three additional full-year Psychology courses or equivalent, and a minimum of eight full-year courses or equivalent in Departments other than Psychology (see also the Arts Faculty General Programme requirements).

Honours Programme Students choosing the Honours programme in Psychology must complete, before graduation, the equivalent of nine full courses in Psychology. Before entering the fourth year of the programme, all students must complete Psychology 283*, 284*, 285*, 331* and one research half course from each of the following groups:

Group 1: 293*, 295*, 297*
Group 2: 393*, 395*, 397*

In the fourth year, all students must complete Psychology 499.
Joint Honours Programme  Students choosing a Joint Honours Programme involving Psychology must complete the equivalent of seven full courses in Psychology and an Honours thesis course. Unless other arrangements are approved by the Department, all students in Joint Honours Programmes must complete, before entering the fourth year, Psychology 283*, 284*, 285*, 331*, and one research half course from each of the following groups:

Group 1: 293*, 295*, 297*
Group 2: 393*, 395*, 397*

In the fourth year, all students must complete Psychology 499 or the Honours Thesis course in the related discipline.

Joint Honours programmes other than those already approved may be arranged by consultation with the Psychology Department and the Department concerned.

Minor Programme  The Department offers a minor programme in Psychology. Any student interested in planning a sequence of five courses to complement his/her major field of study is encouraged to consult the Undergraduate Officer. All minor programmes must be approved by the Department.

Undergraduate Courses

The number of hours of lectures shown after the course descriptions is an attempt to indicate the "normal"; each instructor determines how often his particular class will meet.

101* Introductory Psychology  A general survey course designed to provide the student with an understanding of the basic concepts and techniques of modern psychology as a behavioural science.
3 hours.

102* Introductory Psychology  Special Topics  A more in depth study of selected topics introduced in Psychology 101*.
Prerequisite: Psychology 101*.
3 hours.

203* Learning and Motivation  This course is designed to introduce the student to theories in Learning and Motivation and to provide the student with an understanding of the experimental techniques in these areas.
3 hours.

205* Sensory Processes  A consideration of data and theory concerning sensory processes. Topics will include psycho-physical methodology, sensory mechanisms and the neuropsychological basis of perception.
3 hours.

206* Perceptual Processes  An examination of data and theory concerning perceptual processes. Topics will include the perception of form and space, perceptual learning and a consideration of the effect of personality variables in perception.
3 hours.
207* Cognitive Processes
An examination and evaluation of selected topics dealing with human learning, thinking, concept formation, memory and language.

3 hours.

211* Developmental Psychology
An examination of the process and factors of human development.

3 hours.

214* Psychology of Adolescence
A study of the psychological processes occurring in the second decade of human development. Consideration is given to such areas as intellectual development, emotional and social growth, and identity formation. Current concepts, issues, and research are stressed.

Prerequisite: Psychology 211*.

3 hours.

218* Aging, Dying and Death
An examination of both the psychological aspects of the aging process and the traditional and recent literature relating to various views as to the part played by the reality of death in the life of man. Recent attempts at therapy with dying individuals are reviewed and evaluated.

3 hours.

241* Educational Psychology: The Psychology of Classroom Learning
A consideration of the main variables affecting learning in the classroom with special focus upon the conditions essential to efficient learning.

3 hours.

242* Educational Psychology: Learning Disabilities
Analyses of learning disabilities associated with various categories of exceptionality including mental retardation, emotional problems, and receptive and expressive handicaps.

3 hours.

253* Social Psychology
An introduction to theories and research on people in their physical and social environment. Typically, topics such as conformity, persuasion, attraction, prejudice, communication, aggression, the psychology of freedom, justice and human exchange will be introduced. The general emphasis is on an understanding of the processes which determine how people are affected by their environment and how people in turn shape their world.

3 hours.

254* Interpersonal Relations
A psychological analysis of social interaction. The development of interpersonal attraction from first impressions to long-term relationships. The roots of hostility, conflict and communication problems.

Prerequisite: Psychology 253*.

3 hours.

261* Physiological Psychology
The structure and function of the nervous system and their relation to behaviour.

3 hours.
271* Animal Behaviour  An in depth study of the behaviour of animals emphasizing both observational and experimental research.  
3 hours.

275 Statistics and Measurement  An introduction to basic statistical concepts and to the theory and use of psychological tests. Consideration is given to the assessment of personality, intelligence, aptitudes, and interests, and to the analysis of individual and group differences in behaviour. Required of all students in the General Psychology Programme.  
2 hours lecture, 2 hours laboratory

283* Statistical Methods in Psychology  An introduction to the logical and theoretical base for the application of statistical methods to the solution of problems in the social sciences. Consideration will be given to descriptive statistics, to sampling statistics and to an introduction to inferential statistics. Required of all students in Honours Psychology.  
3 hours.

284* Experimental Design  An examination of the effective use and interpretation of statistics in the design and understanding of experiments in the social sciences. Required of all students in Honours Psychology.  
Prerequisite: Psychology 283*.  
3 hours.

285* Tests and Measurements  An introduction to the theory and use of psychological tests. Special emphasis is placed on the assessment of personality, intelligence, aptitudes and interests.  
Prerequisite: Psychology 283*.  
3 hours.

293* Research in Learning and Motivation  Open only to students in Honours Psychology (and Joint Honours Programmes with Psychology), and to those students in the General programme who are majoring in Psychology. Open to students in other programmes by permission of instructor only.  
Prerequisite: Psychology 283* and one of Psychology 203*, 207* or 271*.  
2 hours lecture, 2 hours laboratory.

295* Research in Perceptual and Cognitive Processes  Open only to students in Honours Psychology (and Joint Honours programmes with Psychology) and to those students in the General Programme who are majoring in Psychology. Open to students in other programmes by permission of instructor only.  
Prerequisite: Psychology 283* and one of Psychology 205*, 206* or 207*.  
2 hours lecture, 2 hours laboratory.

297* Research in Biopsychology  Open only to students in Honours Psychology (and Joint Honours programmes with Psychology) and to those students in the General programme who are majoring in Psychology. Open to students in other programmes by permission of instructor only.  
Prerequisite: Psychology 283* and one of Psychology 261* or 271*.  
2 hours lecture, 2 hours laboratory.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisite(s)</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>316*</td>
<td>Moral Development</td>
<td>A consideration of psychological theory and research dealing with the nature and origin or moral development, developmental differences in moral judgment, and various approaches to teaching moral behaviour with its consequent effects on the individual.</td>
<td>Psychology 211*</td>
<td>3</td>
</tr>
<tr>
<td>331*</td>
<td>Individual Differences</td>
<td>An analysis of individual and group differences in behaviour, with emphasis on studies of intelligence.</td>
<td>Psychology 285*</td>
<td>3</td>
</tr>
<tr>
<td>333*</td>
<td>Industrial Psychology</td>
<td>An introduction to the methods and problems in Industrial Psychology.</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>334*</td>
<td>Theories of Counselling</td>
<td>An introduction to the methods, theories and problems in Counselling Psychology.</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>340</td>
<td>Community Psychology</td>
<td>Theory and practice are integrated in an attempt to identify and understand the social factors which inhibit or facilitate healthy development of the individual. The adequacy of existing social structures and institutions in the treatment of various personal problems is assessed.</td>
<td>Psychology 253*</td>
<td>3</td>
</tr>
<tr>
<td>350</td>
<td>Group and Individual Counselling</td>
<td>Facilitative human relations within the context of education, guidance and interpersonal exchanges are treated in terms of current psychological theories and research. The demonstration and development of these concepts are aided by personal participation, observation and taped sessions. Application to both individual and group interaction.</td>
<td>Psychology 355*, 357* and 334* or suitable alternative and permission of instructor.</td>
<td>3</td>
</tr>
<tr>
<td>355*</td>
<td>Personality Theory</td>
<td>An examination and evaluation of some of the outstanding theories of personality.</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>357*</td>
<td>Psychopathology</td>
<td>The nature and origin of deviant behaviour.</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>359*</td>
<td>Personality and Adjustment</td>
<td>A study of theory and research related to the adaptation and to the function of personality in a variety of natural and artificial settings. The focus is on normal behaviour.</td>
<td>Psychology 355*</td>
<td>3</td>
</tr>
<tr>
<td>363*(A-E)-366*(A-E) Special Subjects</td>
<td>One or more half courses will be offered at different times as announced by the Department.</td>
<td>Consent of Instructor.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
393* Research in Development Psychology
Open only to students in Honours Psychology (and Joint Honours programmes with Psychology) and to those students in the General programme who are majoring in Psychology. Open to students in other programmes by permission of instructor only. 
Prerequisite: Psychology 283* and Psychology 211* or 331*.
2 hours lecture, 2 hour laboratory

395* Research in Social Psychology
Open only to students in Honours Psychology and Joint Honours programmes with Psychology) and to those students in the General programme who are majoring in Psychology. Open to students in other programmes by permission of instructor only. 
Prerequisite: Psychology 283* and 253*.
2 hours lecture, 2 hours laboratory

397* Research in Personality and Psychopathology
Open only to students in Honours Psychology (and Joint Honours programmes with Psychology) and to those students in the General programme who are majoring in Psychology. Open to students in other programmes by permission of instructor only. 
Prerequisite: Psychology 283* and one of Psychology 331*, 355* or 357*.
2 hours lecture, 2 hours laboratory.

410 History and Systems
An examination of current theoretical approaches to psychological problems present in a historical context.
2 hours.

Seminars

451* Senior seminar in Learning. 
Admission by consent of instructor. 
2 hours.

452* Senior seminar in Perception. 
Admission by consent of instructor. 
2 hours.

453* Senior seminar in Development Psychology. 
Admission by consent of instructor. 
2 hours.

454* Senior seminar in Educational Psychology. 
Admission by consent of instructor. 
2 hours.

455* Senior seminar in Social Psychology. 
Admission by consent of instructor. 
2 hours.

456* Senior seminar in Personality. 
Admission by consent of instructor. 
2 hours.

457* Senior seminar in Clinical Psychology. 
Admission by consent of instructor. 
2 hours.
458* Senior seminar in Cognitive Processes.  
*Admission by consent of instructor.  
2 hours.

459* Senior seminar in Motivation.  
*Admission by consent of instructor.  
2 hours.

461* Senior seminar in Physiological Psychology.  
*Admission by consent of instructor.  
2 hours.

462* Senior seminar in Animal Behaviour.  
*Admission by consent of instructor.  
2 hours.

463* Senior seminar in Special Topics.  
*Admission by consent of instructor.  
2 hours.

464* Senior seminar in Special Topics.  
*Admission by consent of instructor.  
2 hours.

465* Senior seminar in Special Topics.  
*Admission by consent of instructor.  
2 hours.

466* Senior seminar in Special Topics.  
*Admission by consent of instructor.  
2 hours.

480 Directed Studies in Special Topics  
For the student who desires to pursue a particular topic in depth through independent experimental research and/or extensive reading. A faculty member must approve a student's project prior to registration for this course. Open to exceptional students with permission of the instructor and the Department.  
3 hours.

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 students in Honours Psychology.
The following courses are administered by Renison College. Since these courses are intended primarily for students in the Social Science (Applied) programme, students planning a General or Honours Psychology programme must consult their faculty advisor concerning Psychology major credit for these courses.

120R Introductory Psychology
Basic concepts and techniques of modern psychology as a behavioural science, with special emphasis on social aspects of behaviour. The development of behaviour, learning and remembering, motivation, values and attitudes, personality, sensation and perception, and small group processes will be studied with reference to physiological correlates and environmental factors.

220R Social Psychology
An examination of the psychological principles involved in the interaction between the individual and society. Emphasis on social attraction, socialization of the child, language and social communication, interpersonal perception, attitude formation, personality and society, status and roles, social control, group dynamics and leadership.

330R Social Functioning and Human Behaviour
Relationships between models of the nature of the human being and societal structures. Psychoanalytic, existential, behaviouristic and humanistic models will be examined. Contrasts of views of abnormal behaviour as human experiencing, personality disorder, social problems, and a manifestation of culture. A brief summary of treatment procedures, with special emphasis on community based approaches to treatment and prevention. 3 hours.

367*R-369*R Special Topics in Psychology
One or more half courses will be offered from time to time as announced in each given year.

398R*-399R* Independent Study
An independent in depth study of a selected area, undertaken by an individual or small group of students with one of the faculty members.
Department of Recreation

Assistant Professor, Acting Chairman of the Department
G.C. Godbey, B.S. (New York), M.S., Ph.D. (Penn. State)
Professor, Dean of the Faculty
G.S. Kenyon, B.P.E. (U.B.C.), M.S. (Indiana), Ph.D. (N.Y.U.)
Professor
F.M. Avedon, B.S.S. (William and Mary), M.A., Ed.D. (Columbia)
Associate Professors
D.M. Crapo, B.P.E. (Alberta), M.S., Ph.D. (Michigan State)
C.A. Griffith, B.A. (Sir George Williams), M.S., Re.D. (Indiana)
D. Ng, B.A. (Lingnan), M.A. (Carver), M.Sc., Re.D. (Indiana)
Assistant Professors
D.J. Arnold, B.P.E. (British Columbia), M.Sc. (San Francisco), Re.D. (Indiana)
F.W. Martin, B.S. (City College, New York), M.S., Ed.D. (Columbia)
J.D. Pearse
C.H. Pierce, B.A. (Grinnel), M.A. (DePauw), Ph.D. (Kansas)
(part-time)
K. Balmer, B.A. (Toronto), Ph.D. Liverpool
Lecturer
J. Levy, B.A. (Waterloo Lutheran), B.P.E. (Waterloo), M.S.W.
(Waterloo Lutheran)

Course Descriptions

100* Introduction to the Study of Leisure and Recreation
A course designed to develop an overview of the total field of recreation and an understanding of the leisure phenomena and the implications for contemporary society.
3 lectures, Fall term.

101* Introduction to Leisure Services
An introduction to various leisure service agencies and the services provided. Field trips to municipalities, specialized institutions, and voluntary agencies.
For Departmental students only.
1 two-hour lecture and one hour discussion session.
Fall term.

200* Theories of Play
A critical analysis of definitions, concepts and assumptions of classical, recent and modern theories of play with implications for research strategies, programming and planning for play.
Spring term.

210* Organization and Administration of Recreation Services
The organization and administration of recreation on federal, provincial and municipal levels; legislation, financing, budgeting, problem solving, public relations, administrative practices and departmental organization with particular emphasis on the municipal level.
3 lectures, Fall term.

211* Specialized Institutions in Recreation
A course designed to examine different organized recreation settings in detail. Included will be municipal recreation, industrial recreation, Y.M.C.A.’s therapeutic programmes, correctional programmes, and armed forces programmes.
3 lectures.
220* Recreation Programme Planning 1
A study of the scope of community recreation programmes and the factors involved in programme leadership. Emphasis will be placed on the goals in recreation for the leader and participant, effective leadership of individuals and groups, individual and group creativity, and leadership through direct experience. Specific reference will be given to the techniques of programme leadership in music, drama, dance, games and social recreation.
2 lectures, 2 hours lab, Winter term.

230* Introduction to Outdoor Education and Recreation
A study of outdoor education and recreation in relation to contemporary lifestyles, natural and human resource systems. Includes the examination of outdoor settings as an integral part of an education – outdoor recreation continuum. Includes the role of selected governmental and non-governmental bodies and their programmes.
3 lectures, Winter term.

241* Administration of Camping and Outdoor Education
The philosophy and objectives of camping and outdoor education; administration, organization, planning, staff relationships, leadership training, trends in camping and outdoor education. The emphasis in this course will be the place of the resident camp in education and recreation with particular reference to administrative policies and procedures.
3 lectures, 1 week-end field trip to a resident camp. Lab fee, approximately $20.00.
Prerequisite: Recreation 230*, Winter term.

250* Introduction to Therapeutic Recreation
Examines the philosophical, theoretical and empirical frameworks of recreation as a therapeutic service and process to individuals with physical, emotional and intellectual disabilities.
3 lectures, Winter term.

252* Recreation and Mental Retardation
An analysis of the motoric and psycho-social behavioral dimensions specific to the retarded with direct and obvious applicability to the planning, implementing and evaluating of recreational programmes.
3 lectures.
Prerequisite: Recreation 250* and Psychology 242*.
Fall and Spring terms.

253* Recreation and Physical Disabilities
The psycho-social aspects of physical disabilities will be analysed, with special focus given to the planning, implementing and evaluating of leisure activities.
3 lectures.
Prerequisite: Recreation 250*, and permission of instructor.
Fall term.

254* Recreation and Mental Illness
A psycho-social analysis of the determinants and consequences of recreative behavior as related to positive and negative mental health, discussing in detail, structure, semiotic factors and interaction patterns.
Prerequisite: Recreation 250*, Fall term.
3 lectures.
270* Statistical Techniques Applied To Leisure Studies
An introduction to descriptive and inferential statistics and the interpretation of data. A major consideration of the course is the use of statistics in the solution of problems in recreation and leisure.

3 lectures, 1 hour lab, Fall term

271* Research Designs Applicable to Leisure Studies
An introduction to the methods and techniques of research as applied to leisure studies and services. General consideration will be given to the technical problems involved in various stages of research methodology with emphasis on the logic underlying the research process.

Prerequisite: Recreation 270*

3 lectures, Winter and Spring terms

300* Philosophy of Leisure
Examination of major philosophical themes through the ages with reference to contemporary viability and effect upon social behaviour.

Prerequisite: Consent of instructor

3 lectures, Winter term

301* Sociology of Leisure (Sociology 375)
Nature and extent of leisure phenomena in contemporary society. Examination of institutional and formal organizational aspects, social role, social research strategies employed in the study of leisure.

Prerequisite: Two term courses in Sociology, e.g. Sociology 101 and 341

3 lectures, Winter and Spring terms

302* Travel and Tourism
The scope and nature of travel and tourism as contemporary leisure experiences. Economic, political, and social ramifications, research strategies employed, implications for the future.

Prerequisite: Recreation 301*

3 lectures, Fall term

303* Sports in Society (Kinesiology 452)
An introduction to the sociology of sport. Utilizing the major frames of reference of the social sciences, the function of sport in contemporary society is examined.

Prerequisite: Sociology 101 and one other Sociology course

3 lectures, Winter and Spring terms

306* Leisure and Psychopathology
Examination of the psychodynamics of popular leisure experiences, e.g. – sport, gambling, fashion, and the like, and their relationship to psychopathology. Examination of the use of leisure experience to resolve emotional conflict and cope with stress.

Prerequisite: Recreation 301*, Psychology 357*, and advanced standing

3 lectures, Winter term

307* The Individual In Sport Situations (Kinesiology 455*)
An introduction to the social psychology of sport and physical activity, including sport involvement and personality, attitude and beliefs; the team as a small group; and social influence and facilitation in sport situations.

Prerequisite: Two term courses in Psychology or consent of instructor

3 lectures, Winter and Spring terms
311* School Recreation
An analysis of the relationship between recreation and education with particular emphasis on the sponsorship of community recreation programmes by education authorities including leisure education and co-curriculum activities.
*Prerequisites: Recreation 210*
3 lectures, Winter term

312 Recreation and Community Action
The role of the citizen in recreation systems with regard to social change. Students will examine models for social change which interact with recreation systems and power relationships between citizen's groups and recreation systems. They will participate actively in a community action group as a means of relating theory to real world situations.
*Prerequisite: Recreation 210*
3 lectures, Winter and Spring terms

316* Principles of Recreation Planning
(Planning 344)
An exploration of the nature and functions of recreation in modern urban-industrial societies and an analysis of alternative approaches to the planning of recreation opportunities in urban-centred regions. The demand for and supply of recreation opportunities; standards, models and systems; recreation planning policies and agencies; and selected recreation planning issues.
*Prerequisite: Planning 100 or a full credit in Geography, or consent of instructor*
3 lectures, Winter term

320* Evaluation of Recreational Programmes
Evaluation procedures and techniques applicable to recreation programmes are examined in detail. Specification of objectives, development of practical recording procedures and experimental analysis are stressed. Students conduct field evaluations in local community agencies.
*Prerequisite: Recreation 220*. (Not offered in 1974)
2 lectures, 2 hours lab in community agencies

321*-324* Selected Topics in Recreation
The study of particular topics pertaining to recreation. Course topics will be announced in advance, but will not be offered on a regular basis.
*Prerequisite: Consent of instructor*

330* Outdoor Recreation
The present status of outdoor recreation in modern society; government functions and policies related to outdoor recreation services; the planning and administration of outdoor recreation activities. Current problems.
*Prerequisite: Recreation 230*, lab fee approximately $15.00
2 lectures, 2 hours lab, Winter term

332* Theory and Practice in Outdoor Education
Emphasis on methods and techniques for the selection, development, and implementation of programmes and projects through the utilization of diverse and unique natural settings and environments.
*Prerequisite: Recreation 230*, 241*
2 lectures, 2 hours lab, (lab fee $20), Full term
334* Park Management  Basic administrative procedures in park management. Operational techniques are examined together with general policies of acquisition, operation and development.
Prerequisite: Recreation 210*, Recreation 230*, or equivalent
3 lectures, Fall term

360* Growth, Development and Aging  The changing capacities and interests of man as related to leisure.
The relationship of development processes to social gerontology is examined. A special emphasis is placed on basic Canadian statistics related to aging.
Prerequisite: Psychology 211*, Recreation 250*
2 lectures, 2 hours lab, Fall term

361* Aging, the Aged, and Leisure: A Sociological and Social Psychological Perspective  Employing a sociological and psychological frame of reference, the process and problems of aging will be analyzed. Special emphasis will be given to the problem of leisure time in the later years of life.
Prerequisite: Sociology 101, and one other sociology course
3 lectures, Fall and Spring terms

370* Directed Study in Special Topics  For the student who desires to pursue a particular topic in depth through guided independent research and/or reading. A faculty member must approve a student's project prior to registration. May be repeated in subsequent terms.
Prerequisite: Faculty approval, Fall, Winter and Spring terms

400* Seminar in Recreation and Leisure  An in depth analysis of the current major issues and trends.
Fourth year Departmental students only
3 hours, Winter and Spring terms

402* Colloquium on Religion and Leisure  Theological notions as they relate to theories of leisure. Contemporary trends and behaviour which affect organized religion, and other leisure-related institutions. Issues for possible consideration, e.g. -- public ritual as a leisure and religious phenomenon, leisure forms and liturgy, leisure as prayer, the church and a leisure ethic, ministering in 'mass leisure', the Sabbath and leisure.
Prerequisite: A course in philosophy and theology, or consent of the instructor
3 lectures, Fall term

406 Comparative Recreation Systems  A study of multi-national recreation systems. Course meets on Campus and in the field in other countries. Full term study over a period of 6-8 weeks. Laboratory fee varies with field observation.
Spring term

410* Planning of Recreation Facilities  A course to introduce the student to the planning, design and layout of recreation areas and facilities.
Prerequisite: Recreation 210*
3 lectures, Fall term
432* Theory and Practice in Outdoor Education
Concepts, philosophy and practices relative to the enrichment of school and community curricula through the use of the natural environment. Emphasis on the role of the school, the community, the provincial and federal government relative to a systems approach toward an integrated design for leadership programmes, areas, facilities and management.
2 lectures, 2 hours lab, Lab fee approximately $20.00, Winter term
Prerequisite: Recreation 332* or consent of the instructor

434* Park Management
A study of policies, procedures, and practices relative to the management of natural resources. Emphasis is placed on a systems approach to management as it relates to park management at all levels of government.
Prerequisite: Recreation 334*
3 lectures, Fall term

470*/471* Research Project
An independent research project on an approved topic supervised by a faculty member. Required of all students enrolled in the Honours Recreation Programme. Recreation 470* includes an approved design and completion of the first segment of the paper.
Prerequisite: Completion of an honours optional course sequence
3 lectures, Winter and Spring terms

Recreation 471* requires the completion of the project begun in 470*.
Prerequisite: Recreation 470*
Fall, Winter and Spring terms
Religious Studies

Associate Professor and Convenor
A.F. Thompson, B.A.(Toronto), B.Th.(Huron), M.A.(Western), S.T.M., Ph.D.(McGill)

Associate Professor
W. Klaassen, B.A.(McMaster), B.D.(McMaster Divinity School), D.Phil.(Oxford)
P A.M. McLachlin, M.A.(Toronto), B.D.(Emmanuel), Th.D.(Emmanuel)

Assistant Professors
W.J. Bildstein, B.A.(Western), S.T.B.(Gregorian), M.A.(Windsor), S.T.D.(Angelicum)
R M. Bird, B.A., M.A.(Iowa)
R M.D. Bryant, B.A.(Concordia), S.T.B.(Harvard), M.A.(Toronto)
J M.D. Coogan, B.A.(Fordham), Ph.D.(Harvard)
J B.J. Hubbard, B.A.(Seattle), M.A.(Marquette), Ph.D.(Iowa)
R.D. Legge, B.A.(Transylvania), S.T.B.(Harvard), Ph.D.(McMaster)
D. Sahas, B.D.(Athens), S.T.M.(Christian Theological Seminary), Ph.D.(Hartford Seminary Foundation)

Lecturers
W.H. Hall, B.A.(Loyola), B.Th., S.T.L.(Montreal)
(part-time) P P.K. Hawkes, B.A.(Queen's), B.D.(Emmanuel), M.A.(Toronto)
P D.R. Newman, B.A.(Toronto), B.D.(Emmanuel), M.A.(Toronto)
P L.L. Newmarch, B.A.(Toronto), B.R.E.(Victoria), M.A.(Columbia)

Note 1 Purpose of the Programme in Religious Studies:
a) to expose the student to the issues and problems involved in, and to the nature of the questions raised by, the study of religious phenomena and ideas;
b) to enable him to approach, in a methodical way, the study of the major religious traditions living today, for the purpose of encountering and understanding the life and the expression of religion through the various religions of the world;
c) to introduce him to the distinctive features of one or more religious traditions and to the methods for their systematic study.

Note 2 Students majoring in Religious Studies must have their programmes approved by the undergraduate officer. Each student is required to take any 100 level R.S. course in the first year and two R.S. courses in each of the two subsequent years. These courses should be selected from at least two of the following four main categories of approaches to religious phenomena (the decade grouping of the numbering scheme will guide the student in making this selection):
Course Categories and Numbering Scheme

1) Studies in Religious Texts
   00-09

2) Studies in the History of Religions
   10-19 A) History of Religions
   20-29 B) History of the Christian Church

3) Theological – Philosophical Studies
   30-39 A) Theological
   40-49 B) Philosophical
   50-59 C) Ethics

4) Cultural Studies
   60-69 A) Religion and Culture
   70-79 B) Religion and the Social Sciences

Note 3 The honours programme in Religious Studies can be found in Chapter 8 of this Calendar.

Note 4 Students at the University of Waterloo and Wilfrid Laurier University may, with the permission of their adviser, take courses in Religious Studies at either university. For details regarding registration procedures and courses available at Wilfrid Laurier University, consult the undergraduate officer, Religious Studies.

Note 5 Courses designated with suffix G (Conrad Grebel), J (St. Jerome's), P (St. Paul's), and R (Renison) are administered by the respective Colleges.

Undergraduate Courses

103G* Origins of the Judaeo-Christian Tradition 1
A study of the history, literature and basic concepts of the religion of ancient Israel in the pre-Christian era, against the background of the religions of the ancient Near East.
3 lectures, Fall term
Not open to students who have taken 201J* Miller.

104G* Origins of the Judaeo-Christian Tradition 2
A study of the origins of the Christian community and faith, with special focus on the church's relation to Jesus and the emergence of Christian literature, theologies, and life styles.
3 lectures, Winter term
Not open to students who have taken 202J* Rempel.

105J Elementary Hebrew
A study of the phonemic structure of Biblical Hebrew, elementary technical points, morphology of the noun, verb, etc.; numerals; an introduction to Hebrew Syntax. Written exercises in both Hebrew and English. Reading of selected portions of the Hebrew scriptures.
This course is offered in 1974-75 at Wilfrid Laurier University through cross-registration, and in alternate years at St. Jerome's College.
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
Hubbard

An introduction to the religious traditions of the East: history, religious beliefs and practices of Hinduism, Buddhism, Confucianism, Taoism and Shinto.

3 lectures, Fall and Winter terms
Hubbard, Legge, Thompson

An introduction to the religious traditions of the East: history, religious beliefs and practices of Hinduism, Buddhism, Confucianism, Taoism and Shinto.

An introduction to the religious traditions of the East: history, religious beliefs and practices of Hinduism, Buddhism, Confucianism, Taoism and Shinto.

Encounter with Judaism, Christianity and Islam: the history and interaction of the three major religious traditions which have shaped the image of the Western World.

3 lectures, Fall and Winter terms
Coogan, Sahas, Thompson

A study of the nature of the Christian faith with consideration of questions such as these: How do you speak of God in a secular age? What significance have the Bible and Church doctrines for history and faith? Who is Jesus? the Cross and Resurrection; the question of Salvation.

3 lectures, Fall term
McLachlin

Further study of the Christian faith to include the questions and issues: What is man? What is freedom? Is there a Christian lifestyle? the new morality; Man and Nature; the Church: Mission and Worship; the Future.

3 lectures, Winter term
McLachlin

An introduction to the methods and themes in the study of religion and culture. An exploration of the correlations between quests for God and cultural models of authentic humanity, the quest for religious community and the institutions of common life. Such themes will be illustrated in relation to religious traditions and cultures of the East and West.

3 lectures, Fall term
Bryant

An exploration of religion as the “substance of culture” and culture as “the form of religion”. The manifestation of this relationship in terms of the quest for meaning, the evolution of human sexuality, the creation of the “good society” and the creations of the fine arts.

3 lectures, Winter term
Bryant
201J* **Introduction to the Old Testament**
A survey of the literature of the Old Testament as viewed in its historical and cultural setting in the ancient Near East and as interpreted by modern scholarship; the literature as an expression of the religious thought of ancient Israel, one of the formative influences in Western civilization.
3 lectures, Fall term
*Not open to students who have taken 103G*
Coogan

202J* **Introduction to the New Testament**
A survey of the literature of the New Testament as viewed in its historical and cultural setting in the Greco-Roman world and as interpreted by modern scholarship; the literature as an expression of the religious thought and experiences of the early Christian communities, the origin of the Church.
3 lectures, Winter term
*Not open to students who have taken 104G*
Hubbard, Newmarch

203G* **Wisdom Literature in the Old Testament**
A study of Proverbs, Job, Ecclesiastes and other wisdom writings in ancient Israel, against their Near Eastern background.
3 lectures, Fall term
Miller

204G* **Worship Life in Ancient Israel**
A study of the festivals, prayers and liturgies of the Old Testament against the background of worship practices in the ancient Near East.
3 lectures, Winter term
Miller

205G* **The Hebrew Prophets**
A study of the writings of Amos, Hosea, First Isaiah, Second Isaiah, Micah, Jeremiah, and Ezekiel in the historical, social, and religious context of the ancient world, and of their influence upon the development of religious life and thought.
*Not offered in 1974-75*

206G* **Modern Study of Jesus**
An examination of recent approaches to the study of Jesus of Nazareth to determine his significance for the beginnings of the Christian Church and for modern man.
3 lectures, Winter term
Garber

207G* **The Gospel of John**
An interpretation of the Fourth Gospel in the light of the situation of the Church at the end of the first century, with an emphasis on the Johannine portrait of Jesus. The letters of John will also be studied.
*Prerequisite: R.S. 104G*, 202J* or consent of the instructor*
3 lectures, Fall term
Garber

209G* **Cultural Conflict in Early Christianity**
A study of the conflict within the early church over the nature of the Christian message and community, with special consideration of the writings of Paul, one of the leading missionaries and theologians of the church.
3 lectures, Fall term
Newmarch
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Credits</th>
<th>Term</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>212J*</td>
<td>Ancient Near Eastern Religions</td>
<td>An analysis of the myths, epics, legends, rituals, incantation, prayers and festival texts of ancient Near Eastern peoples, with special emphasis on the religions of Egypt, Mesopotamia and Canaan-Phoenicia. Not offered in 1974-75</td>
<td>3</td>
<td>Fall</td>
<td></td>
</tr>
<tr>
<td>213*</td>
<td>Hinduism</td>
<td>A study of the development of religious thought in India from the Vedic Period to the present. The course will combine a historical survey with a study of representative texts from the religious, philosophical, social, and political thought of the Hindus. 3 lectures, Fall term</td>
<td>3</td>
<td>Fall</td>
<td>Thompson</td>
</tr>
<tr>
<td>214*</td>
<td>Buddhism in India, China and Japan</td>
<td>This course will consist of a historical survey of the essential doctrines and practices of Buddhism in India, China and Japan, along with a study of representative texts from the various schools of thought. 3 lectures, Fall term</td>
<td>3</td>
<td>Fall</td>
<td>Legge</td>
</tr>
<tr>
<td>215*</td>
<td>Chinese Religions</td>
<td>A historical survey of the various expressions of Chinese spirituality from the classical period to the present. Special attention will be given to the dynamics between the indigenous traditions (e.g., Taoism) and those imported into China (e.g., Buddhism). 3 lectures, Winter term</td>
<td>3</td>
<td>Winter</td>
<td>Legge</td>
</tr>
<tr>
<td>216*</td>
<td>Islam</td>
<td>The religion of the Muslims through the fourteen centuries of its existence. An introduction to the life and the personality of Muhammad the Prophet, the Qur'an, the Muslim Tradition, the development of the Muslim Theology and Philosophy, Sufism, Muslim expansion and civilization, Muslim life and piety, and present condition of the religion in the Muslim world. 3 lectures, Fall term</td>
<td>3</td>
<td>Fall</td>
<td>Sahas</td>
</tr>
<tr>
<td>217*</td>
<td>Judaism</td>
<td>The religion of the Jews through the 4000 years of its existence. An introduction to the history, scriptures and literature, intellectual life and spiritual experience of the Jewish people. 3 lectures, Winter term</td>
<td>3</td>
<td>Winter</td>
<td>Sahas</td>
</tr>
<tr>
<td>218*</td>
<td>Christianity</td>
<td>An introduction to the Christian tradition in retrospect: the facts and the experiences pertinent to the evolution of beliefs, institutions, practices and cultural expressions, as these elements delineate the essential identity of Christianity as one of the religious traditions of the world. 3 lectures, Fall term</td>
<td>3</td>
<td>Fall</td>
<td>Sahas</td>
</tr>
</tbody>
</table>
227G*/228G* (Hist. 235G*/236G*) History of Christianity 1 and 2
The object of this course is to study the historical development of Christianity from its beginnings to the present as well as the institutions and doctrines expressed in the major forms of Roman Catholicism, Eastern Orthodoxy and Protestantism.
Klaassen
Not offered in 1974-75

231J The Evolution of Christian Thought: A Catholic Survey
An analysis of the major developments in Christian belief, practice and thought through the centuries. The course will examine the question of faith as a personal encounter: God meeting man; man meeting God in faith; the transmission of God's message in terms of personal communion between God and man in Christ - Kerygma, community, doctrine.
3 lectures
Bildstein

232J Christ and Contemporary Man
A systematic reflection on the revolution in contemporary consciousness and its meaning for the understanding of Jesus in a secular and pluralistic world, a search for God and experiments with truth. The significance of Trinitarian doctrine for our time. An investigation of the Jesus of History and the Christ of Faith question. Symbolism and the presence of the Risen Christ in time.
Prerequisite: 2nd year standing or consent of instructor
2 hours
Hall

233P*/234P* Contemporary Atheism and Faith in God
An examination of the sources of atheism in Western culture, the question of God in philosophy, the denial of theism and of the God of Christian faith, the hollow universe. Questions contemporary atheists ask of the Christian faith, and the response of faith. The thought of representative atheists: Nietzsche, Feyerbach, Marx, Freud, Russell, Sartre, Ayer. Experimental restatements of theism.
3 lectures, Fall and Winter terms
Prerequisite: Consent of the instructor
McLachlin

235J* Issues in Catholic Moral Theology 1
A study in moral theology of current social problems such as racism, war, poverty, urban crises, management versus labour, air and water pollution, the population explosion in the light of a Catholic interpretation of Judaeo-Christian concern. Concrete possibilities for individual initiative toward needed social change will be stressed.
Prerequisite: 2nd year standing or consent of instructor
2 hours, Fall term
Bildstein

236J* Issues in Catholic Moral Theology 2
Human sexuality and morality: a theological study of the moral aspects of issues confronting the individual: one's basic commitments, family life, work, leisure, eroticism, pornography, population control, venereal disease, contraception, abortion, consenting adults, prostitution, homosexuality, sexual relationships obscenity, censorship and similar issues.
Prerequisite: 2nd year standing or consent of instructor
2 lectures, Winter term
Bildstein
238J The Ecumenical Movement
An examination of the origin and history of the modern ecumenical movement through a study of its important leaders and events. Documents of the different Christian Churches will be examined and major doctrines in the Christian understanding of the Church will be analysed: Word, Authority, and Sacrament. 
*Not offered in 1974-75*

239* Islamic Theology, Philosophy and Mysticism
A survey of the development of the Islamic Theology and Philosophy from the beginning of sectarianism to the dawn of the 20th century, along with a study of the contribution of the mystics (sufis) to the Islamic thought. The course will introduce for study various texts from representative figures and schools of thought.
*3 lectures, Winter term*
Sahas

262R* Religion and Politics 1
An historical examination of the relationship between religious and political consciousness and institutions from primitive to modern societies. Special focus on the role of religion in the de-divinization of political society, the question of “civil religion” and the problem of “new beginnings”.
*3 lectures, Fall term*
Bryant

263R* Religion and Politics 2
An examination of the relationship between religion and politics in the 20th century. Areas of concentration will vary from year to year, and will include the following topics: the Nazi phenomenon, the Christian-Marxist dialogue in Latin America and Europe, and movements for the “re-birth of politics”.
*3 lectures, Winter term*
Bryant

264P* Religion in Canada 1
An examination of religion in Canada with particular attention to topics such as the introduction of Christianity to Canada, the encounter with native religions, the church in colonial times, denominational differences and ecumenism, the impact of religion on social and political activity, and the post-Christian era.
*3 lectures, Fall term*
Newman

265P* Religion in Canada 2
A thematic study relating to motifs arising out of the Canadian experience, e.g., the open society and transcendence, abandonment, survival, etc., based on examination of the topics indicated in RS 264P*.
*Prerequisite: 264P*
*3 lectures, Winter term*
Newman

266R* Religion and the Film 1
A theological approach to the study of film as a world-transforming phenomenon for man. An assessment of film’s special characteristics as an art form capable of addressing man’s quest for a significant existence. Consideration of a wide range of films and directors, with particular emphasis on Ingmar Bergman. Film fee: $5.00.
*3 lectures, Fall term*
Bird
267R* Religion and the Film 2
An exploration of selected themes—death, evil, guilt, fate, alienation, love, and redemption—in the films of several of today’s leading directors: Bunuel, Pasolina, Kurosawa, Fellini, Antonioni, Polanski. Film fee: $5.00.
3 lectures, Winter term
Bird

270P* Psychology of Religion
A study of theories of the psychological nature of religious experience, the sources of religious belief, and the religious significance of psychological phenomena. Special attention to such questions as faith and doubt, mass evangelism, conversion, faith healing, mysticism, ‘Jesus people’, drugs and religious experience.
3 lectures, Fall term
Newmarch

275G* Religion and Psychotherapy
A review and analysis of the dialogue between theistic religion in the West and the personality sciences since Freud: their respective views of God, man, sin, sickness and the therapeutic process. Clinicians and theorists in psychotherapy and religion from the surrounding community will contribute to the exploration.
3 lectures, Winter term
Miller

298*-299* Directed Readings in Special Subjects.

301J* Palestinian Archeology
An introduction to archaeological discoveries in Palestine. The course will deal with selected evidence for each successive archaeological period, with particular emphasis on those periods and sites which shed light on biblical sources from both the Old and New Testaments. Other areas of concern will include a critical introduction to methods of excavation and a discussion of the applicability of archaeological evidence to the reconstruction of the history and culture of the ancient Near East.
2 hours, Fall term
Coogan

302J* Covenant Theologies in Ancient Israel
An analysis of the various theologies of covenant developed in the Old Testament, with particular emphasis on the Mosaic and Davidic covenants; these will be examined both in their earliest formulations, as compared with ancient Near Eastern documents of similar form, and in their later re-interpretations in response to political, military, and moral crises in Israel’s history.
Prerequisite: R.S. 103G*, or R.S. 201J*, or the consent of the instructor
2 hours, Winter term
Coogan
303J Palestinian Archaeology: Field Experience
Participation in and archaeological excavation jointly sponsored by several institutions. The programme, which lasts for six weeks, will include training and experience in actual field work as well as lectures on the history of excavations in Palestine and on archaeological method.
Prerequisite: acceptance as a volunteer by the excavation (Costs: travel to and from Jerusalem plus weekend expenses. Estimate: $500. minimum).
Coogan

305P Intermediate New Testament Greek
Prerequisite: RS 106 or consent of the instructor
Hawkes

306J Intermediate Hebrew
Reading and exegesis of selected prose and poetic portions of the Hebrew scriptures.
Prerequisite: RS 105J or the equivalent
Three hours
Coogan

Note This course is offered in alternate years at WLU through cross-registration.

308J Intertestamental Judaism
A study of Jewish literature of the two centuries before Christianity and the first century A.D.(C.E.) with special reference to apocalyptic writings (including the Dead Sea Scrolls) and their influence upon early Christianity and the subsequent development of Judaism.
2 hours, Winter term
Hubbard

309P* The Theologians of Early Christianity
A comparative study of the distinctive ways in which New Testament writers view key issues in the early church, e.g., freedom and authority, social responsibility, the role of law, relations with the Jewish religion, the person of Jesus. An attempt will be made to relate their views to issues facing Christianity today.
Prerequisite: RS 202J*, 104G* or consent of the instructor
Winter term
Newmarch

313* Modern Religious Movements in India
A study of the development of Hinduism from medieval times to the present, with emphasis on new movements of religion and thought in the 19th and 20th centuries. Selected texts will illustrate Indian responses to the impact of the West and new expressions of Hinduism in social concern, faith and philosophy.
Prerequisite: RS 110*, 213* or consent of the instructor
3 lectures, Winter term
Thompson
314* Zen Buddhism  A seminar based on interpretations of Zen, East and West. The course will develop through four areas of concern: a) basic Mahayana principles, b) the uniqueness of Zen within Mahayana, c) Eastern interpretations, and d) Western interpretations. 
*Not offered in 1974-75*

321G* (History 347G*)  
**Radical Reformation 1**  
A study of spokesmen for radical reform of the church including Andreas Carlstadt, Thomas Müntzer, Caspar Schwenckfeld, Sebastian Franck, Michael Servetus and others.  
*Not offered in 1974-75*

322G* (History 348G*)  
**Radical Reformation 2**  
A study of Anabaptism and its place in the history of the Christian church and of the Reformation period.  
*Not offered in 1974-75*

323G* (History 353G*)  
**Medieval Church History from 312-1122**  
A study of the evolution of the dogmatic approach. Topics will include dogmatic, moral and political questions which have affected the teaching of the Church.  
3 hours, lectures and seminars, Fall term  
*Klaassen*

324G* (History 354G*)  
**Medieval Church History from 1112-1449**  
A study of the evolution of the dogmatic approach. Topics will include dogmatic, moral and political questions which have affected the teaching of the Church.  
3 hours, lectures and seminars, Winter term  
*Klaassen*

325* The Orthodox Church  
A study of “Eastern” Christianity; its history, theology, culture, spiritual experience, and its situation in modern Greece, Russian, Eastern Europe, the Middle East, and in the West.  
3 lectures, Winter term  
*Sahas*

331J The Church in the Modern World  
An examination of the technological society and an investigation of the capacity and willingness of the Church to respond to the challenges presented by a radically new world situation. Special consideration of controversial questions: War and Non-Violence; Politics and Revolution; Secularism and Secularization; Racism and Poverty; Sexuality and Marriage.  
*Not offered in 1974-75*

332R* Fantasy  
A thematic consideration of fantasy and related elements such as play, festivity, imagination, celebration and ritual as they pertain to religious thought and experience.  
Prerequisite: 2nd year standing or consent of the instructor  
3 hours, Fall term  
*Bird*

333J* Creativity  
A theological reflection on the idea of creativity by studying the play of the Creator and by investigating what has traditionally been thought of as rest and celebration and what these could be for 20th century man and woman seeking “leisure for God”. A creative look at several patterns of religious experience.  
Prerequisite: 2nd year standing or consent of the instructor  
2 hours, Winter term  
*Hall*
335J* Theologians of Renewal: John A. T. Robinson

A study in depth of the thought of Bishop Robinson, who in his response to secularization seeks to establish a radically secular concept of God and the Church. Consideration will also be given to the unique phenomenon of the Death of God theology.

2 hours, Fall term

Bildstein

336P Contemporary Theology

The sources of contemporary theology in 18th and 19th century thought, with particular reference to Kant, Schleiermacher and Kierkegaard. Selected 20th century theologians, including Buber, Barth, Tillich, Bonhoeffer and Teilhard de Chardin. Special attention to current themes such as secularization, the 'death of God', hope and the recovery of religion.

2 hours

Newman

337J* The Ideas of Teilhard de Chardin

An analysis of Teilhard de Chardin's worldview which is founded on the phenomenological observations of the scientist and on the mystical experience of the cosmic Christ. Special consideration will be given to the problems raised by Teilhard's writing: influence of science in theology, evolutionary origin of man, role of Christ-Omega, problem of evil, Teilhardian approach to ecology, contemporary contemplative spirit.

Prerequisite: 2nd Year standing, or consent of instructor

2 hours, Fall term

Hall

338J* Theologians of Renewal: John Henry Newman

An introduction to the modern problem of the integration of man's reason and religious beliefs through the writings of this prominent figure during the nineteenth century social revolution in England. Newman's attempt to reconcile Catholic teaching with the individualism, subjectivism and relativism of a World discovering the reality of change. Comparison of life-styles through a study of autobiography.

Prerequisite: 2nd Year standing

2 hours, Fall term

Hall

339J* Theologians of Renewal: Bernard Lonergan

An investigation of the thought of this contemporary Canadian scholar who examines the modern challenge to Christianity and suggests how 20th century man can discover the 20th century foundations for reflecting on God.

Prerequisite: 2nd Year standing

2 hours, Winter term

Hall
351J* Towards a Contemporary Contemplative Spirit
A theological interpretation of the 20th century search for self-meaning and an attempt to explore the need for and the possibility of a contemporary contemplative spirit. An examination of the influence of science on theology and an investigation of the religious dimensions in science. Some "contemporary contemplatives" will be considered: Jacob Bronowski, Martin Luther King, Thomas Merton, Emmanuel Mournier, Simone Weil, Elie Wiesel, etc.
Prerequisite: 2nd year standing or the consent of the instructor
2 hours, Full term
Hall

352P* Situation Ethics
An examination of the new morality that places the emphasis in ethical decision-making on the situation. The course will include consideration of the writings of Fletcher, H.R. Niebuhr, Barth, Bonhoeffer and Lehmann.
Prerequisite: 2nd year standing or the consent of the instructor
2 hours, Winter term
Newman

353* Ethics in Indian Thought
A study of ethical theory in the classical literature of India – the Vedas and the Upanisads, the unorthodox systems of the Carvakas (materialists), the Jains and the Buddhists, the six orthodox schools and the Bhagavadgita – and in the modern period – the thought of Tagore, Radhakrishnan, Gandhi and Nehru.
Prerequisite: RS 110*
3 lectures, Winter term
Legge

365* Religious Issues in Marxism
An examination of essentially religious issues in the writings of Karl Marx and in selected 'classical literature' of Marxism: the nature of transcendance, the question of ultimate reality, the nature of man, the meaning of history, the problems of alienation ideology and ethics.
3 lectures, Winter term
Thompson

366R* Religion and Contemporary Literature 1
A discussion of fundamental presuppositions concerning the relationship of religion and literature in general. Subsequently, an investigation of religion as a factor in literary vision, drawing from a wide selection of writings, including novels, essays, poetry and short stories from Eastern and Western cultures.
Prerequisite: any introductory R.S. course or consent of instructor
3 lectures, Full term
Bird

367R* Religion and Contemporary Literature 2
A thematic consideration of religious questions in contemporary literature. Reading selections will include in addition to selected theological writings a variety of representative materials from contemporary authors.
Prerequisite: any introductory R.S. course or consent of the instructor
3 lectures, Winter term
Bird
373* Religion and Social Change in the Third World
A study of basic issues that have arisen in the interaction of Hinduism, Buddhism, Islam and Christianity with politics and social change in selected areas of the Third World.
Not offered in 1974-75

398*-399* Directed Reading in Special Subjects†

401 Studies in Jewish Scriptures†

402 Studies in the Christian Scriptures†

415 Studies in Comparative Religion†

425 Studies in Church History†

430 Studies in Historical Theology†

431 Studies in Contemporary Religious Thought†

432 Studies in Selected Theological Problems†

421 The Study of Religion
The History of the study of Religion and of the religious phenomena and traditions, as well as the Methodology or methodologies developed in the field from the Classical Antiquity to the present.
Not offered in 1974-75

433J* The Problem of Authority in Contemporary Catholicism
This course will analyse the erosion of the traditional bases of authority in Roman Catholicism since the Second Vatican Council in 1965 and the Papal Encyclical “Of Human Life” in 1967. Special consideration will be given to the change in attitude toward the central authorities of the church, especially the papacy, as a result of the emergence of the laity in church government, and the implementation of the principles of subsidiarity, collegiality, the supremacy of conscience and responsible disobedience, all of which arose in some way from the Second Vatican Council.
Prerequisite: consent of the instructor
2 lectures, Winter term
Bildstein

460R*-463R* Special Topics in Religion and Culture
Focus on themes, development or the work of individual thinkers who have devoted study to the relationship of religion and culture.

460R* Eugen Rosenstock-Huessy
Special attention to the work and thought of Rosenstock-Huessy and to the “grammar of the spirit” in the writings of this contemporary thinker.
Prerequisite: 2nd year standing; at least one previous RS course
3 hours, Fall term
Bryant
461R* Sacred and Profane in Art

A consideration of the idea of "the holy" and of categories of sacred and profane in art. Particular emphasis on the writings of Mircea Eliade, Geraldus van der Leeuw and others.

Prerequisite: 2nd year standing; at least one previous RS course

3 hours, Winter term

Bird

598*/599* Directed reading in Special Subjects for graduate students.

† Students wishing to enrol in a course marked with a dagger (†) should consult the department.
Science

The Faculty of Science offers the following courses of a general nature, intended for students registered in other Faculties (Arts, Environmental Studies, Engineering, Mathematics, Human Kinetics and Leisure Studies) as well as for Science students desiring electives. Normally, no more than eight of these Science term courses (or their equivalent) at the 100-, 200- or 300-level may be applied towards any Science degree program.

100* Geological Foundations of the Environment
2 lectures per week, 2 hours laboratory alternate weeks, Fall term

Note Students desiring a full-year Geology elective should consider Earth Sciences 130 (Introductory Geology) to be found in the listings of the Earth Sciences Department. Students who are taking, or have taken Earth Sciences 130 may not take Science 100* for credit because of overlapping material.

110* From Matter to Man
Astronomy: Origin and evolution of the Universe; Galaxies, Stellar and Solar Systems. 6 weeks.


A special course available to students in the Mathematics Faculty who do not have a strong Science background, especially at the Ontario Grade 13 level. Not open to students registered in the Faculty of Science.

No prerequisites
3 lectures, Fall term

A special division of this course may be offered to first year Engineering students in the Fall term or in other terms if sufficient demand exists.

111* From Matter to Man
Chemistry: The nature of matter, atomic and nuclear reactions. Chemical bonds and the formation of molecules. 6 weeks.

Biophysics: Biological macromolecules, D.N.A., genetic code, protein synthesis. Photosynthesis, enzymes and A.T.P. Cells, organelles, specialization, nerve and muscle cells. 6 weeks.

A special course available to students in the Mathematics Faculty who do not have a strong Science background, especially at the Ontario Grade 13 level. Not open to students registered in the Faculty of Science.

No prerequisites
3 lectures, Winter term
160* Computational Methods in Science

The digital computer and graphical methods of problem solving in science will be used in the discussion of topics selected from: elementary data analysis, elementary functions, numerical and graphical differentiation and integration, solution of algebraic and differential equations, series approximation. Examples will be selected from Biology, Chemistry, Earth Sciences and Physics. *Intended for first year Science students. Offered on a CR/NCR basis

No prerequisites

3 lectures or discussion sessions per week, Fall term

200* Contemporary Science 1

An examination of some of the issues and development in contemporary science (e.g., molecular biology, astrophysics, etc.) at a non-technical level. The interaction between science and society will also be discussed. Extensive skills or background knowledge in mathematics or science are not necessary. Open to first year or upper year students. (Students registered in Science or Engineering may not take this course for credit).

No prerequisites

3 lectures per week, Fall term

201* Contemporary Science 2

Similar discussions to those of Science 200*. (Science 200* need not be taken first.) Open to first year or upper year students. (Students registered in Science or Engineering may not take this course for credit.)

No prerequisites

3 lectures per week, Winter term

209* Scientific Literature and Writing

Information search and retrieval: libraries, scientific and technical literature, abstracts, sources of data, use of computers. Patents. The art of writing: scientific papers, technical reports, letters.

No prerequisites

2 lectures or discussion sessions per week, offered in Fall and Winter terms

210 Geology of the British Isles

Stratigraphy of the British Isles. Relationship of Geological structures and lithologies to land forms: geological factors influencing the distribution of extractive industries. The course will consist of two weeks of lectures, followed by a four week field excursion through Wales, Scotland, and England. The development of stratigraphic palaeontologic techniques will be demonstrated with visits to classical geographic exposures.

Prerequisite: Earth Sciences 130 or equivalent

Summer term only, 1.0 course credit

219* Chemistry in Modern Society

The impact of chemistry on modern society will be considered by discussion of a number of topics including: marijuana and other non-medical drugs; food additives; birth controls; cancer-causing chemicals; pesticides and other chemical methods to control insects; chemical warfare.

Prerequisite: at least one year of high school Chemistry

2 lectures, Fall term
220* Chemistry of Pollution  A study of the chemistry involved in pollution problems encountered with consumer products and in selected industries. Progress in overcoming the pollution will be discussed with emphasis on the Chemistry. (Open to all interested students.)  
Prerequisite: at least one year of high school Chemistry  
2 lectures, Winter term

237* Descriptive Astronomy  A survey course in astronomy intended for non-Science students (primarily Arts, Environmental Studies and Human Kinetics and Leisure Studies students). The solar system, stars, the galaxy, galaxies and the universe. Open to first year or upper year students (Students registered in Engineering, Mathematics or Science may not take this course for credit.)  
No prerequisites  
3 lectures per week, offered in Fall and Winter terms

238* Descriptive Astronomy  A survey course in astronomy intended for Mathematics, Engineering and Science students. The solar systems, stars, the galaxy, galaxies and the universe. Open to first year or upper year students. (Students whose major field is Physics may not take this course for credit.)  
No prerequisite  
3 lectures per week, offered in Fall, Winter and Spring terms

Note  Students interested in the above courses in Astronomy should note that because of overlapping material both courses may not be taken for credit – only the one most suitable to their background. Similarly students who have taken Physics 250* – The Solar System or Physics 251* – The Stellar System may not take the above courses in Astronomy for credit because of overlapping material.

249* Continents Adrift  A review of the current revolution in the Earth Sciences. This course will trace the evolution of the Earth as we know it today, primarily from the new viewpoint afforded by the hypothesis of seafloor spreading, plate tectonics and continental drift. Recent data from the moon and neighboring planets will also be introduced.  
(Students whose major field is Earth Sciences may not take this course for credit.)  
No prerequisites  
3 lectures, Winter term

250* Environmental Geology  The influence of geological factors on the natural environment: natural hazards; effects of engineering works on the environment; geological aspects of water resources and waste disposal with particular attention to solid waste (garbage) and deep well injection of liquid wastes.  
Prerequisite: Students will find a course in Physical Geography or Earth Sciences to be an advantage.  
3 lectures, Winter term
251* Genetics and Evolution The principles, methods and applications of genetics. The basis and implications of modern evolutionary theory. The modern approach and social implications will be discussed. Open to first year or upper year students. (Students whose major field is Biology may not take this course for credit.)
No prerequisites
3 lectures per week, Fall term

252* Biology and Society A topical approach to problems of human society directly related to biological systems. Areas for discussion in any one year will be chosen from a wide range of topics. These will be dealt with both from the theoretical and practical aspects of modern biology. Open to first year or upper year students. (Students whose major field is Biology may not take this course for credit.)
No prerequisites
3 lectures per week, Winter term

260* Man and Vision Elementary treatment of physical, physiological and psychological aspects of vision. Emphasis will be placed upon the visual environment and man. Selected phenomena in vision will also be covered. (Open to non-Optometry students only.)
No prerequisites
2 lectures per week, Fall term

270* Nuclear Science A non-mathematical general treatment of the following areas of nuclear Science: historical development and discovery of new fundamental particles; artificial transmutation of elements; nuclear sources of energy; biological effects of radiation and use of radioisotopes in industry, medicine and agriculture. The impact of nuclear science on social, economic and political systems will be discussed.
Prerequisites: at least one year of high school Chemistry or Physics
3 lectures per week, Winter term

312* Physics of Music A discussion of the nature of musical sounds and the function of the instruments that produce them. The mathematical basis of harmony, musical scales. Sound production by various instruments including the human voice; radiated power, sound spectrum. Acoustics of auditoriums; amplifier and speaker systems.
3 lectures, Fall term
Recommended for any student who understands logarithms and who is interested in both Music and Physics

313* Physics of Music A continuation of Science 312* with greater use of mathematical models. Acoustics of simple sounds; sources, waves, resonance. The ear as a sound detector and analyzer. The analysis and synthesis of complex sounds. Electronic music, sound modifiers, organs and synthesizers. Acoustical impedance matching, loudspeaker enclosures, determination of the shapes of the wind instruments, acoustic radiation.
Prerequisites: Science 312*, Mathematics 31*, Physics 252* or equivalent or consent of instructor
3 lectures, Winter term
Recommended for students in the third and fourth years of Mathematics, Engineering or Science programmes
350* Canadian Non-Renewable Natural Resources
An introduction to mineral resources and the state of reserves of selected minerals. Geologic factors affecting the occurrence of economic minerals and rocks, concentrating upon energy supplies, metallic and non-metallic minerals. The historical development of certain extractive industries will be discussed together with the political and social implications of economic development.
(Identical to Man-Environment 356*)
(Students whose major field is Earth Sciences may not take this course for credit)
No prerequisites
3 lectures, Fall term

351* Human Biology 1
An approach to man as a "biological machine", and the effect of these changes on homeostasis. (Science 351* or 352* are not recommended to those students who have taken or are taking Biology 301, 303*, 304*, or 342. Not available to students who are Honours Biology or 4-year Biology majors.)
3 lectures, Fall term

352* Human Biology 2
Selected topics in human biology such as co-ordination of tissue function, metabolism, reproduction and the effects of harmful chemicals and drugs in common usage. (Science 351* or 352* are not recommended to those students who have taken or are taking Biology 301, 303*, 304*, or 342. Not available to students who are Honours Biology or 4-year Biology majors.)
3 lectures, Winter term

400 The History of Science
The development of scientific concepts from the Renaissance to the early 20th century, Copernicus and Galileo, Sir Isaac Newton. The physical and biological sciences during the 18th century. Lavoisier. 19th century developments in physics, chemistry, geology, biology and technology. Evolution and the rise of modern genetics. The 20th century revolution. Emphasis will be given to the reading of the works of historically important scientists.
Prerequisites: The first year Science programme (page 000) or equivalent
2 lectures per week, two terms, (Fall-Winter)
This course will normally be given every other year (usually in odd years, e.g. 1973, 1975, etc.)

410* Technical Report (For Students in Co-op Applied Chemistry, Co-op Applied Physics and Co-op Earth Sciences only.)
Technical reports covering work term assignments are submitted by all Co-op Science students. These will be carefully evaluated for technical content and writing ability. Four satisfactory reports are required prior to graduation but this number will be reduced to three for students transferring to Co-op Science in the 2B or later terms. A word Grading system will be used and will range from Excellent to Unsatisfactory. This course will be added to the student's transcript at the completion of Year 4 and will be given 0.50 course credit; this credit is to be in addition to the regularly required number of course credits shown in the programme listings.
451* Our Biological Environment. The Land

A lecture course providing a study of the terrestrial environment with special reference to the impact of man. Topics covered will include a consideration of the main terrestrial ecosystems of the world; energy flow and material cycling, succession and adaptation; soils and soil erosion; applied ecology including aspects of conservation and pollution; biological versus chemical control of pests; and a discussion of the problems of human population and world food supply. (Students registered in Honours Biology programmes may not take this course for credit.)

No prerequisites

Science 451* may not be taken for credit if credit has been given for Environmental Studies 200*, except by permission of instructor

3 lectures, Fall term

452* Our Biological Environment. The Water.

A lecture course providing a study of freshwater and marine environments with special reference to the effects of modern man. Topics covered will include a survey of the ecosystems and biota; nutrients and biological growth; eutrophication; biological aspects of water supply and water pollution; pests and their control; fish and fisheries problems; introduction to oceanography. (Students registered in Honours Biology programmes may not take this course for credit.)

No prerequisites

3 lectures, Winter term
Social Science (Applied) Programme

Professor, Director of Programme
D.G.S. M'Timkulu, M.A.(South Africa), M.A.(Yale), Ph.D.(Natal)

Associate Professor
B. Sheppard, B.A.(Queen's), M.S.W.(Ottawa)

Assistant Professors
J. Forest, B.A.(Sir George Williams), Ed.D.(Massachusetts)
H. Miller, B.Sc.(McGill), M.A.(Waterloo)
M. Nagler, B.A.(U.B.C.), M.A.(Chicago)
M. Webber, B.A., M.S.W.(Dalhousie)
J. Wine, B.Sc.(Lewis and Clark), M.Sc.(Wisconsin), Ph.D.(Waterloo)

Assistant Professor, Religious Studies
M. Bird, B.A., M.A.(Iowa)

Assistant Professor, Religious Studies
D. Bryant, B.A.(Concordia College), S.T.B.(Harvard), M.A.(Toronto)

Assistant Professor, Human Relations and Counselling Studies
M. Forest, B.A.(Queen's College), M.A.(Columbia), Ed.D.(Massachusetts)

Assistant Professor, Geography
B. Hyma, B.Sc., M.Sc.(Madras), M.A.(Sheffield), Ph.D.(Pittsburgh)

The Social Science (Applied) Programme at Renison College currently offers a three-year interdisciplinary curriculum leading to a general B.A. within the Arts Faculty of the University of Waterloo. In addition to this ongoing programme, a four-year honours programme (co-operative or regular) may also be launched in September, 1974. The idea for this unique programme was generated as a response to contemporary student needs which point to the need for an expanding opportunity to integrate academic pursuits and substantial practical experience.

Courses in sociology, psychology, social work and interdisciplinary concerns are offered by faculty in each of these core areas as well as by supportive faculty from other disciplines. Human growth and social issues are examined in the context of institutional arrangements that affect life, as well as safeguards and systems that must be created to enhance collective human welfare.

The programme realizes its applied emphasis through the development and operation of projects within and outside the university community to balance and test theory and practice against each other. With a commitment to confronting contemporary social problems, the Social Science (Applied) Programme is designed for students interested in employment or graduate studies in human service areas such as community organizing, journalism, law, social work, communications, international service programmes, theology, etc.

Proposed Honours Programme (4 Year Co-operative or Regular)
Renison College hopes to initiate, in September 1974, a 4 year programme which will lead to an Honours B.A. in Social Science (Applied). If this programme is implemented students will have two options: Co-operative and Regular.

Specific requirements have not yet been finalized. For further information contact the Programme Director, Renison College, Waterloo, Ontario N2L 3G4.
The General Programme
(3 Year Regular)

The general programme consists of 6 academic terms in a period of 3 years. All courses are offered in the Fall or Winter terms. Students in all years enroll in September. The programme requirements are listed below.

1) A minimum of 15 full courses in total;
2) The normal "Group A and B" requirements of the Faculty of Arts (Refer to Chapter 8);
3) A minimum of 6 full courses from the core area courses listed below with the following stipulations:
   a) A student is required to complete a minimum of 2 full courses from the list in each year that he/she is registered in the three year programme. (In the first year a student normally registers for the 3 introductory courses in sociology, psychology and social work or their equivalent in the Integrated 120's sections of these courses. See Note 1 under Core Area Courses).
   b) The six courses must be distributed over at least 3 of the 4 core areas with a maximum of 3 courses within a single area counting towards the requirement.
   c) The prerequisite for all courses at the 200 level or above is 2 courses from among the 120 level courses. In the case of upper level courses in psychology, sociology, and social work, one of the prerequisite courses should be in the appropriate discipline.
4) After meeting these minimum requirements, the student may elect his/her remaining courses from the general arts offerings of Renison or any department of the University.
5) Transfer students from other programmes, faculties or universities must comply with all requirements as set out above. In special cases they may petition for equivalent credit for courses taken elsewhere which are similar to core area courses. Petitions should be directed in writing to the Programme Director.
6) For further information consult the Programme Director, Renison College, Waterloo, Ontario N2L 3G4.

Core Area Courses

<table>
<thead>
<tr>
<th>Interdisciplinary</th>
<th>Psychology</th>
<th>Sociology</th>
<th>Social Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Science</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS 120R*</td>
<td>Psych 120R</td>
<td>Soc 120R</td>
<td>Soc WK 120R</td>
</tr>
<tr>
<td>121R*</td>
<td>or 120(RI)</td>
<td>or 120(RI)</td>
<td>or 120(RI)</td>
</tr>
<tr>
<td>ISS 210R</td>
<td>Psych 220R</td>
<td>Soc 220R*</td>
<td>Soc WK 235R*</td>
</tr>
<tr>
<td>ISS 225R</td>
<td></td>
<td>Soc 221R*</td>
<td>/236R*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soc 225R*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>226R*</td>
<td></td>
</tr>
<tr>
<td>ISS 310R</td>
<td>Psych 330R</td>
<td>Soc 320R</td>
<td>Soc WK 320R</td>
</tr>
<tr>
<td>ISS 367R*</td>
<td>Psych 367R*</td>
<td>Soc 367R*</td>
<td>Soc WK 367R*</td>
</tr>
<tr>
<td>369R*</td>
<td>-369R*</td>
<td>369R*</td>
<td>-369R*</td>
</tr>
<tr>
<td>ISS 398R*</td>
<td>Psych 398R*</td>
<td>Soc 398R*</td>
<td>Soc WK 398R*</td>
</tr>
<tr>
<td>399R*</td>
<td>-399R*</td>
<td>399R*</td>
<td>-399R*</td>
</tr>
</tbody>
</table>
Note Integrated 120's sections of Introductory Sociology, Psychology, and Social Work are designated with an (RI) division suffix. Taken together these 3 sections comprise a team-taught alternative to the regular introductory courses in these subjects which incorporates a more experimental approach and a different time schedule. Contact Renison before registering.

Interdisciplinary Social Science

ISS 120R*/121R* Focal Issues in Contemporary Society
An attempt to bring together and condense what are believed to be essential elements of the several social science disciplines. The core of the study is a group of selected contemporary issues with implications that cut across all the various disciplines. An effort will be made to discuss values appropriate for our age. (Cross-listed with Arts 120G*/121G*).

ISS 210R Community Issues
An examination of political, social and ethical issues, with particular emphasis on the Kitchener-Waterloo community. A study of both historical and contemporary aspects of selected problems and a consideration of various strategies for maximising social concern and response.

ISS 225R Social Research
Introduction to the philosophy and methods of applied social science, the problems and strategies of research design and analysis. Emphasis on collection, analysis, and presentation of research data using a variety of qualitative and quantitative methods. Descriptive, sampling and elementary inferential statistics are considered together with interviews, surveys, case studies, participant observation, demographic analysis, small group research, experimental design, etc.

ISS 310R Critical Encounter With the Study of Man
An attempt to develop a critical sense of the relevance of the social sciences to man. Focus on questions cutting across several disciplines. Special attention to men, theories and methodologies at the “cutting edge” of the social sciences, with emphasis on those taking an interdisciplinary approach. For students with some prior background in social science courses. The course will be team-taught by persons from different disciplines.

ISS 367R*-369R* Special Topics in Applied Social Sciences
One or more half courses of an interdisciplinary nature will be offered from time to time as announced by the Social Science (Applied) Programme. Subjects will be dependent upon special research and/or instructional interests of faculty.

ISS 398R*-399R* Independent Study
An independent in-depth study with an interdisciplinary focus of a selected area of concern to the student. This course may be undertaken by an individual or small group of students with one of the faculty members from the Social Science (Applied) Programme.
Psychology

Psych 120R Introductory Psychology
Basic concepts and techniques of modern psychology as a behavioural science, with special emphasis on social aspects of behaviour. The development of behaviour, learning and remembering, motivation, values and attitudes, personality, sensation and perception, and small group processes will be studied with reference to physiological correlates and environmental factors.

Psych 220R Social Psychology
An examination of psychological principles involved in the interaction of individual and society. Emphasis on social attraction, socialization of the child, language and social communication, interpersonal perception, attitude formation, personality and society, status and roles, social control, group dynamics and leadership.

Psych 330R Social Functioning and Human Behaviour
Relationships between models of the nature of the human being and societal structures. Psycho-analytic, existential, behaviouristic and humanistic models will be examined. Contrasts of views of abnormal behaviour as human experiencing, personality disorder, social problems, and a manifestation of culture. A brief summary of treatment procedures with social emphasis on community-based approaches to treatment and prevention. (Cross-listed with Psych 355* / 357*).

Psych 334*(R) Theories of Counselling Psychology
An introduction to the theories, methods and problems in Counselling Psychology. 
Fall term.

Psych 367R*-369R* Special Topics in Psychology
One or more half courses will be offered from time to time as announced by the Social Science (Applied) Programme. Subjects will be dependent upon special research and/or instructional interests of faculty.

Psych 398*-399R* Independent Study
An independent in-depth study of a selected area of concern to the student within the discipline of psychology. This course may be undertaken by an individual or small group of students with one of the faculty members from the Social Science (Applied) Programme.

Sociology

Soc 120R Fundamentals of Sociology
An examination of the fundamental concepts of sociology and their application in seeking to understand the changing patterns and life styles taking place specifically in Canada, and in general, within North American society. Patterns of deviance, social stratification, minority adaptation, and changing patterns in organization, family, political process, and religious observance will be examined.

Soc 220R* Sociological Analysis
An application of sociological analysis to the study of various institutions such as education, religion, law and marriage (in 1974-75 emphasis will be on the institution of marriage). Development of an approach or methodological perspective which can be applied to the study of other social phenomena. 
Fall term.
Soc 221R* Master Trends in Modern Society  
Introduction to the major problems of urban, industrial, and political sociology studied within a framework emphasizing social change. Illustrations will be drawn from emergent as well as advanced societies.  
Winter term.

Soc 225R* Race and Culture in the Third World 1  
A general introduction to contemporary problems of race, culture and ethnic relations in the developing countries of Asia and Africa.  
Fall term.

Soc 226R* Race and Culture in the Third World 2  
Problems of acculturation and intergroup relations in plural societies in selected areas in the Caribbean, South and Southeast Asia, East and Southern Africa.  
Winter term.

Soc 320R Canadian Ethnic and Cultural Minorities  
A detailed examination of various minorities in Canadian society. The first section of the course will stress the fundamental concepts and issues of race and ethnic relations and the final segments of the course will incorporate the application of these fundamentals to the various groups in the Canadian mosaic. In 1974-75 North American Indians will constitute a central focus of analysis.

Soc 325*/326R* Issues in Third World Development  
The course will examine the impact of modernization on the value systems and social structures of selected African/Asian societies – Zambia, Malawi, Botswana, Lesotho and Swaziland with comparative reference to some developing Asian countries. The approach will be a case study approach within a theoretical framework. The course will in particular investigate the functioning of the new elite, including some analysis of its new habitat, the city.

Soc 367R*-369R* Special Topics in Sociology  
One or more half courses will be offered from time to time as announced by the Social Science (Applied) Programme. Subjects will be dependent upon special research and/or instructional interests of faculty.

Soc 398R*-399R* Independent Study  
An independent in-depth study of a selected area of concern to the student within the discipline of sociology. This course may be undertaken by an individual or small group of students with one of the faculty members from the Social Science (Applied) Programme.

Social Work

Soc WK 120R Introduction to Social Work  
A study of the origins and developments of the profession, of social work, including the study of parallel societal developments.

Soc WK 125R* Social Problems  
A study of contemporary social problems with which social work is concerned. Emphasis is divided between theoretical approaches to understanding the problems and study of societal responses to and intervention in the problem.  
Winter term.
Soc WK 235R*/236R*
**Foundations of Practice**
An examination of the methods of social work practice: casework, group work, community organization and administration.

Soc WK 320R
**History of Social Welfare**
History and development of social welfare as an institution from its origins to the modern welfare state. Emphasis on current issues in social welfare and patterns of service.

Soc WK 367R*-369R*
**Special Topics in Social Work**
One or more half courses will be offered from time to time as announced by the Social Science (Applied) Programme. Subjects will be dependent upon special research and/or instructional interests of faculty.

Soc WK 398R*-399R*
**Independent Study**
An independent in-depth study of a selected area of concern to the student within the discipline of social work. This course may be undertaken by an individual or small group of students with one of the faculty members from the Social Science (Applied) Programme.

**Elective Courses**
The following elective courses are administered by Renison College. For fuller descriptions, see appropriate departments.

**Arts**
220R*/221R* Chinese Thought and Culture, 1 and 2  
250R Art and Society

**English**
140R*/141R* The Use of English, 1 and 2  
205R* The Canadian Short Story  
245R Form and Function  
376R*/377R* Our Changing Language: Syntax and Semantics, 1 and 2  
385R Twentieth Century Literature

**Fine Arts**
246R*/247R* Religion and the Film, 1 and 2

**Geography**
125R* Introduction to the Developing World  
126R* The Emerging “Third World”  
225R* Urbanization in Newly Developing Countries  
226R* Population Growth and Resource Development in “Third World” Countries

**History**
101R*/102R* Major Themes of Western Civilization, 1 and 2  
269R A History of Modern Revolutions  
367R*/369R* A History of Militarism, 1 and 2

**Religious Studies**
160R*/161R* Religion and Culture, 1 and 2  
262R*/263R* Religion and Politics, 1 and 2  
266R*/267R* Religion and the Film, 1 and 2  
298R*/299R* Directed Readings in Special Subjects  
331R* Fantasy  
366R*/367R* Religion and Contemporary Literature, 1 and 2  
460R*/463R* Special Topics in Religion and Culture  
460R* Eugen - Rosenstock Huessy  
461R* Sacred and Profane in Art
Department of Sociology and Anthropology

Sociology

Assistant Professor and Chairman
J.E. Curtis, B.A.(Sir George Williams), M.A.(Central Michigan), M.A.(Cornell)

Professors
G.L. DeGre, B.S.S.(City College, N.Y.), M.A., Ph.D.(Columbia), Cated Hon.(San Marcos, Lima)
H.J. Fallding, B.A., B.Sc., M.A.(Sydney), Ph.D.(Australian National)
N. High, B.S.A.(Toronto), M.S., Ph.D.(Cornell)
H.D. Kirk, B.S.(City College, N.Y.), M.A., Ph.D.(New York)
G D. Smucker, B.A.(Bluffton), B.D.(Princeton), M.A., Ph.D. (Chicago)

Visiting Professor 1973-74
O. Hall, B.A.(Queen's College), M.A.(McGill), Ph.D.(Chicago)

Associate Professors
M.A. Beauchamp, B.A., M.A.(Buffalo)
E.A. Fasick, B.A.(Penn. State), M.A., Ph.D.(Columbia)
D. Kubat, M.A.(Kansas), Ph.D.(L. Maximilian, Munich)
R.D. Lambert, B.A., M.A.(McMaster), Ph.D.(Michigan)

R D.G.S. M'Timkulu, M.A.(S. Africa), M.A.(Yale), Ph.D.(Natal)
W.G. Scott, B.A.(Western), M.A.(Toronto)
E.W. Vaz, B.A., M.A.(McGill), Ph.D.(Indiana)
A. Wipper, B.A., M.A.(McGill), Ph.D.(California, Berkeley)
P. Wooldridge, B.A.(Chicago), B.S., M.A.(Florida), Ph.D.(Yale)

Assistant Professors
J.M. Alleyne, B.A.(Sir George Williams), Ph.D.(Johannes Gutenburg)
J. Curtis, B.A.(Sir George Williams), M.A.(Central Michigan), M.A.(Cornell)
M. Eichler, M.A., Ph.D.(Duke)
L. Fischer, B.A.(Rutgers), M.A.(Northwestern), Ph.D.(Duke)
A.Q. Lodhi, M.A.(Punjab), M.A., Ph.D.(Toronto)


Lecturer
B. Leathers, B.A., M.A.(Carleton)

Associated Faculty

Professor, Human Relations
J.M. Butler, B.Sc., Ph.D.(Minnesota)

Professor, Statistics
W.F. Forbes, Ph.D., D.Sc.(London) D.I.C.

Professor, Kinesiology

Professor, Psychology and Human Relations
M. Lerner, B.A., M.A.(Ohio State), Ph.D.(N.Y.U.)

Assistant Professor, Kinesiology
B. McPherson, B.A., M.A.(Western Ontario), Ph.D.(Wisconsin)
Undergraduate Courses in Sociology

Note 1 General students who major in Sociology must elect the following courses: Sociology 101*, a half course in sociological methods, a half course in sociological theory, and three and one half full courses (or equivalent half courses) in Sociology. Students are strongly encouraged to elect Sociology 202*, although this is not required.

Note 2 An Honours programme in Sociology is a pre-professional degree, so the specific requirements have been formulated in the light of professional and graduate school requirements. Students are reminded that Sociology is now accepted as a high school teaching subject in Ontario. Potential high school teachers should keep informed of the requirements for teaching Sociology in high schools. Students may elect Honours Sociology (Canadian Studies) by fulfilling the requirements listed under Canadian Studies in this calendar.

Note 3 The student is reminded that an Honours or a major programme in Sociology is intended to provide a liberal arts education. Students are encouraged to avoid excessive concentration in Sociology, and to elect courses in a variety of social sciences, humanities, modern languages, as well as in other Faculties.

**101* Introduction to Sociology** An introduction to the basic concepts and frames of reference of sociological investigation and interpretation. Topics for analysis will include communities, associations and institutions, classes and status groups, crowds and publics, social processes, and social change. Special attention is given to Canadian society.

*Not open to students who have taken Soc. 1417, 101(f)* or 101(m)*

2 lectures, Fall and Winter terms

**101(f)* The Sociological Enterprise** A survey of what sociologists do, with an introduction to rudimentary sociological methods. Readings from a variety of sources giving an account of the thinking behind sociological projects of small and large scale.

*Not open to students who have taken Soc. 101*

*Not offered 1974-75*

**101(m)* Introduction to Formal Sociology** An introduction to the fundamentals of sociology using examples from mathematical sociology. While students will be responsible for the core material covered in Sociology 101 the emphasis will be on experiments in and simulation of social processes. The course will consider several modelling efforts in the areas of three person games, spontaneous group formation, organizational complexity, diffusion of innovation, and stable population theory.

*The course is intended as an elective for mathematics students or as a basis for a combined honours in mathematics and sociology.*

2 lectures and lab, Fall term
202* Sociological Statistics
A first course in sociological statistics; sampling, central tendency, probability, co-variance, as illustrated in specifically sociological data.
Prerequisite: Soc. 101*, or equivalent other introductory social science course
2 hours lecture, 2 hours lab, Fall term

203* Introduction to Comparative Social Thought
Lectures, readings and discussion of selected original sources both Eastern and Western which attempt to define and evaluate the relation of the individual to society, and society to nature and cosmos, as expressed in classical as well as in later documents. Topics will include the mythological world-view; the emergence of an ordered social cosmos in Greece, the Middle East and China; and the response to these issues in the social thought of Europe.
No prerequisite
2 hours, Fall term

205* Sociological Analysis of 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, poverty, delinquency and industrial disruptions in Canadian society.
No prerequisite
2 lectures, Fall and Winter terms

208* Elementary Problems in (non-participant) Field Observation
Sociological concepts and ideas are put into use in systematic observation, recording, and analysis of structures and processes related to particular social institutions. For example, courts that are open to the public enable us to combine theoretical learning about the systems of jurisprudence and jurisdiction on the one hand and their application in particular courts on the other. Relevant readings, observational records, and resulting methodological or theoretical questions will be discussed in seminars and tutorials.
Prerequisite: Soc. 101* and permission of the instructor
Not offered 1974-75

209* Advanced Problems in (non-participant) Field Observation
A continuation of Sociology 208*. Here instruction concentrates on the use of observational data in the formulation of questions about the structures and dynamics that have been and are currently being observed and recorded. A satisfactory grade in Soc. 208* is required for admission to Sociology 209*.
Prerequisite: Soc. 208*
Not offered 1974-75

210* Introductory Social Psychology
Basic concepts in the interdisciplinary field of social psychology; approached from the perspectives of social influence. Individualistic, interpersonal, and group-based strategies for influencing the behaviour of others are examined.
Prerequisite: Soc. 101* or Psych. 101*
3 hours, Winter term
215* Sociology of Sex Roles
A comparative analysis of women's roles in past and present with selected cross-cultural data. Assessment of the present situation, especially sex role socialization and the impact of sex roles on the family and the economy. A discussion of the women's liberation movement is included.
Prerequisite: Soc. 101*
2 hours of lecture, 1 hour of discussion, Fall and Winter terms

218* Sociology of Adolescence
The social definitions of adolescence in cross-cultural and historical perspective. Social roles of adolescence in the institutional structures of urban industrial societies with special emphasis on the family, education, and the economy. The relationship of adolescents' social roles to processes of social change and stability.
Prerequisite: Soc. 101*
2 lectures, Winter term

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.
Prerequisite: Soc. 101*
2 lectures, Winter term

241* Social Movements
The sociological analysis of varieties of social movements and their relationships to social organization and social change.
Prerequisite: Soc. 101*
2 lectures, Fall term

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. Special attention is given to Canadian data. A sound knowledge of sociological concepts is advisable.
Prerequisite: Soc. 101*
2 lectures, Fall term

251* Ethnic and Racial Relations
Relations between different racial and cultural groups; analysis of majority-minority group status with special reference to Canada.
Prerequisite: Soc. 101*
2 lectures, Winter term

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.
Prerequisite: Soc. 101*
3 lectures, Fall and Winter terms

261* Population Issues
The study of population as an area of sociological investigation; population size, composition, and distribution; population trends and problems.
No prerequisites
Not offered 1974-75
262* Canadian Population
Study of the basic demographic processes in the population of Canada. Demographic implications for selected social institutions. Use of Canadian enumeration and registration data.
No prerequisites
Not offered 1974-75

265* Social Structure of East Asia: China and Japan
An analysis of the social structure and stratification of East Asia in terms of class, status, prestige, rank and functions with special consideration given to the question of class formation in Japan and attempted class elimination in China.
No prerequisites
Not offered 1974-75

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.
Prerequisite: Soc. 101*
2 lectures, Fall term

280* Social Organization of Animal Societies
The social behaviour of various species of animals will be examined and compared. The main emphasis will be on exploring the nature of social behaviour and gaining further understanding of human societies by comparing them with others.
Prerequisite: Soc. 101*
2 lectures, Fall term

300* Canadian Social Institutions
General theoretical and methodological issues in the study of social institutions and Canadian substantive examples in comparative perspective. Special attention is paid to such social institutions as the economy, polity, stratification and the family and to institutional interrelations. How are institutions linked? What is exchanged between institutions? What are the origins and character of institutions and how do they undergo change? Extensive readings from the Canadian literature.
Prerequisite: Soc. 101*
Not offered 1974-75

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 Canada, with comparative reference to the principal industrial cities of Western societies.
Prerequisite: Soc. 101*
2 lectures, Fall term

302* Social Structure and Character
The relationship between social structure and modal as well as deviant personality types. Differential processes of socialization and effects of personality on social organization. Social structures considered will include occupational and kinship groupings in the context of comparative studies of capitalist and socialist societies, and of slavery in Latin and Anglo America.
Prerequisite: Soc. 101* or permission of the instructor
2 hours, Winter term
303* Crises in Social Structure and Character
The effect of drastic change on social structures and on modal as well as deviant personality types. A series of sociological studies of disasters suggests systematic ways of thinking about catastrophic circumstances and their effects on social systems and related patterns of human identity.
Prerequisite: Soc. 101* and permission of the instructor
2 hours, Fall term

308* Elementary Problems in (participant) Field Observation
Here, as in Sociology 208* and 209* concepts and ideas are to be put to use. Now, however, the observational setting is complicated by making the observer part of it. Participant observation may take place in formal organization settings such as hospitals, factories, or schools, or in informal association settings involving voluntary associations and groups. Reading recording and seminar discussion supplement the field experience.
Prerequisite: Soc. 101* and permission of the instructor
Not offered 1974-75

309* Advanced Problems in (participant) Field Observation
A continuation of Sociology 308*. Here instruction concentrates on the use of observational data in the formulation of questions about the structures and dynamics that have been and are currently being observed and recorded. A satisfactory grade in Sociology 308* is required for admission to Soc. 309*
Prerequisite: Soc. 308*
Not offered 1974-75

310* Seminar in Group Dynamics
An analysis of natural and experimental groups from a social structural view. The study of processes of differentiation, integration, power, etc., internally; and of nesting of small groups in larger collectives.
Prerequisite: 3rd or 4th year standing in a social science or by permission
2 hours seminar, Fall term

315* Social Stratification
Analysis of social classes in society including their basis for development, composition, and consequences for society. Special attention is given to social stratification in Canada.
Prerequisite: Soc. 101*
3 hours, Winter term

321* Research Methods I
A systematic treatment of the logic and practice of methods basic to social research. Emphasis is on problems of research design based on the analysis of case studies. Special attention is given to problems of participant observation, use of available data, measurement of variables, and simple multivariate analysis. Students will be given laboratory and field experience in several techniques of research. Special attention is given to Canadian cases and data.
Prerequisite: Soc. 101* or equivalent other introductory social science course
2 lectures, 1 hour lab., Fall term
322* Research Methods 2  Continuation of Research Methods 1. Includes an introduction to sampling, scaling, the analysis of change, and experimental design. Students will be asked to construct a research design for the study of a theoretically relevant problem in sociology.

Prerequisite: Sociology 321*
2 lectures, 1 hour lab., Winter term

323* Projects in Sociological Research  Introduction to sociological research through the formation of a theoretically based research objective and its implementation in a small scale team research project. Students must be willing to participate in team research with 6-8 other students. Readings are assigned that relate to the steps in the team project. The course grade is based on each team’s final project report and on a final examination covering the readings.

Prerequisite: Soc. 101*
2 hours seminar, Winter term

324* Field Research in Canadian Institutions  A study of selected institution in the local community, such as the Courts, Mass Media, and Labour Unions, will be conducted employing observational and interview procedures.

Prerequisite: consent of the instructor
Not offered 1974-75

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 (including Canada).

Prerequisite: Soc. 101*
Not offered 1974-75

331* Theories of Social Change  A systematic review and analysis of major theories of social change including some of the classical and modern theories. Analysis will focus upon the sources, patterns, processes and consequences of change. Special topics to be included are: Marxism, social change in developing countries, the role of ideas, and the breakdown and reorganization of social structure.

Prerequisite: Soc. 101*
2 lectures, Winter term

332* Social Conflict and Modernization  This course constitutes a sociological study of violent and non-violent conflict and modernization in comparative perspective. A critical review of the selected theoretical explanations of collective protest and social change will be done to discover linkage between social conflict and modernization. An attempt will be made to examine causes and consequences of racial and political violence in modernizing society.

Prerequisite: Soc. 101*
2 lectures, Winter term

334* Northern Lands and Peoples  A comparative study of social and cultural change in Arctic and Sub-arctic areas brought about by political and economic development of those lands.

No prerequisites. $45.00 fee to cover field trip
Not offered 1974-75
335* Sociology of Science  
The study of science as an institution; its historical development and contemporary relationship with other institutions including government, education, and industry.  
*Prerequisite: Soc. 101*  
3 lectures, Winter term

338* Sociology of Literature  
This course attempts to provide the student with an opportunity for exploring literature as a social phenomenon. Specific areas to be dealt with might include: 1) the relationship of the artist to his social structure; 2) the nature of the relationship of the work and its audience; 3) the attitudes toward the social structure implicit in the work of art. In general the course is viewed as an attempt to combine both the scientific approach and the humanistic approach to literature. Here literature is viewed as including both belles lettres and popular culture. The course will be taught by someone in Sociology and someone in Literature in dialogue method.  
*Prerequisite: Sociology 101* and English 101 (or equivalent)  
Not offered 1974-75

339* Industrial Sociology  
Sociological analysis of industry, including relationships between labour and management and industry and society.  
*Prerequisites: Soc. 101*  
2 lectures, Winter term

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.  
*Prerequisite: Soc. 101*  
2 hour seminar, Fall term

341* Occupational Sociology  
An introduction to the study of work and occupations; the problems of occupational choice, occupational socialization and identification; the concept of careers and career mobility, the professionalization process, the nature of professions; the impact of occupation on life styles, leisure and retirement.  
*Prerequisites: A 100 level sociology course. Soc. 342 is recommended as complementary*  
2 hours, Winter term
342* Social Structure of the Canadian Labour Force
An examination of the social factors which account for the deviation of the structure and functioning of the Canadian labour market from the "pure" economic market model. Topics will include: the changing occupational structure; sex based differences in occupation and participation; ethnic factors in occupations; the impact of large corporations and unions on labour market functioning; the role of national and international mobility in labour allocation; the labour market and social mobility. Some background in economics and/or demography is desirable but not essential.
Prerequisite: A 100 level sociology course. Soc. 341 is seen as complementary to 342 but is not a prerequisite.
2 hours, Winter term

350* Seminar in Socialization Processes
The social creation of Actors; the establishment of legitimacy and the development of loyalty; socialization through the life cycle; cohorts and age-grading; generational differences and youth movements.
Prerequisite: 3rd or 4th year standing in a social science or by permission
3 hours, Fall term

355* Sociology of Religion
Religion is defined broadly and its relation to phenomena like totalitarian movements, psychoanalysis and drug experience examined. The features common to all religions are explained, viz. myth, dogma, church, ritual, ethic, and religious experience. Much religious diversity is explained, for example, the diversity due to sectarian and ecumenical movements, to divergent views of salvation, and to secularization.
Prerequisite: Soc. 101*
2 lectures, Fall term

360* Political Sociology
The sociological analysis of the institutionalization of power, political movements, parties, conflict and its accommodation.
Prerequisite: Soc. 101*
2 lectures, Winter term

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.
No prerequisites
Not offered 1974-75

371* Philosophy of Social Science
Problems about the fundamental methods and aims of the social sciences generally, the problems specific to Psychology, Sociology, Political Science, etc., and their relations to one another will be considered.
(Same as Phil 362*)
Not offered 1974-75
372* Medical Sociology  Examination of the medical care structures from the point of view of patients, health care professionals in the system, and systems analysis. Structures of interest are primary health care settings, hospitals, and professional associations. Emphasis on cross-cultural comparisons and changes over time as well as critical analysis of current structure from the point of view of the Canadian health care consumer.

Prerequisite: Soc. 101*

2 lectures, Winter term

373* Aging, the Aged and Leisure: A Sociological and Social Psychological Perspective  Employing a sociological and psychological frame of reference, the process and problems of aging will be analysed. Special emphasis will be given to the problem of leisure time in the later years of life.

(Same as Kinesiology 352* and Recreation 361*)

Prerequisite: Sociology 101* and one other sociology course

3 lectures, Fall term

374* Sport in Society  An introduction to the sociology of sport. Utilizing the major frames of reference of the social sciences, the function of sport in contemporary society is examined.

(Same as Recreation 303* and Kinesiology 452*)

Prerequisite: Sociology 101 and one other Sociology course

3 lectures, Winter and Spring terms

375* Sociology of Leisure  Nature and extent of leisure phenomena in contemporary society. Examination of institutional and formal organizational aspects, social role, social research strategies employed in the study of leisure.

(Same as Recreation 301*)

Prerequisite: Two term courses in Sociology, i.e. Sociology 101* and 341*

3 lectures, Winter term

382* Techniques of Demographic Analysis  Introduction to the standard techniques of analysis of enumeration and registration data.

Prerequisite: Soc. 261*

Not offered 1974-75

399* Research Seminar in Canadian Society  A research oriented seminar dealing with selected topics in Canadian society and cross-national comparisons. Each student will select a research problem and collect and analyze fresh data or subject existing data to secondary analysis. Students should be willing to acquire the necessary research skills, such as processing data with SPSS.

Prerequisite: Registration in 3rd or 4th year of social science honors programme

3 hours seminar, Winter term
400 Processes of Planned Change

The goal of the course is to develop models of social change, through active participation in action groups in the community, reading, seminars, and written analyses. All students will be expected to join a group oriented to altering or maintaining existing social structures, to participate as full members, and at the same time to make social scientific sense of social process as manifested in the group and its relation to the environing system.

Prerequisite: Consent of instructor
Not offered 1974-75

402* Marxist Social Theory

This course will focus on the contribution of Marxism to the development of sociological theory in its relation to other types of social thought. Readings will include selections from Marx, Engels, Lenin, Gramsci, Plekhanov, Lukacs, and contemporary sources.

Prerequisite: 4th year Honours or graduate standing
2 hours seminar, Winter term

404* Crisis Management

Some crises of social structure and of social identity or character are so pervasive as to require universally understood social mechanisms for coping with them. Chronic physical or mental disabilities, disease and death, poverty and economic dependency – these are among the common, generic human crises. Being generic, such crises are everywhere institutionally managed. This course seeks to explore such institutional coping mechanisms as medical and welfare services in the context of Weber's types of authority and types of rationality.

Prerequisite: Sociology 303 or permission of the instructor

2 hours, Winter term

410* Seminar in Self and Social Interaction

Social Psychological theory and research on the self, self-awareness, and self-worth; the self in systems of social interaction.

Prerequisite: 3rd or 4th year standing in a social science or by permission
Not offered 1974-75

415* Seminar on the Impact of Sex Factors on Sociological Theory and Research

An examination of selected areas of contemporary sociological theory with respect to their treatment of women and men.

Prerequisite: Soc. 215 and 3rd or 4th year standing in social science or permission of the instructor

2 hour seminar, Winter term

421* Secondary Analysis of Survey Data

Methodological problems in developing and testing social and behavioural theory through the analysis of survey data will be examined, and actual analysis of data from local data banks will be performed, using available computer programmes. A term paper consisting of an original analysis and interpretation will be required. No previous experience with the computer is assumed.

Prerequisite: Soc. 202* or permission of instructor
Not offered 1974-75

425* The Development of Sociological Theory

Development of sociological theory in the 19th and early 20th centuries. Emphasis is on the European tradition although selective attention is given to North American theorists.

Prerequisite: Open only to students in Sociology
2 lectures, Fall term
426* Contemporary Sociological Theory
The development of sociological theory in the 20th century. Included is discussion of current theoretical work.
Prerequisite: Open only to students in Sociology
2 lectures, Winter term

432* The Sociology of Political Knowledge
This seminar will undertake to develop a general theory of the sociological roots and implications of political thought in relation to contemporary social movements and ideologies in historical perspective. Comparative illustrative materials will be drawn from Latin America, Europe, Africa and/or Asia, which will also serve as a basis for research papers.
Prerequisite: any 1 of the following Soc. 241*, 331*, 360*, 425* and Honours Soc. and/or Political Science or graduate standing
Not offered 1974-75

451* Seminar: Problems in Contemporary Theory and Research
Examinations of current frames of reference and theories in sociology and related disciplines. Their utility in sociological problem formulation and their test by current methods and techniques.
Prerequisite: 3rd or 4th year Honours
Not offered 1974-75

466* Reading 1
Selected readings and essay assignments under the direction of a faculty member.
Prerequisite: 3rd or 4th year standing in Sociology and permission of the instructor
Fall term

467* Reading 2
Selected readings and essay assignments under the direction of a faculty member.
Prerequisite: 3rd or 4th year standing in Sociology and permission of the instructor
Winter term

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.
Prerequisites: 4th year Honours or equivalent
Not offered 1974-75

480* Advanced Social Statistics
Multiple and partial correlation; regression; analysis of variance and covariance; selected non-parametric techniques.
Prerequisite: Sociology 202* or equivalent
2 lectures, 1 hour lab, Fall term

481* Mathematical Sociology
Selected mathematical techniques with applications to sociology; sets and graphs, Markov chains and game theory.
Prerequisite: Permission of instructor
2 lectures, Winter term
499 Senior Honours Essay

Required of all honours students in Sociology or by election by joint honours students in their fourth year. For students electing Honours Sociology (Canadian Studies) the essay should bear on some topic of particular sociological significance for Canadian Society.

Prerequisite: 4th year Sociology Honours

500* Modern European Social Theory

Discussion and reports on leading social thinkers and the development of a systematic body of knowledge about social life. Special emphasis will be given to the emergence of sociological thought from the turn of the century to the period between the French Wars. Topics will include Durkheim and the French Sociological Tradition; Max Weber and the German Interpretative Sociology; Pareto and Machiavellian Social Theory; Marx and Historical Materialism; trends in contemporary existential social philosophy.

Prerequisite: Fourth year Sociology major or permission of the instructor

3 hour seminar, Fall term

525* and/or 526* Ideology and Social Change in Latin America

A research seminar on the dynamics of social change as reflected in social thought and social movements in specific countries of Latin America. Students will be expected to present a research paper to the seminar; and a reading knowledge of Spanish or Portuguese is a desideratum. The seminar will draw on the library and, when feasible, the faculty resources of the Ontario Co-operative Programme in Latin America and Caribbean Studies.

Prerequisite: Open to fourth year Honours students in Sociology/Anthropology, Regional and Planning Studies, Latin American History, Sociology/Politics and other relevant programmes

3 hour seminar

542* Seminar: Organizational Analysis

This seminar will study diverse theories, models and methods, and interdisciplinary approaches relevant to the analysis of complex organizations, such as industrial enterprises, public and governmental organizations, educational institutions, etc. Particular attention will be given to problems of productivity and organizational effectiveness, power and human relations, decision-making, innovation, and resistance to change.

Prerequisite: Fourth year Sociology Major or permission of the instructor

3 hour seminar, Fall term

The following courses are administered by Conrad Grebel College

207G* Educational Sociology

This course is designed for co-op and regular students who plan to enter the teaching field. Attention will be focused on the concepts and theories of sociology as they apply especially to the educational system.

Prerequisite: Soc. 101

3 hours, Fall and Winter terms
230G* 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.
Prerequisite: an introductory social science course
3 hours, Winter term

275G* The Mennonites as a Sociological Community
A case study of the Waterloo County Mennonites as a social system. Attention is paid to a methodology for studying a religious-cultural group by engaging in direct field studies. The community's charter resources, integration, family system, life ceremonies, adaption to change, and survival techniques will be examined.
Prerequisite: an introductory social science course
3 hours, Fall term

290G Utopian Communities Past and Present
An examination of intentional communities; extinct and contemporary. Attention will be paid to origin, purpose, structure and process in each community studied. An assessment of factors contributing to success and failure will be attempted.
Prerequisite: an introductory social science course
3 hours, Winter term

307G* Problems in Contemporary Education
A study of problems arising from the interplay between institutionalized education and the forces of rapid social change in the contemporary society; the clash of value systems of youth and the "establishment". It emphasizes the changing concepts of the roles of the learners and instructors, social dimensions of newer learning theories and educational programmes arising therefrom, goals of formal education, decision making processes within educational organizations, obsolescence of some of the traditional patterns of formal education, and like topics. Themes will be selected and studied in depth on a seminar basis.
Prerequisite: Soc. 101 and 207G*
3 hours, Winter term

370G* Sociology of Law
An overview of the major trends in the sociology of law since World War II. Consideration will be given to contributions of legal scholars as well as of social scientists. Special attention will be paid to the growing public awareness of the failure of law in Canadian society to provide adequate justice or social control in a growing number of situations. Investigations of concrete issues, such as the jury system, courts, police and mass media, will be an integral part of the course.
Prerequisite: third year standing in a social science course or by permission
3 hours, Winter term
The following courses are administered by Renison College

**120R Fundamentals of Sociology**
An examination of the fundamental concepts of sociology and their application in seeking to understand the changing patterns and life styles taking place specifically in Canada, and in general, within North American society. Patterns of deviance, social stratification, minority adaptation, and changing patterns in organization, family, political process, and religious observance will be examined.
*No prerequisite*
3 hours

**220R* Sociological Analysis**
An application of sociological analysis to the study of various institutions such as education, religion, law and marriage (1973-1974 emphasis will be on the institution of marriage). Development of an approach or methodological perspective which can be applied to the study of other social phenomena.
*Prerequisite: Soc. 101* or Soc. 120R
3 hours, Fall term

**221R* Master Trends in Modern Society**
Introduction to the major problems of urban, industrial and political sociology studied within a framework emphasizing social change. Illustrations will be drawn from emergent as well as advanced societies.
*Prerequisite: Soc. 101* or Soc. 120R
3 hours, Winter term

**225R* Race and Culture in the Third World 1**
A general introduction to contemporary problems of race, culture and ethnic relations in the developing countries of Asia and Africa.
*Prerequisite: Soc. 101* or Soc. 120R
3 hours, Winter term

**226R* Race and Culture in the Third World 2**
Problems of acculturation and inter-group relations in plural societies in selected areas in the Caribbean, South and Southeast Asia, East and Southern Africa.
*Prerequisite: Soc. 101* or Soc. 120R
3 hours, Winter term

**320R Canadian Ethnic and Cultural Minorities**
A detailed examination of various minorities in Canadian society. The first section of the course will stress the fundamental concepts and issues of race and ethnic relations and the final segments of the course will incorporate the application of these fundamentals to the various groups in the Canadian mosaic. In 1974-75, North American Indians will constitute a central focus of analysis.
*Prerequisite: Soc. 101* or Soc. 120R
3 hours
325R*/326R* Issues in Third World Development (Africa)
The course will examine the impact of modernization on the value systems and social structures of selected African/Asian societies—Zambia, Malawi, Botswana, Lesotho and Swaziland with comparative reference to some developing Asian countries. The approach will be a case study within a theoretical framework. The course will in particular investigate the functioning of the new elite including some analysis of its new habitat, the city.

The whole approach would suggest a way of thinking about "Development" based on the premise that human problems must be resolved before economic growth can take place.

Prerequisite: Soc. 101* or Soc. 120R
3 hours

The following course is administered by St. Jerome's College

232J The Family and Society
The course is designed essentially to assess the role of the family in society. This will be done primarily on the basis of an analysis of the institutions of the family and marriage on a cross cultural basis. The universality of the family has always been proclaimed by Anthropologists. This view will be challenged in the light of relatively recent ethnographic materials which tend to establish the fact that this proclaimed universality is not absolute.

The biological basis of the family will be examined in some detail, and an attempt will be made to establish the family as a biosocial unit. Courtship, mate selection and divorce, as well as a brief overview of human sexuality and the role of sex in marriage and family stability will be examined.

Prerequisite: Sociology 101* or permission of the instructor
3 hours, lectures and tutorial
Instructor: J. Alleyne
Anthropology

**Associate Professor**  
Wm. B. Roosa, B.A.(Texas Christian), M.A.(New Mexico), Ph.D. (Michigan)  
S.M. Weaver, B.A., M.A., Ph.D.(Toronto)

**Assistant Professors**  
T.S. Abler, B.A.(Northwestern), M.S.(Wisconsin-Milwaukee), Ph.D.(Toronto)  
D.E. Counts, B.S.(S.W. Texas State College), M.A.(Kentucky), Ph.D.(Southern Illinois)  
C.E. De'ath, B.A.(Auckland), ASOPA Cert.(Sydney), M.Ed., Ph.D.(Pittsburgh)  
H.F. McGee, B.A., M.A.(Florida State), Ph.D.(Southern Illinois)  
S. Gabow, B.A.(California, Berkeley), Ph.D.(Toronto)  
J. Rogers, B.A.(Radcliffe), M.A.(New Mexico), Ph.D.(Toronto)

**Lecturer**  
J.G.E. Smith, Ph.B., M.A., Ph.D.(Chicago)

Faculty members holding cross appointments as shown  
1 Anthropology and Urban Regional Planning  
2 Anthropology and Man-Environment Studies

**Undergraduate Courses in Anthropology**

**Note 1**  
Anthropology degree requirements are currently under revision. Students are strongly advised to consult the department before beginning to plan a programme in order that they may take the new requirements into account.

**Note 2**  
Many of the listed courses are given irregularly. Students should consult the course offerings list issued at preregistration.

**101** Origins of Man and Culture  
An introductory course in Physical Anthropology and Archaeology. Lectures on living and fossil primates, the fossil primates, the fossil evidence for the origins and development of man, modern races, and archaeological evidence for the origins and development of culture.  
*Three hours lecture, Fall term*

**102** Cultural and Social Anthropology  
An introductory course on the nature of culture. Data are presented on several primitive cultures.  
*Three hours lecture, Winter term*

**201** Principles of Archaeology  
An introduction to the working assumptions analytic approaches and integrative and descriptive methods of archaeological anthropology.  
*Offered annually  
Three hours lecture  
Recommended to Honours Anthropology students  
No prerequisite*
202* Principles of Social Organization
An introduction to basic concepts used by social anthropologists for the analysis of social, economic, political and ideational systems.
*Offered annually
*Three hours lecture
*Recommended to Honours Anthropology Students
*Prerequisite: 102* or permission of instructor

210* Anthropology of Religion
An introduction to the study of the beliefs and practices of primitive peoples about the world of nature and of man. The course will deal with the religious and related systems of selected primitive peoples. Readings will reflect these accounts in the ethnographic literature.
*Prerequisites: 102 or permission of instructor

218* A Survey of North American Archaeology
Paleo-Indian and Archaic
This course deals with the earliest known cultures in North America (mostly prior to 1000 B.C.).
*Three hours lecture
*No prerequisites
*Not acceptable for Honours Credit

220* Old World Prehistory
The Food Procuring Phases
A survey of the development of culture, from the beginnings of tool making to the transition to agriculture. Primary attention to sequences from Africa, Western Asia, and Europe. Comparative attention to the nonagriculture peoples of recent times.
*Prerequisites: 101 or permission of the instructor
*Three hours lecture
*Not acceptable for Honours Anthropology Credit

221* Old World Prehistory
The Food Producing Phases
Examination of the transition to an economy based on food production, the spread of food producing economics, the rise of civilization in the Near East to the early literate periods. Consideration of later prehistoric developments in Africa, Asia and Europe.
*Prerequisites: 101 or permission of the instructor
*Three hours lecture
*Not acceptable for Honours Anthropology Credit

224* A Survey of Southwestern Archaeology
The origins and development of food-producing cultures in the American Southwest.
*Three hours lecture
*No prerequisites
*Not acceptable for Honours Anthropology Credit

226* A Survey of Great Lakes Archaeology
A Survey of the cultures in the Great Lakes area, with emphasis on the period from ca. 1000 B.C. to 1500 A.D.
*Three hours lecture
*No prerequisite
*Not acceptable for Honours Anthropology credit

227* Peoples of Africa
A survey of the cultures and societies of sub-Saharan Africa. An emphasis will be placed upon the ethnographic present.
*Prerequisite: 102 or permission of the instructor
228* Peoples of the Pacific
A comparative ethnological survey of selected indigenous societies in the Pacific region.
*Three hours lecture
Prerequisites: 102 or permission of the instructor

230* (Art 216*)Primitive Art
A study of Paleolithic, Mesolithic and Neolithic world art, aspects of Bronze Age Europe, Asia and the Near East, the art of the African continent, the North and South American Indians in pre-Columbian and colonial times, and Australian-Oceania, together with related fields such as folk art, naive art and child art.
*Three hours lecture

233* Eskimo Cultures
Eskimo cultures of Alaska, Canada and Greenland from the time of European and Asian contact to the present. Administrative systems imposed on the Eskimo will be analysed and compared, as will the contemporary problems these communities face today.
*Three hours lecture
Prerequisites: 102 or permission of the instructor

234 North American Indians
A survey of the cultures of the native peoples of Canada and the United States at the time of contact with European Civilization. Emphasis will be placed upon such aspects as cultural ecology, tribal socio-political organization and nativistic reactions to Europeans.
*Three hours lecture
Prerequisites: Anthropology 102 or permission of the instructor

236J* Social and Cultural Change in South East Asia
This course analyses the traditional social structure as well as changes in social, economic and cultural spheres in selected Asian countries. Historical perspective will be emphasized. Current topics such as land reform, the consequent changes, or changing values in the traditional societies will also be discussed.
*Three hours lecture
Prerequisite: Sociology 101* or Anthropology 101*, 102*

238* Caribbean Society
A survey of Caribbean society in which particular attention will be devoted to an analysis of the historical, cultural and socioeconomic background of selected representative Caribbean societies, within the general framework of the continuing process of acculturation in this area.
*Three hours lecture
Prerequisites: Anthropology 102* or permission of the instructor

240* Canadian Indian-White Relations 1830-1950
A survey of the adaptation of the Canadian Indian to Euro-Canadian society. The development of the Indian Act and Indian administration and policy will be explored and compared with parallel developments in the United States.
*Three hours lecture, Fall term
Prerequisites: Anthropology 102* or permission of the instructor
241* The Contemporary Canadian Indian Scene
An analysis of present-day Canadian Indian politics, economics, social organization and education. The emergence of pan-Indianism and large-scale Indian organizations will be examined as responses to the federal government's policy of withdrawing and decentralizing administrative services for native people.

*Three hours lecture, Winter term

247* Urban Anthropology
Approaches to the study of urban centres as undertaken by anthropologists. Selected topics such as urban social networks, the urbanization of non-western societies, and the culture of poverty will be pursued.

*Three hours lecture

248* Peasant Society
A survey course with data taken from Latin America, Europe, India, Southeast Asia. Included will be a consideration of different types of peasant societies, the relationship of peasants to urban areas, and the effects of modernization on peasant society.

*Three hours lecture

260* Human Evolution
Data, methods and theory in the study of the origin and evolution of man. Emphasis will be on the fossil evidence.

*Prerequisites: 101 or permission of the instructor

261* Primate Behaviour
An introduction to the behaviour of non-human primates with emphasis on the relevance to the origin of man.

*Three hours lecture

283* Phonology for Non-Linguists
Devising adequate writing systems for unwritten languages. The class will simulate field sessions, with an informant who speaks an unfamiliar language.

*Three hours lecture

285* Introduction to Structural Linguistics I
A general introduction to structural linguistics. A survey of linguistic approaches to the analysis and description of language.

*Three hours lecture

286* Introduction to Structural Linguistics 2
A continuation of Anthropology 286.

*Prerequisite: Anthropology 286*

Three hours lecture

310* Ethnology of North American Sub-Arctic
An analysis of Northern Athabaskan and Algonkian social organization and culture from earliest European contact, the fur trade periods to the period of modern, concentrated village life. Emphasis will be upon culture change and adaptation in a theoretical framework of cultural ecology and historical development.

*Prerequisite: 102*, 234 or permission of the instructor.

*Three hours lecture*
318* North-American Archaeology – Paleo-Indian and Archaic This course deals with the earliest known cultures in North America (mostly prior to 1000 B.C.).

Three hours lecture and tutorial.
Permission of Instructor.
Primarily for Honours Anthropology students.

320* Pleistocene Prehistory in the Old World Detailed considerations of prehistoric cultural developments from earliest toolmaking to the transition to agriculture. An examination of the human mode of adaptation and the increasing complexity of cultural systems among prehistoric hunters and gatherers.

Three hours lecture and tutorial.
Primarily for Honours Anthropology students.
Offered 1975-76 and alternate years.
Prerequisite: Anthropology 201* or permission of instructor.

321* Recent Prehistory in the Old World Cultural development from the agricultural revolution to the rise of literacy. Special attention to the development of agriculture as a means of subsistence and to the rise of early civilization in the Near East.

Three hours lecture and tutorial.
Primarily for Honours Anthropology students.
Offered every other year.
Prerequisite: Anthropology 201* or permission of instructor.

324* Southwestern Archaeology The origins and development of food-producing cultures in the American Southwest.

Three hours lecture and tutorial.
Permission of Instructor.
Primarily for Honours Anthropology students.

326* Great Lakes Archaeology A survey of the cultures in the Great Lakes area, with emphasis on the period from ca. 1000 B.C. to 1500 A.D.

Three hours lecture and tutorial.
Permission of instructor
Primarily for Honours Anthropology students

330* Cultural Ecology This course will study the inter-relations between societies and their environments. It will cover both the cultural relations to the natural surroundings and community organization.

Three hours lecture
Prerequisite: 101* and 102* or permission of instructor.

342J* Introduction to the Study of Acculturation A study of culture contact and the cultural changes that result, pursued through a study of representative non-European peoples in different parts of the world including their indigenous cultures and the problems of adapting themselves to the modern world.

Three hours lecture
Prerequisite: Anthropology 101*, 102* or permission of the instructor.
350* Sex Roles in Anthropology

A comparison of the roles of men and women as they are treated in the literature of anthropology. In addition, differences between male and female anthropologists in their functions as field workers, and their status in the discipline are considered.
Offered 1974-75 and alternate years.
Prerequisite: consent of the instructor.

355J Ethnic and Cultural Pluralism in World Perspective

A survey of representative plural societies of the world, including an analysis of the historical background and genesis of ethnic and cultural pluralism in these societies. An attempt will be made to establish the relevance of the concept of plural society for some national societies not usually recognized as such on the basis of the nature of some of their major continuing international social problems. Considerable attention will also be given to race and ethnicity and the major role these two factors play in plural societies.
Prerequisites: Anthropology 101*, 102* or permission of the instructor.
Three hours lecture.

356* Comparative Economic Organization

A discussion of the alternative means of organizing economic activity, focused primarily on non-market societies.
Three hours lecture
Prerequisites: 102 or permission of the instructor.

359* Political Anthropology

The study of political behaviour in both state and non-state society. A comparative approach will be used with a thorough examination of the political systems of selected societies.
Three hours lecture
Prerequisites: 102 or permission of instructor.

360* Genetics and Variability in Human Populations

Study of variation and its causes in contemporary human populations.
Three hours lecture
Prerequisites: 260* or permission of instructor.

361* Behaviour and Evolution

Analysis of the relationship between behaviour and natural selection in human evolution. Attention will be paid to theory as well as data from fossil evidence and other sources.
Three hours lecture.
Prerequisites: 260* or permission of instructor.

362* New World Civilization

Problems in cultural dynamics will be considered as exemplified in the rise and effects of the civilizations of Meso and South America. Data are provided primarily by the archaeological record.
Three hours lecture.
Prerequisites: 101* or permission of the instructor.

370* Ethnographic Field Methods

Traditional and recently developed approaches to ethnographic field work are explored. The problems the worker faces in the field, and possible solutions to them, are discussed. Some effort will be made to develop field technique in simulated and/or real field situations.
Three hours lecture.
Prerequisites: 102* or permission of the instructor.
371 Archaeological Field Methods

Data gathering techniques will be studied and applied in fieldwork on both constructed and natural archaeological sites.

*Three hours lecture.*

*Offered occasional summer sessions only.*

*Prerequisites: 101* or permission of instructor.

372* Archaeological Techniques

Methods of gathering, processing and interpreting archaeological data will be studied. Limited excavations will be followed by laboratory analysis of collected materials.

*Four hours lecture, plus labs.*

*Prerequisite: 101* or permission of instructor. *This course will ordinarily be offered in Fall terms. Students cannot receive credit for both 371 and 372*.

380* Language and Culture

The importance of language in culture. Language is examined as a vehicle of culture (a linguistic code as a device for communication), as a mirror for culture (lexical and semantic aspects), and as a tool of society (uses and functions of language). Illustration will be from a variety of languages.

*Three hours lecture.*

*Prerequisite: At least one previous half-course in linguistics and one in cultural/social anthropology.*

381* Semology

A linguistic approach to the study of meanings expressed in the grammatical systems and lexical sets of particular languages.

*Three hours lecture.*

*Prerequisites: Anthropology 280* or 285.

388* Applied Anthropology

The technical and ethical aspects of directed culture change will be examined.

*Three hours lecture.*

*Prerequisites: 370* or permission of the instructor.

390, 391*, 392, 393*, 395*, 397* Reading in Anthropology

Guided reading in a selected portion of the anthropological literature.

*Prerequisites: Anthropology major and permission of the instructor.*

401 Seminar in the Literature of Social and Cultural Anthropology

Seminar in the literature of Social and Cultural Anthropology. Intensive reading and discussion of classic studies in ethnography.

*Prerequisites: 102* or permission of the instructor.

420* Social and Cultural Change

An analysis of contemporary thought on culture contact and cultural evolution. The concepts to be explored might include integration, assimilation, conflict, nativistic reactions, general and specific evolution.

*Seminar.*

*Prerequisites: Anthropology 102* or permission of the instructor.

449*/450* Honours Seminar

Seminar on selected contemporary issues in anthropology. Open only to Honours Anthropology students.

451* The Formative Years of Cultural Theory

A survey of the history of cultural theory from 1850 to 1940.

*Three hours lecture.*

*Prerequisites: Anthropology 101*, 102*. 


452* Contemporary Cultural Theory  A survey of cultural theory from post World War II to the present.
Three hours lecture.
Prerequisites: Anthropology 101*, 102*.

458* Archaeological Theory  A seminar on selected topics in archaeological theory.
Prerequisites: Anthropology 102* and an additional half course in archaeology or permission of the instructor.

460* Advanced Physical Anthropology  An examination of selected topics of current research interest in physical anthropology. Students will be encouraged to undertake guided research projects.
Seminar.
Prerequisites: Anthropology 260*, 360* and permission of the instructor.

480* Theoretical Approaches to Linguistic Description  Different theoretical approaches – stratificational, transformational and signals grammar, one approach to be emphasized during each offering.
Seminar.
Prerequisites: Anthropology 285 or English 375.

499 Honours Essay  Directed reading and research in a selected area of anthropological inquiry.
Open only to Honours Anthropology students.
Department of Systems Design

Professor, Chairman
T.M. Fraser, M.B., Ch.B.(Edinburgh), M.Sc.(Ohio State), L.M.C.C., F.A.C.P.M., F.A.M.

Professor, Associate Chairman
P.H. O’N. Roe, B.A.Sc.(Toronto), M.Sc., Ph.D.(Waterloo)

Professors
H.K. Kesavan, B.Sc., B.E.(Mysore), M.S.(Illinois), Ph.D.(Michigan State)
G.N. Souls, B.A.Sc.(Toronto)

Associate Professors
M.I. Constant, B.A.Sc.(Toronto)
R.N. Howard, B.Sc.(London), Ph.D.(London)
K. Huseyin, M.Sc.(Istanbul), Ph.D.(London)
P.H. Meincke, B.Sc.(Manitoba)
G.F. Rabideau, B.A.(Wisconsin), M.A.(Wisconsin), Ph.D.(Purdue)
P.L. Seeley, B.A.Sc.(Toronto)
B.L. Wills, B.A.Sc., M.A.Sc., Ph.D.(Waterloo)

Assistant Professors
M. Chandrashekar, B.Tech.(I.I.T. Kanpur), M.A.Sc., Ph.D. (Waterloo)
C.K.G. Hahn, M.A.Sc.(Waterloo)
D.D. Schleiermacher, Diploma(Technische Hochschule, Munich), Diploma(Hochschule fuer Gestaltung, Ulm)
F. Sengupta, B.A.Sc.(Cairo), Dipl.(Einsham U.), Dipl.(Cairo), M.Sc.(Case)
S. Toida, B.S.(Tokyo), M.A.Sc., Ph.D.(Illinois)

Instructors
G.J. Savage, B.A.Sc., M.A.Sc.(Waterloo)
M.C. Volker, B.A.Sc., M.A.Sc.(Waterloo)

Visiting Professor
F.H. Branin, Jr., B.A.(Middletown, Conn.), M.A., Ph.D. (Princeton)

Adjunct Professor
R.S. Frew, B.Arch.(Manitoba), M.A.Sc., Ph.D.(Waterloo)

Undergraduate Courses

101 Tutorial
Systems Design first year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, inter-relation of coursework, later work and engineering practice will be discussed.

102 Tutorial

111 Calculus 1

112 Calculus 2
Techniques of systematic integration. applications of integration. Sequences, series, infinite series, power series, with applications
113 Linear Algebra
(formerly SD 115)

114 Theory and Applications of Probability

121 Digital Computation
Introduction to electronic digital computers; hardware and software organization, basic features of Fortran, examples of efficient algorithms for engineering computations.

131 Engineering Economics
(formerly SD 132)
Cost-benefit analysis, critical path methods, interest, project economics, decision making, utility theory, project organizational theory.

142 Introduction to Ergonomics
The man-machine environment complex; the nature of the operational environment; human sensory processes, perception, human information processing; motor function; human work, skill, fatigue; problems of acoustic noise, vibration, heat, cold; needs of ventilation, lighting.

161 Systems Behaviour
Introduction to the ideas and techniques of systems analysis and design. Data collection and handling, statistical methods, systems representation, modelling and simulation, allocation of function and interface design, systems dynamics. Examples from various areas such as container handling, air traffic control, telephone systems, work group systems, local government, respiratory systems, economics of ship building, etc.

162 Engineering Design Methodology
An introductory course on the principles of engineering design culminating in a project involving the solution of a relevant need. Specific topics introduced are: The systems approach, principles of planning, the statement of a design problem and the flow of information. Innovation and the creation of design solutions, physical, economic and financial feasibility, solution evaluation and selection. Value and utility, simulation, modelling and optimization.

181 Statics (formerly SD 151)
Statics of particles, vectors, equilibrium of rigid bodies, centroids, the analysis of structures, forces in beams and cables, friction and moments of inertia.

182 Dynamics (formerly SD 152)
Rectilinear motion, plane motion, dynamics of particles, work and energy, linear momentum, rotational motion, angular momentum, harmonic motion, gravitational, wave motion.
183 Graphics and Design
(formerly SD 181)
Fundamentals of Graphics with emphasis on basic techniques required for visual communication and computation. Use of graphics as an aid to idea generation in design. The course includes projects designed to enhance the creative abilities of the student.

184 Electricity and Magnetism (formerly SD 281)
Electric charge, Coulomb's Law of Electrostatic Forces; Electric fields, Gauss' Law, conductors and electric fields; Electric Potential; Capacitance, dielectrics. Magnetic fields, flux of magnetic induction; current, resistance and electric circuits; Induced EMF, inductance, Lenz' law, Faraday's law; magnetism in matter, transformers, motors, generators, introduction to basic electronic devices.

192 Systems Design Laboratory 1
(formerly SD 291)
An integrated laboratory sequence stressing human sensing and an introduction to electronic measurement techniques. Part of the material will be chosen to accompany SD 184 Electricity and Magnetism.

201 Tutorial
202 Tutorial
Systems Design second year students will meet a faculty member designated as their class professor. Performance in Assignments, conceptual difficulties with courses, inter-relation of coursework, later work and engineering practice will be discussed.

211 Applicable Mathematics for Systems Design 1
(Also listed as Mathematics 61)
First order differential equations, integrating factor, higher order differential equations. Complex variables, forced and free solutions to differential equations, transient and steady state solutions, applications. Fourier series, Fourier transforms and applications.

212 Applicable Mathematics for Systems Design 2
(Also listed as Mathematics 62)

213 Theory and Applications of Statistics (formerly SD211)

221 Numerical Analysis and Computation
(formerly SD222)
Application of digital computers to the solution of equations; determinants and matrices; eigenvalue problems, numerical solution of ordinary differential equations; difference equations, numerical integration methods; error analysis.

252 Physical Systems 1
Component models, interconnection models, system equations and their rank properties and solutions. These concepts are developed with respect to electrical systems.
261 Systems Design
Workshop 1
A problem and project oriented course wherein emphasis is placed on designing and presenting creative solutions to real-life problems. The problems are selected to cover all disciplines to which the student becomes exposed each year. Both the problems and the student's work are expected to increase in sophistication and complexity in accordance with the student's progress through the course.

262 Systems Design
Workshop 2

264 Form and Function in Design
The manipulation and arrangement of defined spaces with emphasis on the interrelation between spatial geometry and spatial perception; the creation of the perceived spatial patterns or designs by the use of module, proportion, rhythm, and symmetry in spatial arrangement; theories of spatial perception, spatial packing and their contribution to the problem of creating spatial arrangements.

281 Mechanics of Deformable Solids
(formerly SD282)
Statics and resistance of materials, Equilibrium of particles, rigid bodies and deformable bodies. Vector fields, Bay systems. Stress-strain relationships. Elastic and inelastic behaviour of prismatic members subjected to axial, shearing, torsional and flexural deformations.

282 Thermodynamics
(formerly SD384)

284 Fluid Mechanics

286 Introduction to Biochemical and Polymer Systems
An introduction to the chemistry of amino acids, peptides, proteins, nucleic acids, carbohydrates and lipids. An introduction to polymer chemistry, isomerism, chain-growth polymerization and co-polymerization, ionic polymerization.

291 Systems Design Laboratory 2 (formerly SD 292)
A continuation of SD192 for second year students. The emphasis will be on electronic measurement techniques and associated transducers. Some of the material will be chosen to accompany SD281.

301 Tutorial
Systems Design third year students will meet with a faculty member designated as their class professor. Performance in assignments, conceptual difficulties with courses, inter-relation of coursework, later work and engineering practice will be discussed.
Introduction and background to the application of scientific models to the study of operational problems. This course is intended to present an integrated view of the "deterministic operations research models." Topics will include: mathematical techniques of unconstrained and constrained optimization, followed by the construction, evaluation and applicability of various models in allocation, inventory, replacement, sequencing and related problems.

System modelling, discrete and continuous system models; system simulation techniques, digital computer methods, fundamentals of analog computation, time and magnitude scaling; analog computer simulation methods; digital simulation of analog computers; block-oriented languages; advantages and disadvantages of digital and analog simulation techniques, introduction to system simulation using hybrid computers.

Boolean algebra, number systems and data representation; flipflops and registers; computer operation, control unit, instruction sequencing, arithmetic unit; storage organization; operating systems, compilers, assemblers, multiprogramming, multi-processing and time-sharing.

Theory and application of linear programming, techniques: simplex, the transportation and assignment problems, duality and degeneracy. Industrial applications to production and inventory control. Selected problems from nonlinear and dynamic programming.

Optimum seeking methods: analysis of experimental optimum-seeking techniques. Studies include deterministic and stochastic problems. Topics include: single variable search, simultaneous and sequential search, simulations and sequential search, geometry of multidimensional response surfaces and methods of steepest ascent; regression analysis with a systematic treatment of the analysis of multiple classifications involving fixed and random effects and crossed and nested variables of classification. Applications of statistical methods to the efficient design of industrial experiments with considerations to suitability.

Neuroendocrine system and the human response to stress (Adaptation); sustained acceleration, weightlessness and restrictive confinement; hypobarism, hypoxia, and high altitude; hyperbarism and under-water environments; impact acceleration and automotive safety; toxic atmospheric contamination.

The subject matter is similar to SD252 except that the development is based on other physical systems such as structural and hydraulic systems.
352 Algorithms for Computer-Aided System Analysis (formerly SD354)  Techniques for tree selection, manipulation of topological information, evaluation of the exponential function of a matrix, etc. The emphasis is on the algorithms but students will be expected to implement them on the computer. The course includes a survey of the capabilities of existing programmes for system analysis.

353 Time Domain Models for Physical Systems  State equations for two-terminal component systems; time varying and non-linear components; analytical solutions for state models, numerical and analogue methods for solution.

361 Systems Design Workshop 3  A continuation of the Systems Design Workshop for third year students.

362 Systems Design Workshop 4


366 Aesthetic and Perceptual Aspects of Design (formerly SD563)  Presentation and discussion of appropriate and possible methods for the design of systems or artifacts in which aesthetic characteristics and visual form are primary requirements of the design.

381 Materials Engineering  A general introduction to the science of materials: so providing a basic understanding of the scientific principles involved and an introduction to the wide variety of materials available to the designer today. To demonstrate some of the important relationships existing between the structure of a material and its properties, and to consider some of the ways in which materials are shaped, formed and fabricated into articles for our everyday use.

382 Applied Electronics  Component models of various electronic devices, oscillation, amplification, modulation, detection, application to instrumentation.

391 Systems Design Laboratory 3  A continuation of SD291 for third year students.

392 Systems Design Laboratory 4

401 Tutorial  Systems Design fourth year students will meet with a faculty member designated as their class professor. Conceptual difficulties, the inter-relation of course work and engineering practice will be discussed.
411 Systems Operations 2  
(formerly SD312)  
A continuation of SD311, with emphasis on Stochastic Operations Research Models. Topics will include; Decision making under uncertainty, queuing models and related probabilistic techniques, feed back control, probabilistic inventory, competitive strategies and related topics.

412 Topics in Operations Research (formerly SD411)  
Readings suited to individual interests of the students, and aimed at solving special project problems students may select.

421 Computer Aided Design 1  
The design process; computer-oriented system models; simulation languages for continuous and discrete systems; man-machine interaction; design of problem-oriented computer language.

431 Economics of Engineering Design  
The course deals with economics in the engineering design environment. The economics of resource assignment to research and development, applications of such techniques as benefit/cost and cost/effectiveness analysis to engineering design projects; economic problems with product life, obsolescence, design cycles, etc.

432 Analysis of Large Systems  
The course encompasses techniques for the analysis of systems for which physical laws do not provide a simple guideline, viz, systems in which there is human intervention and decision making. Topics include macroscopic modelling of large scale resource and societal systems, decomposition techniques, graph-theoretic and computer based methods of analysis, decision and control problems, other problems concerned with complexity, largeness and aggregation.

433 Conflict Analysis  
(formerly SD331)  
The application of non-quantitative game theory to the analysis of conflict, particularly conflicts arising in the implementation of design projects, the general characteristics, (through Metagame theory) and specific applied techniques for analyzing conflicts between parties each with separate objectives.

441 Human Function (formerly SD242)  
The structure and function of man in relation to systems design; the relationship of biology and human physiology to engineering; biological concepts, biological variation. Introductory concepts in molecular biology and genetics; the cell as a micro-system; the role of water transport; man as a complex of systems and subsystems; the nature of selected subsystems (including introduction to electrophysiology.

443 Human Engineering and Rational Design  
(formerly SD342)  
The Man-machine interface; communication and the design of displays (visual, auditory, kinesthetic, tactile, etc.); human motor activities, speed, accuracy, strength and force; functional operation and the design of controls; illumination, colour, and design of workplaces.

451 Multi-Terminal Representations and Piecewise Analysis of Physical Systems  
Multi-terminal representations, coupled 2-terminal components, tree transformations, solution of large systems through subsystems, two-ports and their interconnection, equivalent 2-terminal component systems.
452 Introduction to Linear Control Systems

Application of Systems theory to the problems of control. The course integrates this study with an exposition of classical control theory.

454 Hydraulic Systems

Applications of systems theory to the analysis of hydraulic systems; particular emphasis is given to the analysis and design of fluid distribution systems.

456 Power Systems (formerly SD453)

Application of systems theory to large power distribution networks and electromechanical energy conversion systems.

461 Systems Design Workshop 5

A continuation of the Systems Design Workshop for fourth year students. The emphasis will be on an individual problem chosen from the student's technical option area.

462 Systems Design Workshop 6

463 Structure and Design

Introduction to problems of definition and enclosure of space with structure and materials; occupancy problems; functional criteria. Problems associated with the effect on the user's perception of spatial arrangements associated with the manipulation of materials and structural design will be discussed.

464 Theory and Application of Photographic Methods to Measurement and Design

The basic theory of photographic measurement techniques; photoinstrumentation; high and low speed data recording techniques and theory; submicrosecond shadow-graphs; photomicrography and photomacrography; theory and visual techniques of photographing physical models; visual perception in engineering design; pulsed visual teaching and learning methods; photographic methods for design and industry; specialized applications and data analyzing tools.

472 Man-Machine Communications (formerly SD 475)

The nature and design of machine-mediated human communication systems. Consideration will be given to displays, computer graphics, computer-aided instruction and mass communication media (Film, T.V., radio, print). The design of new media, innovation. A system approach will be adopted with special attention to the socio-economic effects of such systems.

511 Linear Graph Theory


512 Application of Linear Graph Theory

Topological formulas for general linear systems, synthesis of communication nets, system diagnosis. Applications to switching theory, sociology, economics, etc.

521 Analog and Hybrid Computing Systems

Theory and operation of analog computers, parallel logic; digitally simulated analog computers; introduction to hybrid computing.

522 Computer-Aided Design 2

A detailed study of two major simulation languages, one continuous (CSMP or equivalent) and one discrete-event (GPSS or equivalent). Simulation projects.

542 Human Engineering and Systems Development  Human function in systems; man's capacities and limitations as a component of a complex system; assignment of operations to man and machine. Equipment design in relation to human capacity; training programmes, procedures, and devices; task description and analysis; analytic methods for test and evaluation in human engineering.

543 Human Engineering  Man-machine systems; man-machine interface; presentation of information; design of displays and controls; workplace layout, human factors in design.

544 Ergonomics  Significance of ergonomics; man-machine-environment complex; physiology of work, fatigue, and boredom; environmental factors in industry (noise, vibration, vision, illumination, heat, cold, toxic chemicals, radiation); industrial, and automotive safety.

564 Methodological Processes in Design  Presentation and discussion of appropriate and possible methods for the design of systems or artifacts in which manufacturing processes, material properties and distribution processes constrain the design.
Women's Studies

A selection of courses concerning women will be offered through the departments of Sociology and Anthropology, Psychology, English, Political Science and History. These courses in Women's Studies are designed to approach the study of women from various perspectives and will explore such areas of interest as the past and present roles of women, the treatment of women in contemporary sociological theory, women anthropologists, the nature and role of women in literature, the behavioural development of women and of sex differences, sexual relations and the family in European culture, the role of sex-related ideologies to larger processes of economic and political change, and political participation of women. Students who are interested in the Women's Studies courses listed below will find complete course descriptions in the appropriate departmental sections of this Calendar.

Anthropology 350* Sex roles in Anthropology.  
*Instructor: D. Counts

English 108*E Women in Literature.  
*Instructors: R. Lister and K. Ledbetter  
*Not offered in 1974-75

English 208E* Women Writers of the Twentieth Century.  
*Instructor: R. Lister

History 233* Men, Women, and Families in Modern History.  
*Instructor: S. Johannesen

Political Science 116* Political Participation: The Case of Canadian Women.  
*Instructor: S. Burt

Psychology 102* Psychology of Women Today.  
*Instructor: I. Jackson-Whaley

Psychology 365* The Behavioural Development of Women.  
*Instructor: P. Rowe

Sociology 215* Sociology of Sex Roles  
*Instructors: M. Eichler and L. Fischer

Sociology 415* Seminar on the Impact of Sex Factors on Sociological Theory and Research.  
*Instructor: M. Eichler
Governing Bodies and Staff

17 Governing Bodies and Staff
17

Governing Bodies and Staff
The Board of Governors

Officers
Chairman – C.A. Pollock
Vice-Chairman – W.M. Rankin
Secretary – The University Secretary, J.W. Brown

Ex-Officio Members
The Chancellor
The President and Vice-Chancellor
The Mayor of the City of Kitchener
The Mayor of the City of Waterloo
The Warden of Waterloo County

Other Members
Appointed by the Lieutenant-Governor in Council
E. Dreger (Mrs.), Breslau
R.A. Edwards, Galt
P.J. Ivey, London
D.N. Morris, Galt
J.P.R. Wadsworth, Toronto
L. Wagg, Don Mills
C.N. Weber, Kitchener

Elected by the Board of Governors
E.F. Attridge, Toronto
J.C. Davidson, Toronto
E. MacIntosh (Mrs.), Kitchener
D.W. Maguire, Kitchener
W.W. McGrattan, Toronto
G.A. Mitchell, Kitchener
C.A. Pollock, Kitchener
W.M. Rankin, Toronto
K.A. Reichert, Milton
A.P. Schendel, Waterloo

Appointed by the University Senate – Faculty
T.A. Brzustowski
G.E. Cross
D.E. Irish
R.R. Krueger
J.D. Lawson
H.C. Ratz
C.L. Siegfried

Appointed by the University Senate – Students
1 Vacant Seat (Graduate)
S.H. Clodman (Graduate)
A.C. Knechtel (Miss) (Undergraduate)
B.C. McKay (Undergraduate)
D.E. Wilcox (Undergraduate)

Elected by the University Staff
W. Buzza
A.E. Lappin
Senate

Officers  
Chairman – The President and Vice-Chancellor  
Vice-Chairman – The Vice-President, Academic  
Secretary – The University Secretary – J.W. Brown, B.A.

Ex-Officio Members  
The Chancellor – I.G. Needles, A.B., LL.D.  
The President and Vice-Chancellor – B.C. Matthews, B.S.A., A.M., Ph.D.  
The Vice-President, Academic – H.E. Petch, B.Sc., M.Sc., Ph.D., F.R.S.C.  
The Vice-President, Finance & Operations – A.B. Gellatly, B.A., C.G.A.  
The Librarian – M.C. Shepherd, B.Ed., M.A., (L.S.)  
The Registrar – C.T. Royes, B.A.  
The Chairman of the Board of Governors – C.A. Pollock, B.A.Sc., B.S.

The Principal of each Federated or Affiliated College  
C.L. Siegfried, C.R., B.A., M.Sc., LL.D. (President, St. Jerome’s College)  
F.H. Epp, B.Th., B.A., M.A., Ph.D. (President, Conrad Grebel College)  
A.M. McLachlin, M.A., B.D., Th.D. (Principal, St. Paul’s United College)  
D.G.S. M’Timkulu, M.A., M.A., Ph.D. (Acting Principal, Renison College)

The Dean of each Faculty or School of the University  
P.M. Rowe, B.A., M.A., Ph.D. (Dean of Arts, Acting)  
A.N. Sherbourne, B.Sc., M.S., M.A., Ph.D. (Dean of Engineering)  
G.S. Kenyon, B.P.E., M.S., Ph.D. (Dean of Human Kinetics and Leisure Studies)  
W.F. Forbes, D.I.C., Ph.D., D.Sc. (Dean of Mathematics)  
L.A.K. Watt, B.Sc., M.S., Ph.D. (Dean of Graduate Studies)
Senate

Elective Members  Faculty Representatives

To 1974
D.J. Horton, B.A., M.A., Ph.D. (Arts)
H.C. Ratz, B.A.Sc., S.M., Ph.D. (Engineering)
G.R. Francis, B.A., B.A., M.A., Ph.D. (Environmental Studies)
J.D. Lawson, B.A.Sc., Ph.D. (Mathematics)
H.R.N. Eydt, M.Sc., Ph.D. (Science)
W. Klaassen, B.A., B.D., Ph.D. (Conrad Grebel College)
R.R. Krueger, B.A., M.A., Ph.D. (Faculty at Large)
D.R. Letson, B.A., B.A., Ph.D. (St. Jerome's College)
W.A.E. McBryde, M.A., Ph.D., F.C.I.C. (Faculty at Large)
R.G. Woolford, M.Sc., Ph.D., F.C.I.C. (Faculty at Large)

To 1975
J.R. Dugan, B.A., M.A., Ph.D. (Arts)
W.A. McLaughlin, B.Eng., M.S., Ph.D. (Engineering)
D. Hayes, B.Sc., B.P.E., M.Sc., D.P.E. (Human Kinetics and Leisure Studies)
D.E. Irish, B.Sc., M.Sc., Ph.D. (Science)
J.A. Wahl, C.R., B.A., M.A., Ph.D. (St. Jerome's College)
H. Miller, B.Sc., M.A. (Renison College)
G.W. Bennett, Ph.D. (Faculty at Large)
G.E. Cross, M.A., Ph.D. (Faculty at Large)
J.D. Leslie, B.A.Sc., M.S., Ph.D. (Faculty at Large)
R.A. Staal, Ph.D., (Faculty at Large)

To 1976
W.C. Lennox, B.A.Sc., M.Sc., Ph.D. (Engineering)
R.A. Bullock, B.A., M.A., Ph.D. (Environmental Studies)
P.C. Fischer, M.B.A., Ph.D., F.S.A. (Mathematics)
G.C.S. Woo, O.D., M.S., Ph.D. (Science)
E.P. McCormack, M.A., Ph.D. (St. Jerome's College)
T.A. Brzustowski, B.A.Sc., A.M., Ph.D. (Faculty at Large)
T.L. Batke, B.A.Sc., Ph.D. (Faculty at Large)
G.N. Soulis, B.A.Sc, (Faculty at Large)

Student Representatives

To 1974
A.C. Knechtel (Miss) (Science Undergraduate)
I.D. Robertson (Environmental Studies Undergraduate)
D.E. Wilcox (Arts Undergraduate)
S.H. Clodman, B.Math., M.Math., M.A. (Graduate)
D.M. Kane, M.Sc. (Graduate)
Senate

To 1975
B.C. McKay (Mathematics Undergraduate)
A.P. Palma (Engineering Undergraduate)
M.A. Morris (Ms) (Human Kinetics and Leisure Studies Undergraduate)
1 vacant seat (Graduate)

Alumni Representatives

To 1974
C.T. Wormald, B.A.Sc. ’69

To 1975
D.M.C. Haag, M.A. ’68

To 1976
C.L. Heck, B.A.Sc. ’63

Board of Governors Representatives

To 1974
K.A. Reichert, B.A.Sc., M.A.Sc.

To 1975
W.W. McGrattan, B.A.Sc.

To 1976
D.W. Maguire, B.Sc.
Administrative Offices

President

President Emeritus
J.G. Hagey, B.A., LL.D.
President and
Vice Chancellor
B.C. Matthews, B.S.A., A.M., Ph.D.

University Secretariat

University Secretary and
Director of Development
J.W. Brown, B.A.
Assistant University
Secretary and Director,
Alumni Affairs
P.J. Musclow, B.A.

Office of Operations Analysis

Director
B.R. Foord, C.A.

Dean of Women

Dean of Women
H. Marsden (Mrs.), B.A., M.A.
Assistant Dean of Women
I. Mackay (Mrs.), B.Sc., M.Sc.

Information Services

Director
J.D. Adams, B.A.

Vice-President, Academic

Vice-President, Academic
H.E. Petch, B.Sc., M.Sc., Ph.D., F.R.S.C.

Faculty of Arts

Dean of Arts, (Acting)
P.M. Rowe, B.A., M.A., Ph.D.
Associate Dean
P.M. Rowe, B.A., M.A., Ph.D.
(Undergraduate Affairs)
Associate Dean
M.D. Vogel-Sprott, B.A., M.A., Ph.D.
(Graduate Affairs)
Associate Dean
B.P. Hendley, B.A., M.A., Ph.D.
(Special Programmes)
Assistant to the Dean
J.F. Willms

Faculty of Engineering

Dean of Engineering
A.N. Sherbourne, B.Sc., M.S., M.A., Ph.D.
(Effective July 1, 1974)
Associate Dean
W.A. McLaughlin, B.Eng., M.S., Ph.D.
(Undergraduate Studies)
Associate Dean
E.L. Holmes, B.Sc., M.A.Sc., Ph.D.
(Graduate Studies)
Executive Assistant
T.A. Brzustowski, B.A.Sc., A.M., Ph.D.
to the Dean
J.D. Weller, C.A.
Administrative Offices

Faculty of Environmental Studies

Dean of Environmental Studies

Associate Dean
A.G. McLellan, B.Sc., Ph.D.

(Undergraduate Affairs)

Associate Dean
J.H. Bater, B.A., M.A., Ph.D.

(Graduate Affairs)

Executive Assistant to the Dean

Faculty of Human Kinetics and Leisure Studies

Dean of Human Kinetics and Leisure Studies
G.S. Kenyon, B.P.E., M.S., Ph.D.

Associate Dean
J.C. Nash, B.A., M.S., Ph.D.

(Undergraduate Affairs)

Director of Athletics
C.A. Totzke, B.A.

Assistant Director,
Women's Athletics
P. Davis (Miss), B.P.H.E., M.Ed.

Assistant Director,
Men's Athletics
W.A. Delahey, B.A. (B.P.H.R.E.)

Faculty of Mathematics

Dean of Mathematics

Associate Dean
C.F.A. Beaumont, B.A., M.A.

Associate Dean
K.D. Fryer, B.A., M.A., Ph.D.

Associate Dean
R.C. Mullin, B.A., Ph.D.

(Graduate Studies)

Assistant to the Dean
R.G. Dunkley, B.A.

Assistant to the Dean
W.I. Miller, B.A.

Faculty of Science

Dean of Science

Associate Dean

(Undergraduate Affairs)

Associate Dean
F.W.C., Boswell, B.A., M.A., Ph.D.

(Graduate Affairs)

Inter-Faculty Studies

Director
To be appointed

University Graduate Office

Dean of Graduate Studies
L.A.K. Watt, B.Sc., M.S., Ph.D.

Associate Registrar
B. Ingram, B.A.

(Graduate Studies)

Assistant Registrar
J.J. Bonesteel, B.A.

(Graduate Studies)

Centre for Continuing Management Education

Director
D.V. Deverall, B.A.

Associate Director
Administrative Offices

Computing Centre

Director  P.H. Dirksen, B.Sc., M.A.
Associate Director, Users' Services  J.W. Dodd, B.A.Sc., M.Sc.
Associate Director, Information and Planning  J.P. Sprung, B.A., M.A.

Office of Research Administration

Director  J.W. Tomecko, Ph.D., LL.D.

Academic Services

Director of Academic Services  D.P. Robertson, B.Com.

Audio Visual Centre

Director  G. Downie

Co-ordination

Director, Career Planning and Placement  A.S. Barber, B.Eng., D.Eng., P.Eng.
Programme Administrator, Engineering Faculty Liaison  D.H. Copp, B.A.Sc., P.Eng.
Programme Administrator, Engineering Operations  J.C. Wilson, B.Sc., C.E., P.Eng.
Programme Administrator, Mathematics, Kinesiology and Recreation  B.A. McCallum, B.A.
Programme Administrator, Architecture  J.W. Hoag, B.Arch.
Programme Administrator, Applied Science  R.A. Pullin, B.S.A.

Career Planning and Placement


Cultural Programme Centre

Director  P. Berg

Counselling Services

Director  W.W. Dick, B.A., B.D., M.A., Ph.D.

Data Processing

Director  J.D. Walker, B.A., M.A.Sc.

Health Services

Medical Director  D.E. Andrew, B.A., M.D.
Administrative Offices

Library

University Librarian       M.C. Shepherd, B.Ed., M.A. (L.S)
Assistant Librarians      
Reader Services, Arts      H. McKinnon (Miss), B.A., B.L.S., M.L.S.
Reader Services, Engineering, Mathematics, Science Planning   C. Pugsley (Ms.), B.A., M.L.S.
Collections Development Librarian   D.E. Lewis (Mrs.), B.A., B.L.S., LL.D.
Library Personnel         A. Dunnet, B.B.A.
Administrator

Office of the Registrar

Registrar                    C.T. Boyes, B.A.
Associate Registrar, Admissions and Records B.A. Lumsden, B.A.
Associate Registrar, Systems W.G. Ullman
Assistant to the Registrar   G.L. Buckley
Assistant Registrar--Arts    G.V. Ambrose
Assistant Registrar--Science, Engineering, Mathematics, Human Kinetics and Leisure Studies G.J. Smiley, B.A.
Assistant Registrar--Science, Engineering, Mathematics, Human Kinetics and Leisure Studies R.J. Bullen, B.M.A.
Assistant Registrar--Environment Studies, Integrated Studies J.E. Fauquier, B.A.
Co-ordinator of Scheduling  D.W. Rae, B.A.Sc.
Liaison and Publications Officer S.J. Little, B.A.
Student Awards Officer      A.R. Dejeet

Vice-President, Finance and Operations

Vice-President, Finance and Operations A.B. Gellatly, B.A., C.G.A.
Internal Auditor            B.R. Foord, C.A.
Operating Budgets Analyst    S.S. Farrell, B.A., M.B.A.

Financial Services

Comptroller                 A.H. Headlam, F.C.A
Research Funds Officer      V.E. Leavoy (Miss)
and Assistant to Comptroller
Director of Accounting      W.L. Seguin, B.Com., C.A.
Student Accounts            J.S. Phillips, M.C.I.
Capital Financing Manager   E.D. Coburn, B.Com.
Investments and Risk Manager W.K. Randell, R.I.A.
Trust and Endowment Funds Manager R.C. Charie, B.Com., C.G.A.
Payroll Manager             W.J. Scott
**Administrative Offices**

### Administrative Services Group

**Director**
- W.G. Deeks

### Ancillary Enterprises

- **Book Store Manager**: F. Fischer (Mrs.)
- **Food Services Director**: R.W. Mudie
- **Graphic Services Manager**: J.W. Hammond

### Central Stores

**Manager**
- A. Lawrence

### Office Services

**Manager**
- G.N. Selinger

**Purchasing**
- **Purchasing Agent**: W. Buzza

### Personnel

- **Director**
  - F.S. Lucy, B.A.
- **Assistant Director—Wage and Salary**
  - R.J. Elliott, B.A.
- **Assistant Director—Recruitment**
  - L.W. Brown
- **Assistant Director—Pensions and Benefits**
  - A.H. Boyd

### Physical Resources Group

- **Director**
- **Director, Physical Planning**
- **Director, Plant Operations**
- **Director, Safety**
  - N. Ozaruk

### Housing and Residences Operations

- **Warden of Residences**
  - H.R.N. Eydt, M.Sc., Ph.D.
- **Director, Housing and Residence Operations**
  - H.C. Vinnicombe, B.Sc.

### Security

**Director**
- A.E. Romenco, B.Sc.