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.

If there is any doubt as to the interpretation of the contents of the Calendar, enquiries can be directed to the Registrar.

The Calendar is arranged in chapters which fall into four divisions. The first division contains general information about the University. The second division outlines the undergraduate programmes and the third division describes the courses offered in these programmes. The last division of the Calendar describes the general administrative structure of the University.

The information in this Calendar applies to the 1976-77 academic session which commences in September 1976. The University also publishes:

- a Graduate Studies Calendar
- an Admissions Brochure
- a Summer Session Brochure
- a Part-Time Studies Handbook

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 weekends.

Federated and Affiliated Church Colleges
Conrad Grebel College
Westmount Road, North
Waterloo, Ontario
N2L 3G6
(519) 885-0220

Renison College
Westmount Road, North
Waterloo, Ontario
N2L 3G4
(519) 884-4400

University of St. Jerome’s College
Waterloo, Ontario
N2L 3G3
(519) 884-8110

St. Paul’s College
Waterloo, Ontario
N2L 3G5
(519) 885-1460

All courses listed may not be offered in the current session; therefore, students are advised to consult the University course offerings list prior to arranging their programmes.

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

### Academic Calendar
- 6, 7, 8, 9

### Campus Guide and Legend
- 10, 11

### General Information
1. University of Waterloo, 14
2. Admission, 22
3. Fees and Registration, 28
4. Scholarships, Bursaries, Prizes and Financial Aid, 32
5. Department of Co-ordination and Placement, 46
6. The University Libraries, 62

### Undergraduate Programmes
7. Faculty of Arts, 66
8. Faculty of Engineering, 90
9. Faculty of Environmental Studies, 110
10. Faculty of Human Kinetics and Leisure Studies, 130
11. Programme of Integrated Studies, 138
12. Faculty of Mathematics, 142
13. Faculty of Science, 154

### Undergraduate Course Descriptions
14. Undergraduate Course Descriptions, 194

### Governing Bodies and Staff
15. Governing Bodies and Staff, 416
16. Index 424
   - Index 1, Faculty Members, 424
   - Index 2, General, 425
### Calendar for 1976, 1977, 1978

#### 1976

<table>
<thead>
<tr>
<th>Month</th>
<th>January</th>
<th>April</th>
<th>July</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>S MT W TS F S</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>4 5 6 7 8 9 10</td>
<td>4 5 6 7 8 9 10</td>
<td>4 5 6 7 8 9 10</td>
<td>3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>17 18 19 20 21 22 23</td>
</tr>
</tbody>
</table>

#### 1977

<table>
<thead>
<tr>
<th>Month</th>
<th>January</th>
<th>April</th>
<th>July</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>S MT W TS F S</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>4 5 6 7 8 9 10</td>
<td>4 5 6 7 8 9 10</td>
<td>4 5 6 7 8 9 10</td>
<td>3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>17 18 19 20 21 22 23</td>
</tr>
</tbody>
</table>

#### 1978

<table>
<thead>
<tr>
<th>Month</th>
<th>January</th>
<th>April</th>
<th>July</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>S MT W TS F S</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2 3</td>
<td>1 2</td>
</tr>
<tr>
<td></td>
<td>4 5 6 7 8 9 10</td>
<td>4 5 6 7 8 9 10</td>
<td>4 5 6 7 8 9 10</td>
<td>3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>18 19 20 21 22 23 24</td>
<td>17 18 19 20 21 22 23</td>
</tr>
<tr>
<td>Event</td>
<td>Date</td>
<td>Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>------------</td>
<td>-----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>March 1</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplemental Examinations Begin - Co-operative Programmes</td>
<td>March 8</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-registration Begins - Regular and Co-operative Students for Fall Term 1976</td>
<td>March 8</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-registration Ends - Regular and Co-operative Students for Fall Term 1976</td>
<td>March 12</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>March 15</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures End - Winter Term</td>
<td>March 31</td>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations Begin - Winter Term</td>
<td>April 3</td>
<td>Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>April 5</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Board of Governors</td>
<td>April 6</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Friday - University Closed</td>
<td>April 16</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>April 19</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations End - Winter Term</td>
<td>April 23</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter Work Term Ends - Co-operative Programmes</td>
<td>April 30</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Work Term Begins - Co-operative Programmes</td>
<td>May 3</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration - Undergraduate Co-operative Programmes</td>
<td>May 3</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration - Graduate Studies - Spring Term</td>
<td>May 3</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures Begin - Spring Term</td>
<td>May 3</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>May 17</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Convocation</td>
<td>May 20</td>
<td>Thursday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Course Change Period - Spring Term</td>
<td>May 21</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Convocation</td>
<td>May 21</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Convocation</td>
<td>May 22</td>
<td>Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victoria Day - University Closed</td>
<td>May 24</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-registration Begins - Co-operative Students for Winter Term 1977</td>
<td>May 26</td>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-registration Ends - Co-operative Students for Winter Term 1977</td>
<td>May 28</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Board of Governors</td>
<td>June 1</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>June 7</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>June 21</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominion Day - University Closed</td>
<td>July 1</td>
<td>Thursday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Closed</td>
<td>July 2</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration - Summer Session</td>
<td>July 5</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures Begin - Summer Session</td>
<td>July 5</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End First Half Course Change Period - Summer Session</td>
<td>July 9</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplemental Examinations Begin</td>
<td>July 12</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures End - Spring Term</td>
<td>July 28</td>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End Second Half Course Change Period - Summer Session</td>
<td>July 30</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations Begin - Spring Term</td>
<td>July 31</td>
<td>Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td>Date</td>
<td>Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------</td>
<td>-----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civic Holiday – University Closed</td>
<td>August 2</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations End – Spring Term</td>
<td>August 6</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures End – Summer Session</td>
<td>August 12</td>
<td>Thursday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations Begin – Summer Session</td>
<td>August 13</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations End – Summer Session</td>
<td>August 14</td>
<td>Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Work Term Ends – Co-operative Programmes</td>
<td>August 27</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall Work Term Begins – Co-operative Programmes</td>
<td>August 30</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour Day – University Closed</td>
<td>September 6</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration Begins – Undergraduate Regular and Co-operative Programmes</td>
<td>September 7</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – Senate Executive Committee</td>
<td>September 7</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration – Graduate Studies – Fall Term</td>
<td>September 10</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration Ends – Undergraduate Regular and Co-operative Programmes</td>
<td>September 10</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures Begin – Fall Term</td>
<td>September 13</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – University Senate</td>
<td>September 20</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Course Change Periods – Fall Term</td>
<td>October 1</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – Senate Executive Committee</td>
<td>October 4</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – Board of Governors</td>
<td>October 5</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thanksgiving Day – University Closed</td>
<td>October 11</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – University Senate</td>
<td>October 18</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall Convocation</td>
<td>October 22</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplemental Examinations Begin – Co-operative Programmes</td>
<td>November 1</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – Senate Executive Committee</td>
<td>November 1</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-registration Begins – On-Campus</td>
<td>November 10</td>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-operative Students for Spring Term 1977</td>
<td>November 12</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – University Senate</td>
<td>November 15</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – Senate Executive Committee</td>
<td>December 6</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures End – Fall Term</td>
<td>December 8</td>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations Begin – Fall Term</td>
<td>December 10</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting – University Senate</td>
<td>December 20</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations End – Fall Term</td>
<td>December 23</td>
<td>Thursday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Closed</td>
<td>December 24</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall Work Term Ends</td>
<td>December 24</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christmas Holiday – University Closed</td>
<td>December 27</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter Work Term Begins</td>
<td>December 27</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td>Date</td>
<td>Day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
<td>---------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Year's Holiday - University Closed</td>
<td>January 3</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration - Undergraduate Co-operative Programmes</td>
<td>January 4</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration - Graduate Studies - Winter Term</td>
<td>January 4</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures Begin - Winter Term</td>
<td>January 4</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>January 4</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>January 17</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Course Change Period - Winter Term</td>
<td>January 21</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Board of Governors</td>
<td>February 1</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>February 7</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>February 21</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study Week Begins - Arts &amp; Environmental Studies (regular Programmes)</td>
<td>February 21</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>March 7</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supplemental Examinations Begin - Co-operative Programmes</td>
<td>March 7</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-registration Begins - Regular and Co-operative Students for Fall Term 1977</td>
<td>March 7</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-registration Ends - Regular and Co-operative Students for Fall Term 1977</td>
<td>March 11</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>March 21</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures End - Winter Term</td>
<td>March 30</td>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations Begin - Winter Term</td>
<td>April 2</td>
<td>Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>April 4</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Board of Governors</td>
<td>April 5</td>
<td>Tuesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Friday - University Closed</td>
<td>April 8</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>April 18</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examinations End - Winter Term</td>
<td>April 22</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter Work Term Ends - Co-operative Programmes</td>
<td>April 29</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Work Term Begins - Co-operative Programmes</td>
<td>May 2</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration - Undergraduate Co-operative Programmes</td>
<td>May 2</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration - Graduate Studies - Spring Term</td>
<td>May 2</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures Begin - Spring Term</td>
<td>May 2</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>May 2</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>May 16</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Convocation</td>
<td>May 19</td>
<td>Thursday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Convocation</td>
<td>May 20</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End of Course Change Period - Spring Term</td>
<td>May 20</td>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring Convocation</td>
<td>May 21</td>
<td>Saturday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victoria Day - University Closed</td>
<td>May 23</td>
<td>Monday</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 1977 Academic Calendar

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-registration Begins - Co-operative Students for Winter Term 1978</td>
<td>May 25</td>
<td>Wednesday</td>
</tr>
<tr>
<td>Pre-registration Ends - Co-operative Students for Winter Term 1978</td>
<td>May 27</td>
<td>Friday</td>
</tr>
<tr>
<td>Meeting - Senate Executive Committee</td>
<td>June 6</td>
<td>Monday</td>
</tr>
<tr>
<td>Meeting - Board of Governors</td>
<td>June 7</td>
<td>Tuesday</td>
</tr>
<tr>
<td>Meeting - University Senate</td>
<td>June 20</td>
<td>Monday</td>
</tr>
<tr>
<td>Dominion Day - University Closed</td>
<td>July 1</td>
<td>Monday</td>
</tr>
<tr>
<td>Registration - Summer Session</td>
<td>July 4</td>
<td>Monday</td>
</tr>
<tr>
<td>Lectures Begin - Summer Session</td>
<td>July 4</td>
<td>Monday</td>
</tr>
<tr>
<td>Supplemental Examinations Begin</td>
<td>July 12</td>
<td>Monday</td>
</tr>
<tr>
<td>Lectures End - Spring Term</td>
<td>July 27</td>
<td>Wednesday</td>
</tr>
<tr>
<td>Examinations Begin - Spring Term</td>
<td>July 30</td>
<td>Saturday</td>
</tr>
<tr>
<td>Civic Holiday - University Closed</td>
<td>August 1</td>
<td>Monday</td>
</tr>
<tr>
<td>Examinations End - Spring Term</td>
<td>August 5</td>
<td>Friday</td>
</tr>
<tr>
<td>Lectures End - Summer Session</td>
<td>August 11</td>
<td>Thursday</td>
</tr>
<tr>
<td>Examinations Begin - Summer Session</td>
<td>August 12</td>
<td>Friday</td>
</tr>
<tr>
<td>Examinations End - Summer Session</td>
<td>August 13</td>
<td>Saturday</td>
</tr>
<tr>
<td>Spring Work Term Ends - Co-operative Programmes</td>
<td>August 26</td>
<td>Friday</td>
</tr>
<tr>
<td>Fall Work Term Begins - Co-operative Programmes</td>
<td>August 29</td>
<td>Monday</td>
</tr>
</tbody>
</table>
Campus Guide

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

Parking Lots
Visitor pay parking D (25c per hr.), A, C, N, M (25c); visitor lot Optometry adjacent to O (25c); H evenings and weekends (25c); 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
74 J. G. Hagey Hall of Humanities includes Humanities theatre
8 Dana Porter Arts Library
30 Psychology

Engineering
1 Engineering 1
2 Engineering 2 (Audio Visual Library)
3 Engineering 3
29 Engineering 4
11 Engineering Lecture Hall

Environmental Studies
10 Isaiah Bowman Environmental Studies Building, E. S. Library (maps)
109 School of Architecture

Human Kinetics and Leisure Studies
17 Offices in Mathematics and Computer Building
18 Physical Activities Complex includes Department of Athletics
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 (4th Floor) (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

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 Tutors' Apartments
23 Minot Hagey Women’s Residence
26 Married Students’ Apartments
149 Hammerskjold House (co-op) (W.C.R.I.)
150 Philip St. Residence (co-op) (W.C.R.I.)

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

University Services
16 South Campus Hall includes Festival Room (Cafeteria); Book Store; Laurel Room
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; Food Service Offices
40 Ground Maintenance includes Radio Waterloo; warehouse
104 Graduate Club includes Graduate Student Union
22 Health Services
The University of Waterloo

Dana Porter Arts Library as seen from St. Jerome’s College
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 offered in Architecture, Arts, Engineering, Environmental Studies, Integrated Studies, Mathematics, Optometry, Human Kinetics and Leisure Studies, Science and Urban and Regional Planning. The University is a member of The Association of Universities and Colleges of Canada and 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 175,000 people.

Since the opening of the first permanent structure on campus in 19518, 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 University Mace

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 seeds 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.

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.

Enrolment for each Faculty (as of October, 1975)

| Faculty of Arts                  | 2,633 |
| Faculty of Engineering          | 2,862 |
| Faculty of Environmental Studies| 1,393 |
| Faculty of Human Kinetics and   | 1,160 |
|     Leisure Studies             |      |
| Integrated Studies Programme    | 67    |
| Faculty of Mathematics          | 2,898 |
| Faculty of Science              | 1,858 |

Total Undergraduate Enrolment (Full-Time) 12,871
Graduate Student Enrolment (Full-Time) 1,205

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 before entering 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 at St. Jerome's. In the Calendar, St. Jerome's faculty members and courses are indicated by a J suffix.
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 to both teaching and residential life.

Academic offerings at Renison include courses in two areas:
1) Social Development Studies Programme, and
2) 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. Renison College faculty members and courses are indicated by an R suffix.

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.

Construction of an addition which will include classrooms, offices, library and an auditorium is scheduled for completion in 1976.

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. St. Paul's College faculty members and courses are indicated by a P suffix. 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.

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

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. Further information about the Co-operative System can be found in Chapter 5.

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. Students wishing to pursue 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 Saturdays have been arranged for the convenience of part-time students, some may find it more convenient to attend classes during regular school hours. The University offers a six week summer programme under the Faculty of Arts as well as courses under a correspondence format.

There is no distinction between part-time and full-time students as to admission requirements, grading practices, or promotion policies.

Information regarding the availability of courses and assistance regarding admission and registration procedures can be obtained from the Office of Part-time Studies, Needles Hall.

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

The Correspondence Programme was originally designed 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. Degree programmes in Arts, Mathematics and Science may be taken entirely on a part-time basis by any combination of correspondence, regular or summer courses which will fulfill the degree requirements of the faculty. Further information can be obtained from:

The Director,
Correspondence Programme.

Continuing Education
Through a number of channels the University recognizes its responsibility for the continuing education of adults.
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 Part-Time Studies office.

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.

Disciplinary jurisdiction is vested in the Board of Governors which may delegate its authority in any particular case to the President. The President normally delegates to the Faculty Deans his authority to deal with academic offenses, except that he may not delegate his authority to expel a student from the University.

A full statement of the University's policy on Academic Regulations and Discipline is available from the University Secretariat or from the Dean's office in each faculty.

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 percentage scale depending upon the faculty of registration.

Overall standings are reported in all faculties as numeric averages. The weighting factors are used for calculating overall averages for students on the letter grade system, and for converting assigned letter grades, where required, for students whose faculty is on the numeric system.

Please refer to the individual Faculty sections for a complete breakdown of the appropriate grading system.
The University of Waterloo
Student and Administrative Services

<table>
<thead>
<tr>
<th>Assigned</th>
<th>Common</th>
<th>Assigned</th>
<th>Weighting Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter</td>
<td>Grades</td>
<td>Factors*</td>
<td>Grades*</td>
</tr>
<tr>
<td>A+</td>
<td>95</td>
<td>90-100</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>89</td>
<td>85-89</td>
<td></td>
</tr>
<tr>
<td>A−</td>
<td>83</td>
<td>80-84</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>78</td>
<td>77-79</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>75</td>
<td>73-76</td>
<td></td>
</tr>
<tr>
<td>B−</td>
<td>72</td>
<td>70-72</td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>68</td>
<td>67-69</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>65</td>
<td>63-66</td>
<td></td>
</tr>
<tr>
<td>C−</td>
<td>62</td>
<td>60-62</td>
<td></td>
</tr>
<tr>
<td>D+</td>
<td>58</td>
<td>57-59</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>55</td>
<td>53-56</td>
<td></td>
</tr>
<tr>
<td>D−</td>
<td>52</td>
<td>50-52</td>
<td></td>
</tr>
<tr>
<td>F+</td>
<td>46</td>
<td>42-49</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>38</td>
<td>35-41</td>
<td></td>
</tr>
<tr>
<td>F−</td>
<td>32</td>
<td>30-34</td>
<td></td>
</tr>
</tbody>
</table>

*Actual assigned numeric grades are used in calculating averages for students in faculties on the numeric scale.

Interpretation of Averages

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

Non-Graded Standings

| CR | Credit Granted |
| AEG | Aegeonat, 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 | No mark reported |

Cross-Registration Wilfred 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 Wilfred 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 the examination report. A student's overall academic standing is determined solely by the home University.

Student and Administrative Services

There are a number of centralized services which the student at the University may use as much or as little as he or she desires. More detailed information is available from each of the departments or organizations listed.

Federation of Students

Campus Centre

At the University of Waterloo the opportunity to participate in extracurricular 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.

Objects

The principal "Objects" of the Federation are:

To promote the welfare and common interests of the students of the University of Waterloo.

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 communications between the student body and the duly elected and appointed authorities of the University of Waterloo.

The Students' Council

Twenty-nine 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.

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, the membership of which 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.

The Board of External Relations
The Board of External Relations handles 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.

Through the Board, Waterloo students can be involved with the Ontario Federation of Students (OFS) and the National Union of Students (NUS). OFS and NUS work on many issues which involve provincial and federal agencies.

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 and research.

The various aforementioned activities are used to both complement formal academic programmes and otherwise to supplement alternative ideas and models. In general, students are able to use the Board to foster and promote greater intellectual and academic exchange.

The Board of Entertainment
The Board of Entertainment co-ordinates and supervises all campus-wide special programmes, including, Freshman Orientation, “pubs”, concerts, Winter Weekend, and Summer Weekend. The Board also maintains a classical record collection for the use of all students, supports 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.

The Board of Co-operative Services
The purpose of the Board of Co-operative Services is to lower prices in certain areas such as Toronto bus service. The Board operates the Toronto bus service, providing a less expensive and more convenient alternative to other types of weekend transportation. If feasible, bus service to London and Hamilton may begin this year. The Campus Centre ice cream stand and the concession stands at weekly “Fed Flicks” and large concerts are operated by the Board. Last year a Used Books Store came into operation which enables students to sell course books and for others to obtain them more cheaply than at the Campus Book Store. The Used Books Store is in the Campus Centre, Room 217.

The University of Waterloo
Student and Administrative Services

The overriding policy of the Board is to operate on as close to a break-even point as possible in terms of the above functions. This serves to promote lower prices in certain areas and greater overall utility to the students. It is hoped that students will offer ideas for additional services and student support. Suggestions and inquiries are welcomed.

The Board of Publications
The Board of Publications of the Federation of Students is responsible for overseeing the various publications of the Federation. These include the student newspaper, the Chevron; the student handbook entitled, What’s What; the student directories published each term and various other less regular publications.

The Board is also responsible for the advertising in all of its publications, as well as assisting in setting the budgets for the various productions.

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

Athletics
Physical Activities Complex
The Department of Athletics offers a complete programme of intercollegiate and intramural activities for the enjoyment of the university community.

Book Store
South Campus Hall
Text books, general interest books and supplies are available at the University Book Store.

Career Information Centre
Needles Hall
The Centre contains material which will assist students in their vocational and educational planning. Information related to personal development and work or travel abroad is also available.

Centre for the Arts
Room 254, Modern Languages Building
The Centre administers the two theatres and the Art Gallery. It sponsors a series of professional attractions and, in conjunction with the Federation of Students, it provides participating activities in music, drama and dance.

The Computing Centre
Mathematics and Computer Building
The Computing Centre located on the first two floors of the Mathematics and Computer 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 inter-active 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.

Most students, particularly at first and second year levels, gain access to the computer through the DEBUG Service. This is a cafeteria-style batch processing service in which users line up to submit jobs through a card reader and retrieve their output from a high speed printer further up the line. This service, including the necessary software to make it fast enough, was developed at the University of Waterloo several years ago. More recently, an experimental program to make the DEBUG Service “interactive” has been introduced. In this version, students submit their jobs and receive output via cathode-ray tube key driven terminals, but still have access to the student-oriented software.

More advanced users also use the Debug Service for much of their preliminary work. However, more advanced work is usually processed in a more general BATCH environment, or using the time-sharing facilities provided by VM/370 CMS. With CMS, it is possible to develop and execute programs in an interactive manner, thus increasing human productivity, particularly during program development. The virtual memory capabilities of VM/370 also make it possible to service users with applications requiring large blocks of memory.

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 user services personnel of the Centre to help make using the computer an easier and more efficient process for all members of the University community.

Counselling Services
Needles Hall
Trained counsellors are available to assist the student with his or her vocational, personal and emotional development on a confidential, individual or small group basis.

Dean of Women
Room 224, Modern Languages Building
This office serves as a general academic information and advisory centre for all students.

Health Services
Health Services Building
Staffed by medical doctors, registered nurses, a counsellor and other trained personnel. Health Services is open to all students. The doctors’ services are covered by OHIP so the student should be sure he or she is insured.

Office of the Registrar
Needles Hall
Student admissions, registration, records and financial aid for undergraduate students are administered by the Registrar’s Office.

Office of Research Administration
(Incorporating Waterloo Research Institute)
The Office of Research Administration (ORA), now located on the third floor of Ira Needles Hall, 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.

Contract Research: In this regard the ORA is the organization through which research and development assistance on a contract basis can be made available to industry, governments and other sectors of society. The ORA provides a working liaison between the university and all organizations in which contracted research offers potential assistance and draws upon the resources of all faculties of the university in providing research services on a contractual basis:

Research Involving Human Subjects: The Co-ordinator (Human Research) in consultation with members of the Committee on Research Involving Human Subjects, reviews university research proposals involving human subjects, as to ethical acceptability, legal liability and medical advisability. As the official liaison officer between the university and local public and separate school boards, the Co-ordinator is also responsible for obtaining school age children as subjects for suitable university research projects.

Research Involving Animals: The Committee on Animal Care reviews university research proposals involving animals, according to the requirements of The Animals for Research Act, and the Canadian Council on Animal Care Guide. It is the responsibility of the Committee to co-ordinate and review all activities and procedures relating to the care of research animals.
Residences
Residence accommodation is available at the University for approximately 4,000 students in the University Residences, Federated and Affiliated Colleges and the Student Co-operative Residences. Apartments for married students and their families are available on campus in the Married Students' Apartment Complex. An off-campus housing information service is also provided.

Students who wish to apply for the University operated Residences must have been academically accepted by the University before a Residence Application form will be sent to them. Applications for the Federated and Affiliated Colleges may be submitted at any time. Those students who wish to apply for residence should write to the Director of Housing or directly to the College of their choice for a brochure and the Residence Information sheet which includes the fee schedule.

International Student Office
This office is located on the second floor of Needles Hall and is available to assist any International Students who require information, e.g., Immigration laws, etc.
Admissions
General Information

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. The admission requirements apply to all applicants, full-time, part-time, or correspondence, wishing to pursue degree studies.

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 Assistant Registrar (indicate Faculty desired).

Applicants are advised to outline thoroughly their educational background in order to facilitate the admission process. The admission information and requirements set forth in the Calendar are applicable for admission beginning in September 1976.

Limited Enrolment

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.

The designation of a limited enrolment programme means that in the past, the number of qualified applicants exceeded the number of places available. It is expected that for 1976 the following programmes will be designated as limited enrolment programmes:

- Architecture
- Engineering
- Kinesiology
- Optometry
- Recreation
- Urban and Regional Planning

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 an applicant will be made by an 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 will not profit from University studies.

The University reserves the right to withdraw the offer of admission made to an Ontario secondary school student if the Applicant fails to complete Year 5 satisfactorily.

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. All transcripts and documents should be sent directly to the College.

Inquiries and correspondence should be directed to:

The Registrar, St. Jerome’s College.

Renison College

Applicants may apply for the Social Development Studies Programme and for other programmes in Arts through Renison College. Renison College applicants should indicate “Renison College” clearly on the application form.

Inquiries and correspondence regarding admissions should be directed to:

The Registrar, Renison College.

Admission Requirements

For all programmes, the University normally requires that the prerequisites for the Ontario Secondary School Honour Graduation Diploma be satisfied and that a minimum average of 60% be obtained. Applicants educated outside of Ontario must submit evidence of having obtained a level of education equivalent to Ontario Year 5 (see page 23) as well as meeting the subject prerequisites and satisfying any special average requirements.

Applicants – Ontario Year 5 (Grade 13)

The following criteria are used in selecting Year 5 applicants for admission: Year 5 interim standing; Year 4 final standing; Principal’s recommendation.

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

Please refer to the chart on the following page.
## Specific Faculty Program Recommendations and Requirements

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Specific Year 5 Requirements</th>
<th>Special Averages</th>
<th>Recommendations and Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts</td>
<td>Relocations and Functions</td>
<td>60% overall average in specific requirements.</td>
<td>Applicants who do not have the specific Year 5 requirements but who have a high overall standing including at least Relations and Functions and Calculus are also encouraged to apply for admission. Since Engineering requires considerable writing of reports and reviews, as well as the reading of books, articles and journals, the sixth credit for admission should be a subject requiring literary and writing performance such as English, History, Geography, etc. The University reserves the right to withdraw early offers of admission to Engineering for students receiving final marks below 60% in any of their six credits.</td>
</tr>
<tr>
<td>Engineering</td>
<td>Relations and Functions</td>
<td>60% overall average in specific requirements.</td>
<td>Applicants should select Year 5 courses such as English, History, Languages (other than English) etc.</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>Relations and Functions, Calculus, Algebra, Chemistry, Physics</td>
<td>60% overall average in specific requirements.</td>
<td>Applicants who do not have the specific Year 5 requirements but who have a high overall standing including at least Relations and Functions and Calculus are also encouraged to apply for admission. Since Engineering requires considerable writing of reports and reviews, as well as the reading of books, articles and journals, the sixth credit for admission should be a subject requiring literary and writing performance such as English, History, Geography, etc. The University reserves the right to withdraw early offers of admission to Engineering for students receiving final marks below 60% in any of their six credits.</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>Relations and Functions, Calculus, Algebra, Chemistry, Physics</td>
<td>60% overall average in specific requirements.</td>
<td>Applicants who do not have the specific Year 5 requirements but who have a high overall standing including at least Relations and Functions and Calculus are also encouraged to apply for admission. Since Engineering requires considerable writing of reports and reviews, as well as the reading of books, articles and journals, the sixth credit for admission should be a subject requiring literary and writing performance such as English, History, Geography, etc. The University reserves the right to withdraw early offers of admission to Engineering for students receiving final marks below 60% in any of their six credits.</td>
</tr>
<tr>
<td>Architecture pre-professional programme</td>
<td>Relations and Functions, Calculus, Algebra, Chemistry, Physics, English</td>
<td>Normally a 60% overall average is required in these courses</td>
<td>Selected applicants may be required to come to the University for an interview.</td>
</tr>
<tr>
<td>Geography</td>
<td>Relations and Functions</td>
<td>Normally a 60% overall average is required in these courses</td>
<td>Selected applicants may be required to come to the University for an interview.</td>
</tr>
<tr>
<td>Man Environment Studies</td>
<td>Relations and Functions, Calculus, Algebra, Chemistry, Physics, English</td>
<td>Normally a 60% overall average is required in these courses</td>
<td>Applicants should include Geo. in their Y 5 prog.</td>
</tr>
<tr>
<td>Urban and Regional Planning</td>
<td>Relations and Functions, Calculus, Algebra, Chemistry, Physics, English</td>
<td>Normally a 60% overall average is required in these courses</td>
<td>Students should present at least one Year 5 Mathematics course.</td>
</tr>
<tr>
<td>Human Kinetics and Leisure Studies</td>
<td>Relations and Functions, Calculus, Algebra, Chemistry, Physics, English</td>
<td>Normally a 60% overall average is required in these courses</td>
<td>Selected applicants may be required to come to the University for an interview.</td>
</tr>
<tr>
<td>Kinesiology</td>
<td>Relations and Functions</td>
<td>Normally a 60% overall average is required in these courses</td>
<td>Applicants should select one or more Year 5 course such as Cal., Bio., Chem., Phy.</td>
</tr>
<tr>
<td>Recreation</td>
<td>Relations and Functions</td>
<td>Normally a 60% overall average is required in these courses</td>
<td>Applicants should select both Year 5 Biology and Geography courses.</td>
</tr>
<tr>
<td>Integrated Studies</td>
<td>Relations and Functions, Calculus, Algebra, Chemistry, Physics, English</td>
<td>60% overall average in specific requirements.</td>
<td>Each applicant to Integrated Studies is considered on the basis of a personal interview with a committee composed of students, resource persons and staff. Those who show an 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.</td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>Relations and Functions</td>
<td>The Regular Programme requires a 60% overall average in specific requirements.</td>
<td></td>
</tr>
<tr>
<td>(including Optometry)</td>
<td>Relations and Functions, Calculus, Algebra, Chemistry, Physics, English</td>
<td>The Regular Programme requires a 60% overall average in specific requirements.</td>
<td>Applicants should select both Year 5 Chemistry and Physics courses.</td>
</tr>
<tr>
<td></td>
<td>2 Science Courses, one of which must be Phy. or Chem.</td>
<td>The Co-operative Programme requires a 66% overall average in specific requirements.</td>
<td></td>
</tr>
</tbody>
</table>
Applicants – Other Than Ontario Year 5 (Grade 13)

Applicants who are not currently registered in Ontario Year 5 are considered under the following broad categories. These categories serve to identify general areas of academic preparation.

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, stated in terms of Ontario secondary school preparation, may apply as adult students.

In general, it is recommended that applicants applying as adult students obtain standing in at least one Ontario Year 5 level subject or equivalent. Applicants to programmes requiring specific Ontario Year 5 level prerequisites normally must have standing in those required subjects to be considered for admission. Applicants should contact the Assistant Registrar of the desired faculty to discuss admissibility and appropriate qualifying work before making application. Mature students not meeting the requirements for degree candidacy may in certain cases be admitted to degree studies on a part-time probationary basis. Each application is considered on its own merit by the Admissions Committee.

Mature students who are uninterested in pursuing a degree at this time, may apply on a non-degree basis. Courses taken under this provision will count toward a degree if the student is admitted later as a degree candidate.

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 information such as course descriptions, etc., in addition to their official academic transcript. The provision of such information will 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.

As the specific transfer credit policies vary with each faculty, students are advised to refer to the faculty sections in the calendar for detailed regulations.

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 of the desired faculty.

Letters of Permission
In addition to completing the appropriate application form, applicants wishing to take a course on a “Letter of Permission” must obtain a Letter of Permission form from their “home” university specifying the courses to be taken. Usually no further documents are required.

Certificates Equivalent to the Ontario Secondary School Honour Graduation Diploma
All applicants are required to hold the specific subject requirements indicated on page 23 in addition to the equivalent level of education.

Applicants are required to submit official transcripts for all years spent in secondary and post secondary education. Transcripts must indicate subjects studied, the grades received and an interpretation of the grading system used.

A) Applicants from Other Canadian Provinces

<table>
<thead>
<tr>
<th>Province</th>
<th>Grade Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alberta</td>
<td>Grade 12</td>
</tr>
<tr>
<td>British Columbia</td>
<td>Grade 12</td>
</tr>
<tr>
<td>Manitoba</td>
<td>Grade 12</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>Grade 12</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>Year 1 Memorial University</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>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>Grade 12</td>
</tr>
</tbody>
</table>
B) Applicants from Other Countries

**United Kingdom and Commonwealth**

- General Certificate of Education with passes in at least 5 subjects, 2 of which must be at the Advanced level.

**United States of America**

- Secondary School Graduation plus an additional year of formal study in subjects comparable to Ontario Year 3.

**Hong Kong**

- 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.

**India**

- B.A. or B.A.Sc. (first or second division)

**Europe**

- Maturity or Matriculation Certificate

**Central and South America**

- First year University with a standing of at least (B–)

<table>
<thead>
<tr>
<th>Countries Using</th>
<th>French Educational System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baccalaureate Passable</td>
<td></td>
</tr>
</tbody>
</table>

Candidates from other countries holding other certificates should contact the Registrar’s Office well in advance of the desired session for an assessment of eligibility. As much information as possible should be provided in the initial inquiry.

**English Proficiency Test**

Applicants whose native language is not English are advised to take the “Test of English as a Foreign Language” (TOEFL). Normally, a score of 600 is required to satisfy the Admissions Committee that the applicant’s knowledge of the English language is adequate to pursue university 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.

**Landed Immigrant Status**

Because of the nature of the Co-operative programmes at the University, in which 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, if available, offered under the Regular system of study. In the case of the Co-operative Engineering Programmes, immigrants must have one year’s residency, with suitable work experience, in Canada before applying for admission.

**Application Procedures**

1) Applicants who wish to study on a full-time basis must submit their applications through the Ontario University Application Centre (OUAC):

   a) Applicants presently enrolled in an Ontario Secondary School must complete OUAC form 101 available from the secondary school guidance departments.

   or

   b) Applicants not enrolled in an Ontario Secondary School (e.g. mature applicants, applicants from outside Ontario) must complete OUAC form 105. These forms may be obtained from the Registrar’s Office.

2) Applicants requesting part-time, non-degree or correspondence courses should contact the University for the appropriate application forms. Do not apply through the Application Centre.

**Note**

When requesting an application form from the University candidates should outline their academic background and indicate the exact programme and level of admission they are seeking. This will help to determine the appropriate application form as well as enable us to send additional information which an applicant may find helpful.

Further instructions on application procedures, documents required etc. will be sent out with the application form.

3) Application Dates

Because of the number of applications received each year, the University has established certain dates after which it cannot guarantee consideration of any application that is received.

<table>
<thead>
<tr>
<th>Session/Term starting</th>
<th>Last date for application</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 3, 1976</td>
<td>March 1, 1976</td>
</tr>
<tr>
<td>July 5, 1976</td>
<td>June 1, 1976</td>
</tr>
<tr>
<td>September 7, 1976</td>
<td>July 1, 1976</td>
</tr>
<tr>
<td>January 3, 1976</td>
<td>November 1, 1976</td>
</tr>
</tbody>
</table>

Normally no application will be accepted after the first day of lectures in any specific session/term.
Processing of an Application

Only complete files containing all required documents (transcripts, letters of reference, etc.) will be presented to the Admission Committee for consideration.

All Ontario Year 5 applicants will be notified on or after June 4, 1976, of the status of their application for admission. Year 5 applicants who do not receive an offer of admission at this time will have their applications deferred until their final Year 5 marks are received by the University. When these marks have been received, qualified applicants will be admitted until the remaining places are filled.

Ontario Year 5 applicants who receive an early offer of admission are encouraged to confirm as soon as possible, but are not required to respond before June 18, 1976.

Applicants who are not currently enrolled in an Ontario Year 5 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 it. 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 received by the appropriate Faculty area in the Registrar’s Office.

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 may indicate their wishes in the application form.

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 the departmental undergraduate advisor. Students registering through Renison or St. Jerome’s select their courses with the appropriate advisor at the College. 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.

Note

Pre-registration is the process of choosing courses and having them approved by the appropriate advisor prior to the beginning of classes. Registration is completed when courses have been approved, fees paid, and a receipt issued.

A schedule of fees is outlined in Chapter 3, page 29 of this calendar.
3

Fees and Registration

September 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.

Pre-registration is the process of choosing courses and having them approved by the appropriate advisor prior to the beginning of classes. This action of pre-registration will produce the Student Schedule-Fee Statement. Students must then register (pay fees) using this Fee Statement. Registration will be completed when the courses have been approved, fees have been paid, and the Fee Statement receipted by Financial Services.

Note that late fees will be assessed commencing the first day of classes. Students who pre-register late, so that registration is not completed by the start of classes will be assessed the applicable late fee at registration.

Students over the age of 60 and retired will be awarded a University Bursary to cover tuition and related incidentals (correspondence tape deposits not included). Proof of eligibility for this bursary should be furnished to the appropriate Assistant Registrar at the time of pre-registration.

Academic fees are due and payable before the first day of classes. 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 and beginning of lectures are listed on page 6 of the calendar.

Students who have received a “Notice of Assessment” 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 Assessment 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: 12 March 1976 for the Spring 1976 term;
  - 15 July 1976 for the Fall 1976 term;
  - 12 November 1976 for the Winter 1977 term;

Fees should be paid by money order or certified cheque payable to “University of Waterloo.” Students registering through Renison or St. Jerome’s must pay their fees directly to the appropriate College.

Fees may be paid in two installments, but an extra charge of $10.00 for regular students and $5.00 for co-operative students will then be added to the first installment. The first installment 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:

<table>
<thead>
<tr>
<th></th>
<th>For Full Time Students</th>
<th>For Co-operative Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasible</td>
<td>On or before the first day of the second term.</td>
<td>On or before the first day of the eighth week of the current term.</td>
</tr>
</tbody>
</table>

Part time students may elect to pay fees on a term basis. Students who choose this method of payment must pay full fees for fall courses taken by the same dates as shown for full time students. Fees for winter courses must then be paid on or before the first day of classes in the winter 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.

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

<table>
<thead>
<tr>
<th></th>
<th>Full Time</th>
<th>Co-operative Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Day</td>
<td>$10.00</td>
<td>$25.00 plus*</td>
</tr>
<tr>
<td>Second Day</td>
<td>$15.00</td>
<td></td>
</tr>
<tr>
<td>Third Day</td>
<td>$20.00</td>
<td></td>
</tr>
<tr>
<td>Fourth Day</td>
<td>$25.00</td>
<td></td>
</tr>
<tr>
<td>Thereafter</td>
<td>$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.

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></th>
<th>Session Term Starting</th>
<th>Last Date to Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 1976</td>
<td>13 June 1976</td>
<td></td>
</tr>
<tr>
<td>July 1976</td>
<td>14 July 1976</td>
<td></td>
</tr>
<tr>
<td>September 1976</td>
<td>15 October 1976</td>
<td></td>
</tr>
<tr>
<td>January 1977</td>
<td>21 January 1977</td>
<td></td>
</tr>
<tr>
<td>May 1977</td>
<td>10 June 1977</td>
<td></td>
</tr>
</tbody>
</table>
Fees and Registration

Schedule of Fees

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 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 6 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 Notice of Withdrawal from the Registrar. This Notice, when signed by both the Dean and the Registrar, or their delegates, will entitle the student to a refund of a portion of the 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, Inter-collegiate Athletics on a pro rata basis over 13 weeks for regular students and 6 weeks for co-operative student terms.

The fee schedule is the one proposed for the 1976-77 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 Incidenals 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 – Regular</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-op</td>
<td>Session</td>
<td>$624.80</td>
<td>$54.50</td>
<td>$679.30</td>
</tr>
<tr>
<td></td>
<td>Term</td>
<td>372.70</td>
<td>27.25</td>
<td>399.95</td>
</tr>
<tr>
<td>Engineering</td>
<td>Term</td>
<td>390.20</td>
<td>31.25</td>
<td>421.45</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>54.00</td>
<td>678.80</td>
</tr>
<tr>
<td>– Co-op</td>
<td>Term</td>
<td>372.70</td>
<td>27.00</td>
<td>399.70</td>
</tr>
<tr>
<td>– Architecture – Yr. 1</td>
<td>Session</td>
<td>659.80</td>
<td>54.00</td>
<td>713.80</td>
</tr>
<tr>
<td>– Architecture – Upper Yrs.</td>
<td>Term</td>
<td>390.20</td>
<td>27.00</td>
<td>417.20</td>
</tr>
<tr>
<td>Integrated Studies</td>
<td>Session</td>
<td>624.80</td>
<td>49.50</td>
<td>674.30</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>54.50</td>
<td>679.30</td>
</tr>
<tr>
<td>– Co-op</td>
<td>Term</td>
<td>372.70</td>
<td>27.25</td>
<td>399.95</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>53.50</td>
<td>678.30</td>
</tr>
<tr>
<td>– Co-op</td>
<td>Term</td>
<td>372.70</td>
<td>26.75</td>
<td>399.45</td>
</tr>
<tr>
<td>Optometry</td>
<td>Session</td>
<td>624.80</td>
<td>53.50</td>
<td>678.30</td>
</tr>
<tr>
<td>Human Kinetics and Leisure Studies</td>
<td>Session</td>
<td>624.80</td>
<td>55.50</td>
<td>680.30</td>
</tr>
<tr>
<td>– Regular</td>
<td>Term</td>
<td>372.70</td>
<td>27.75</td>
<td>400.45</td>
</tr>
<tr>
<td>– Co-op</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-Time Students</td>
<td>Per Course</td>
<td>120.00 (limit 2 courses)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer School</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Half Course</td>
<td>66.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Full Course</td>
<td>126.00 (limit 2 courses)</td>
<td></td>
<td></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.

Incidental Fees

<table>
<thead>
<tr>
<th></th>
<th>Regular Session</th>
<th>Co-operative Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federation of Students</td>
<td>$26.50</td>
<td>$13.25</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>
<tr>
<td>S.F.F. (See Note 3)</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>Field</th>
<th>Regular</th>
<th>Co-operative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts</td>
<td>$5.00</td>
<td>$2.50</td>
</tr>
<tr>
<td>Engineering</td>
<td>$4.00</td>
<td>$2.00</td>
</tr>
<tr>
<td>Human Kinetics and Leisure Studies</td>
<td>$6.00</td>
<td>$3.00</td>
</tr>
<tr>
<td>Mathematics</td>
<td>$5.00</td>
<td>$2.50</td>
</tr>
<tr>
<td>Environmental Studies</td>
<td>$4.50</td>
<td>$2.25</td>
</tr>
<tr>
<td>Science (Including Optometry)</td>
<td>$4.00</td>
<td>$2.00</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 start of classes as indicated on page 1 of this Calendar.

Note 3 - S.F.F. (Sandford Fleming Foundation)
In February 1976 the Engineering Undergraduate Student Societies, jointly with the Federation of Students, petitioned the Board of Governors to assess each Engineering undergraduate Student $2.50 per term as a contribution to the Sandford Fleming Foundation. This fee is voluntary, refundable and not a requirement for registration. Requests for refunds should be directed to the on-campus Engineering Society Office, within three (3) weeks after the start of classes as indicated on page 69 of this Calendar.

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

Income Tax Receipts
Receipts for income tax purposes for fees paid will be available on March 1, 1976. On-campus students may obtain their receipts from the Cashiers Office, Needles Hall. Off-campus students’ receipts will be mailed to the home address on record.

Enquiries
Enquiries concerning payment of fees should be directed to “Student Accounts, Financial Services.”
Scholarships, Bursaries, Prizes and Financial Aid

Elizabethan Dancers in Humanities Quadrangle
Scholarships, Bursaries, Prizes and Financial Aid

The Student Awards Office is responsible for the administration of all forms of financial assistance for undergraduate students. This includes the Ontario Student Assistance Programme (O.S.A.P.) and other forms of government aid to students. As well, the office administers the University's Undergraduate Scholarship and Bursary Programme and an Emergency Loan Fund.

Students requiring information regarding the awards listed below or any other information regarding financial aid are invited to contact the Student Awards Office, Needles Hall, University of Waterloo.

Unless otherwise stated, no application is required for the awards listed below.

Regulations Governing University of Waterloo Undergraduate Scholarships

1) The first charge against any scholarship payment will be for tuition and fees.
2) If no qualified applicant is found for a particular award in any year, the University reserves the right to withhold the award.
3) Awards based on donations from outside sources cannot be guaranteed by the University and can be forwarded only after the funds have been received by the donor.

University of Waterloo Entrance Scholarships

The University awards a number of Entrance Scholarships to entering students on the basis of outstanding performance in secondary school. In some faculties and departments, these Scholarships are also based on the results of the following competitions:
- The Chem 13 NEWS Exam;
- The Sir Isaac Newton Physics Test;
- Descartes Mathematics Competition.

Details regarding these Scholarships are listed on the following pages.

An application for admission to the University will suffice as an application for any Entrance Scholarship for which the student is eligible.

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.

The Allen-Bradley Canada Limited Award

The Allen-Bradley Canada Limited is making available three awards, each for $100, to second, third and fourth year electrical engineering students. These awards are given for the work term reports judged best for clarity, grammar and other communication skills. The technical content of the report is important but not a qualifying requirement. The award is made each term and the winner will be determined by the Department of Coordination in consultation with the Department of Electrical Engineering. Reports considered confidential are not eligible.

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.

The AOCO Canada Limited Scholarship

AOCO Canada 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.
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 faculty 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.

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 Year 5 examinations and who is entering an accredited engineering programme at the University of Waterloo.

Association of Professional Engineers Undergraduate Scholarship
The Association of Professional Engineers of the Province of Ontario offers three annual scholarships of $250. one to the student in each of the first, second and third years in an accredited engineering programme who has the highest average in the examinations for his year.

Babcock & Wilcox Canada Limited Award
The Babcock & Wilcox Canada Limited is making available three awards, each for $100, to second, third and fourth year mechanical engineering students. These awards are given for the work term reports judged best for clarity, grammar and other communication skills. The technical content of the report is important but not a qualifying requirement. The award is made each term and the winner will be determined by the Department of Co-ordination in consultation with the Department of Mechanical Engineering. Reports considered confidential are not eligible.

The Bausch and Lomb Optical Company Limited Award for Clinical Proficiency
Bausch and Lomb Optical Company offers a prize to the student in the fifth professional year judged demonstrating the highest levels of proficiency in clinical activities. The prize is a Greens Refractor or equivalent ophthalmic instrumentation to the approximate value of $1675.

The Bausch and Lomb, Soflens Division Outstanding Achievement Awards
Total value of these awards is $1,000. These awards are in recognition of ability and effort in the pursuit and application of knowledge in the contact lens field while a final year student.

J. P. Bickell Foundation Scholarships
The Trustees of the J. P. Bickell Foundation provide a number of J. P. Bickell Foundation scholarships 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.

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.

Canada Packers Awards
Canada Packers Limited is making available two $100. awards to fourth year Chemical Engineering students and two awards to fourth year Mechanical Engineering students having attained high academic achievement in third year. One award will be made in each of stream 'A' and stream 'B' in each department. Other determining factors include personal characteristics.

Canadian Information Processing Society - Grand Valley Chapter Scholarship
C.I.P.S. is making available one scholarship in the amount of $200. to a third year Math student with Computer Science and Business options. Selection will be based entirely on second year marks as recorded by the faculty.

Centennial Optical Scholarships
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.

Chem 13 News Research Assistantships
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.
Chemistry Scholarships
The Department of Chemistry awards Year 1 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 2, 3 and 4 in Honours Chemistry. (Regular or Co-op). These scholarships may be subject to the condition that no other awards be held concurrently.
The above scholarship will be awarded subject to the availability of funds and the attainment of a minimum academic standard by candidates.
Candidates for Year 1 awards must write the CHEM 13 NEWS/Exam. No application is necessary for awards for Years 2, 3 and 4.

Cominco Scholarships
To assist in ensuring a continuing supply of qualified graduates in fields vital to industry in Canada, Cominco Ltd. has established a programme of twenty-four scholarships at specified Universities in Canada. One of these scholarships will be awarded annually in the form of a two-year award of $800 per year at the University of Waterloo. It is open to students who, in the Fall, will enter the penultimate undergraduate year of a course leading to a degree in Chemical Engineering, Honours Geology, Geological Engineering, Mining, Mineral Engineering, Metallurgy, Metallurgical Engineering, 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.

Concordia Club Scholarship in German
A scholarship in the value of $300 will be awarded annually in the Faculty of Arts by the Kitchener-Waterloo Concordia Club to promote and encourage the study of German language and literature.

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 Descartes Mathematics Competition.
Applications may be received through the Associated Dean, Faculty of Mathematics.

Claude Neon Limited Scholarship
Claude Neon 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.

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.

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.

Ferure Homes Scholarship
The Freure Homes Scholarship, valued at $200, is awarded annually to a student entering Year 3 (regular programmes) of either Geography or Urban and Regional Planning. Candidates must have an 80% average or above in Year 1 and 2 and it is desirable but not essential that they have a strong interest in urban problems.
The award will alternate annually between Geography and Urban and Regional Planning and the selection of the candidate will be made by the Chairman of the Department of Geography and the Director of the School of Urban and Regional Planning.
Scholarships, Bursaries, Prizes and Financial Aid
Undergraduate Scholarships

General Motors Scholarships
Two awards of $1,000 each to students in the final or penultimate year of Engineering, Economics or Mathematics-Business Option. The recipients must be Canadian citizens who look forward to careers in industry. General Motors will make summer or work-term work assignments an integral part of the scholarship.

Human Kinetics and Leisure Studies Faculty and Staff Scholarship
A limited number of entrance and upper year scholarships will be made available beginning in Fall, 1975. The amount of each award is yet to be determined. Scholarships will be based on academic achievement in the previous year.

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.

S. C. Johnson and Son, Limited Award
S. C. Johnson and Son. Limited is making available three awards, each for $100, to second, third and fourth year Applied Chemistry and Chemical Engineering students. These awards are given for the work term reports judged best for clarity, grammar and other communication skills. The technical content of the report is important but not a qualifying requirement. The award is made each term and the winner will be determined by the Department of Co-ordination in consultation with the Departments of Chemistry and Chemical Engineering. Reports considered confidential are not eligible.

K-W Optical Company Limited Awards
These awards are made to the two students in each of the second, third and fourth professional years who have shown significant improvement in clinical and academic performance in the preceeding year. In the fourth professional year the awards are for $225. In the other years the awards are for $175.

James F. MacLaren Limited Award
James F. MacLaren Limited is making available three awards, each for $100, to second, third and fourth year Civil Engineering students. These awards are given for the work term reports judged best for clarity, grammar and other communication skills. The technical content of the report is important but not a qualifying requirement. The award is made each term and the winner will be determined by the Department of Co-ordination in consultation with the Department of Civil Engineering. Reports considered confidential are not eligible.

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 scholarship in the upper years. (These scholarships may be subject to the condition that no other scholarships are held concurrently).

S. C. Johnson and Son, Limited Award
S. C. Johnson and Son. Limited is making available three awards, each for $100, to second, third and fourth year Applied Chemistry and Chemical Engineering students. These awards are given for the work term reports judged best for clarity, grammar and other communication skills. The technical content of the report is important but not a qualifying requirement. The award is made each term and the winner will be determined by the Department of Co-ordination in consultation with the Departments of Chemistry and Chemical Engineering. Reports considered confidential are not eligible.

K-W Optical Company Limited Awards
These awards are made to the two students in each of the second, third and fourth professional years who have shown significant improvement in clinical and academic performance in the preceeding year. In the fourth professional year the awards are for $225. In the other years the awards are for $175.

James F. MacLaren Limited Award
James F. MacLaren Limited is making available three awards, each for $100, to second, third and fourth year Civil Engineering students. These awards are given for the work term reports judged best for clarity, grammar and other communication skills. The technical content of the report is important but not a qualifying requirement. The award is made each term and the winner will be determined by the Department of Co-ordination in consultation with the Department of Civil Engineering. Reports considered confidential are not eligible.

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 scholarship in the upper years. (These scholarships may be subject to the condition that no other scholarships are held concurrently).

S. C. Johnson and Son, Limited Award
S. C. Johnson and Son. Limited is making available three awards, each for $100, to second, third and fourth year Applied Chemistry and Chemical Engineering students. These awards are given for the work term reports judged best for clarity, grammar and other communication skills. The technical content of the report is important but not a qualifying requirement. The award is made each term and the winner will be determined by the Department of Co-ordination in consultation with the Departments of Chemistry and Chemical Engineering. Reports considered confidential are not eligible.

K-W Optical Company Limited Awards
These awards are made to the two students in each of the second, third and fourth professional years who have shown significant improvement in clinical and academic performance in the preceeding year. In the fourth professional year the awards are for $225. In the other years the awards are for $175.

James F. MacLaren Limited Award
James F. MacLaren Limited is making available three awards, each for $100, to second, third and fourth year Civil Engineering students. These awards are given for the work term reports judged best for clarity, grammar and other communication skills. The technical content of the report is important but not a qualifying requirement. The award is made each term and the winner will be determined by the Department of Co-ordination in consultation with the Department of Civil Engineering. Reports considered confidential are not eligible.
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 Student Awards Office 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.

Science Faculty Scholarships
A limited number of Entrance Scholarships are awarded to students entering General Science, Biology and Earth Sciences. For Chemistry awards, see Chemistry Scholarships and Assistantships. For Physics, see Sir Isaac Newton Scholarships.

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.

R. H. Walters Award
A $100.00 award, based on academic excellence, is made to the most outstanding student in the graduating year of the Honours Psychology program (Joint Honours included) or equivalent. The Undergraduate Affairs group, Department of Psychology, shall select and recommend the award winner to the Senate Committee on Scholarships and Student Aid, which shall approve the nominee.

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.

Michael Wright Memorial Award
Value: $300. To an outstanding student in course in Political Science. Established in 1975 in memory of Michael Wright by his Mother and Sister.
St. Jerome’s College Awards

Undergraduate Scholarships
Unless otherwise stated, no application form is necessary. Where an application is required, appropriate forms may be obtained from the office of the Dean, St. Jerome’s College, and must be submitted before August 1, 1976.

Year 1 Admission Scholarships

Faculty of Arts
St. Jerome’s College is offering entrance scholarships in order to recognize and encourage academic excellence. Entrance awards will be in the amount of $700.00 and will be awarded on the basis of Year 5 marks and secondary school recommendations. Assessment of these awards will be based on preliminary grades submitted to the Ontario Universities’ Application Centre by the candidates’ secondary schools in April and will be awarded in June along with the candidates’ offers of admission to St. Jerome’s College, University of Waterloo.

Faculty of Mathematics
Awards in varying amounts are offered by St. Jerome’s College to first year students enrolled in the Faculty of Mathematics and showing St. Jerome’s College as their first choice on the application for admission to the University. In order to be eligible a student must write the Descartes Competition. Applications for the Descartes Competition may be received through The Associate Dean, Faculty of Mathematics, University of Waterloo. Students who write the Descartes Competition and who have applied for admission to St. Jerome’s College are asked to request a scholarship application form.

St. Jerome’s College Scholarships to Students of St. Mary’s High School and St. Jerome’s High School, Kitchener.
Two scholarships of $500.00 each are awarded annually to one student from St. Jerome’s High School, Kitchener and to one student from St. Mary’s High School, Kitchener, who demonstrate high academic achievement on six Year 5 level courses, but who are not eligible for an Admission Scholarship in their respective Faculty. Assessment of these awards will be based on preliminary grades submitted to the Ontario Universities’ Application Centre by the candidates’ secondary schools in April and will be awarded in June along with the candidates’ offers of admission to St. Jerome’s College, University of Waterloo.

Upper Year Scholarships

St. Jerome’s College Upper Year Scholarships
St. Jerome’s College is offering upper year scholarships in order to recognize and encourage academic excellence. Upper year scholarships will be in the amount of $600.00 and will be awarded on the basis of a student’s academic standing in the previous year and the recommendation of the College Faculty.

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 $150.00 each are awarded to deserving students who combine academic excellence and contribution to College life. Application forms are required.

The Father Anthony Firetto 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. Anthony Firetto, C.R., who taught at the College. Five annual scholarships of $150.00 each are awarded to deserving students who combine academic excellence and contribution to College life. Application forms are required.

The Newman Scholarships.
Two awards of $250.00 each are provided annually to students in their graduating year who have demonstrated consistent academic excellence and contribution to College life.

Undergraduate Awards

St. Jerome’s College Awards
Five awards in varying amounts are awarded annually to Year 1 and upper year students registered at St. Jerome’s College who combine high academic achievement, and financial need. Application forms are required.

The Father Tony Firetto Bursary Fund
This fund was established and is administered by the Students’ Union in memory of the late Rev. Anthony C. Firetto, C.R., who taught at the College. The Fund makes $100 available annually to a student or students registered in the College and majoring or honouring in Psychology. Application should be made to the Chairman of the Psychology Department.

Awards for Candidates for the Priesthood
The following awards are available for students studying for the priesthood who demonstrate academic excellence and financial need. Application forms are required.

The Schill Awards
Two awards in the value of $300.00 each are awarded annually to students registered through St. Jerome’s College in any year.

Awards for Candidates for the Congregation of the Resurrection:

The J. J. Gnam Award
One award annually in the value of $300.00.
Scholarships, Bursaries, Prizes and Financial Aid

Bursaries

The M. Wintemeyer Award
One award annually in the value of $300.00.

The August and Ann Lang Award
One award annually in the value of $300.00.

Awards for Candidates for the Diocese of Hamilton

The Kehoe – Cosgrove Awards
Two awards annually in the value of $200.00 each.

Bursaries

Note
Second class standing is normally required of applicants for bursary assistance. Students with student visas who have not been in Canada for more than one year will not normally be considered. Applications must be submitted to the Awards Office 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 second or third 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.

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.

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 Office.

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.

Applications 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 honors 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.

IBM Canada Bursary Program
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 Scholarship Committee.

Application may be made through the Awards Office.

Interprovincial Pipe Line Company Bursary
The Interprovincial Pipe Line Company Bursary Fund, of a total value of $2,500, has been established by the 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 USA.

Application for a bursary should be made through the Awards Office.

J. P. Bickell Foundation Bursaries
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.

J. G. Hagey Alumni Bursary
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. Applicants should be directed to the Awards Office, University of Waterloo.
Canadian Federation of University Women – Kitchener-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 Bursary

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 electromechanical fields. It is intended to provide financial assistance to undergraduates in need and may be held concurrently with other awards where the need exists.

Awards will be made by the Scholarships Committee and the amount available may be apportioned among two or more students. Applications for a bursary should be made to the 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.

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.

Proctor and Gamble Student Bursary Fund

A number of bursaries are available to assist needy students in any year or faculty. The bursaries are awarded to residents of Canada on the basis of academic standing and financial need.
Prizes

University of Waterloo Alumni Association Gold Medals
The University of Waterloo Alumni Association is providing a maximum of six gold medals annually to be awarded in recognition of academic excellence. Each medal will be awarded on the recommendation of the Dean of a Faculty. The medals may be awarded, at either the Spring or Fall Convocation, as follows: one each to a student in each of the six Faculties of the University who has demonstrated outstanding academic performance on completion of an undergraduate degree program.

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 students 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 and fourth 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, and fourth years.

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

All of the above prizes are made available through contributions of the following Canadian Suppliers and Laboratories:
- Dominion Contact Lens Laboratory, New Toronto, Ontario
- Eastern Optical Laboratories Limited, Dartmouth, Nova Scotia
- Gordon Contact Lenses, Inc., Rochester, N.Y.
- Kahn Optical Company Limited, Toronto, Ontario
- Monarch Optical Co., Toronto, Ontario
- Omand 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

Classics Prize
The Classics Prize of $50. will be awarded annually to the student who attains the highest mark in either Latin 190 or Greek 200. To qualify for the prize the student must enroll in a further Latin or Greek course at the 200 level.

Political Science Third Year Prize
This prize of $50. will be awarded by the Political Science Department to the fourth year Political Science major who has the highest cumulative average in his or her Political Science courses at the end of third year.

No application is necessary.

The J. C. Thompson Memorial Prize (value $125.00)
The Award of the Alumni Association in memory of the late Dean J. C. Thompson is made to the final year student in the School of Optometry who has ranked highest in Optometry (Optometry 302, 312, etc.).

The Percy Hermant General Proficiency Prizes (value $500 and $250)
The gifts of Sydney Hermant are awarded to the final year students in the School of Optometry ranking first and second in general proficiency.

The General Proficiency Medal
The gift of the Board of Directors, College of Optometrists of Ontario is awarded to the final year student in the School of Optometry ranking highest in general proficiency.

The T. T. Beattie Medal
The bequest of T. T. Beattie is awarded to the final year student in the School of Optometry ranking highest in Orthoptics or Visual Training. The award is made once every three years, approximately, as funds permit.

The E. F. Attridge Prize
The gift of E. F. Attridge is awarded to the final year student in the School of Optometry ranking highest in Pathology.

The K-W Optical Company Limited Prizes
Awards are made to the two students in each of the second, third and fourth professional years who have shown the greatest improvement in academic standing. In the fourth professional year the awards are for $250. and $200. In the other years the awards are for $200. and $150.

The Canadian Contact Lens Society Prize (value approximately $100.00)
The proceeds of a fund invested on behalf of the Canadian Contact Lens Society will be awarded to a final year student in the School of Optometry who shows the greatest proficiency in the theoretical and practical application of Contact Lenses.
Scholarships, Bursaries, Prizes and Financial Aid

Prizes

The E. T. Davies Memorial Prizes
In memory of the late Professor E. T. Davies, his colleagues in the Applied Mathematics Department offer annually two prizes of the approximate value of $100 each: one prize is for the first year student, enrolled in the Faculty of Mathematics, who ranks first in the final examinations; the other is for the third year Applied Mathematics student who ranks first on the final examinations. In the initial year the value of the first year prize will be increased by an amount donated by Professor Davies’ students.

No application is necessary.

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.
University Loan Funds

The Awards Office administers a number of emergency loan funds which are intended to provide emergency assistance to students experiencing temporary, short-term financial problems. Students wishing to obtain assistance from one of the following funds should apply to the Awards Office.

Alumni Association Student Assistance Plan
This Loan Fund has been instituted by the Alumni Association, University of Waterloo.
Loans up to $200, with repayment periods of up to 4 months are available to students in all faculties.

Arts Society Emergency Loans
Short-term, interest-free emergency loans are available to full-time undergraduates who are members of the Arts Society. Loans are to a maximum of $100 for a period of up to 60 days.

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.

Engineering Society “A” Loan Fund
This fund was established by the Engineering Society “A” to assist students in need of short term loans.

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.

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.

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.

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.

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.

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.

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.

The Women’s Auxiliary to the Optometrical Association of Ontario Loan Fund
This fund has been established by the Auxiliary to provide interest-free short-term loans to all eligible full-time students at the University who are experiencing temporary financial difficulty.
Government Assistance Programs

Canada Student Loans Plan and Ontario Student Assistance Program

Full-time students may be eligible for a loan or a loan and grant to help pay for post-secondary studies and certain related costs. Loans are made available through the Federal Government's Canada Students Loans Plan and the loans are interest-free while the student is engaged in full-time study. Grants are provided by the Government of Ontario and do not normally have to be repaid.

The two main principles behind the programs are:
- you qualify for assistance on the basis of financial need, not on your level of academic achievement;
- assistance is to supplement, not replace, your own financial resources and those of your immediate family. You will be expected to contribute to the cost of your own education and, depending on your circumstances, your parents or your spouse may also be expected to contribute.

Further details and applications are available from the Awards Office.

Ontario Special Bursary Program for Part-Time Students

This program will provide bursary assistance based on financial need to students taking less than 60% of a normal full course load. The assistance is intended for individuals who are unemployed, receiving social assistance, or have a low family income.

Additional information and application forms are available from the Awards Office.

Loans for Part-Time Students

The Ontario Student Loans Plan provides loans of up to $700.00 per term to eligible part-time students who are taking less than 60% of a normal full-course load. These loans are made available on the basis of financial need and are normally interest-free for six months after the conclusion of the academic period for which the loan was provided, or six months after you withdraw from your course or courses, or three and one-half years after the start of the first term for which you receive an Ontario Student Loan.

Further details and application forms are available from the Awards Office.
The Department of Co-ordination and Placement

Co-op students check job opportunities.
Department of Co-ordination and Placement

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

Associate Directors
B. A. McCallum, B.A. (Western)
J. C. Wilson, B.Sc., C.E. (U.N.B.), P.Eng.

Operations Analyst
J. R. Culley, B.Comm. (McGill)

The Department of Co-ordination and Placement is responsible for the work terms in the co-operative programmes, and for assisting all students in career planning and obtaining employment on graduation. The staff is comprised of professional personnel having extensive experience related to their fields of service in the Department.

Engineering
Programme Administrator

Assistant to Programme Administrator

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. Mateyk, B.A.Sc. (Toronto), P.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.

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)

Applied Economics
Programme Administrator
R. A. Klawitter, B.A. (Western)

Career Planning and Placement
Administrator
T. H. Fitzgerald, B.A. (St. Lawrence)

Co-operative Mathematics
Options in Actuarial Science, Computer Science, Optimization, Business, Teaching, Chartered Accounting, and Statistics

Programme Administrator
R. A. Klawitter, B.A. (Western)

Assistant to Programme Administrator
E. P. Whelan, B.A. (Waterloo)

Co-ordinators
D. J. Beaupre, B.Com., M. Sc. (Loyola)
J. T. Boniface, B.Sc. (Waterloo)
R. W. Hancox, B.A.Sc. (Waterloo)
E. M. Johnson, B.A. (Queen's)
J. R. Pawley, B.A. (Carleton)
E. R. Pyatt, B.A. (Waterloo), C.A.
S. R. Stankus, B.Sc. (R.M.C.)
G. M. Subastic, B.A.Sc. (Washington)

Environmental Studies – Architecture
Programme Administrator
J. W. Hoag, B.Arch. (Toronto)

Co-ordinator
W. G. Dailey, B.Arch. (Liverpool)

Co-operative Human Kinetics, Health Studies and Leisure Studies
Programme Administrator
W. B. Fuller, B.A. (Western)

Co-ordinators
M. S. McLaughlin, B.A. (Waterloo)
P. J. Upigrove, B.Sc. (Waterloo)

Environmental Studies – Applied Geography
Programme Administrator
R. A. Pullin, B.S.A. (Toronto)

Co-ordinator
M. A. McMartin, B.A. (Western)

Applied Economics
Programme Administrator
R. A. Klawitter, B.A. (Western)

Post Graduate Careers Information Officer
G. L. White, B.A.Sc. (Toronto), P.Eng., F.C.I.C.
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 and Placement. 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, each class is split into two approximately equal groups for 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 in the next column.

---

### Sequence

<table>
<thead>
<tr>
<th>Term</th>
<th>First Group</th>
<th>Second Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>1B</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>2A</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>2B</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>3</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>4A</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>4B</td>
<td>Term</td>
<td>Term</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term</th>
<th>First Group</th>
<th>Second Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>3B</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>4</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>4A</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>4B</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>5</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>5A</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>5B</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>6</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>6A</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>6B</td>
<td>Work</td>
<td>Work</td>
</tr>
</tbody>
</table>

### 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 and Placement. The Co-ordinators counsel the students, visit them on the job, and assist them to adjust to work situations and professional development.**

<table>
<thead>
<tr>
<th>Term</th>
<th>First Group</th>
<th>Second Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>1B</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>I</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>2A</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>2B</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>3</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>4A</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>4B</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>5</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>5A</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>5B</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>6</td>
<td>Work</td>
<td>Work</td>
</tr>
<tr>
<td>6A</td>
<td>Term</td>
<td>Term</td>
</tr>
<tr>
<td>6B</td>
<td>Work</td>
<td>Work</td>
</tr>
</tbody>
</table>

---

### Work Terms

A basic requirement of the co-operative programmes at the University of Waterloo is satisfactory performance during 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 Department of Co-ordination and Placement.**

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

Students are expected to seek employment through the interview process arranged by the Department of Co-ordination and Placement. They are not to approach participating employers directly, unless specific arrangements are made with the Department. A student who has a job available before entering the co-operative programme must have the job evaluated by the Department to confirm that it meets the experience standards required.

Students and employers choose each other through the following process: Job notices are posted on Department bulletin boards, or printed in tabloid form, 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 of Co-ordination and Placement.

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 employers 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 employers 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 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 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 the 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 benefit 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 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. Work reports, a minimum of four in most programmes, are a requirement for graduation.

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 made by a faculty member, or a Co-ordinator, or by the employer, depending on the programme in which the student is enrolled. Both these evaluations (performance and work report) subsequently will be maintained in the student's record.

Graduation Requirements
Work Terms:

Quantity – As a general principle, a co-operative programme includes a number of work-term/months equal to, or greater than, half the number of academic-term/months in the programme, from the time the programme begins. In those faculties which offer both regular and co-operative programmes, the minimum number of related work terms required for a co-operative degree is normally four. In those faculties offering only the co-operative programme, the minimum number of work terms normally equals the number of work terms remaining in the programme from point of entry.

Performance Evaluation – In those programmes with a stated minimum number of work terms, this number is also the minimum number of satisfactory work terms.

In programmes where there is no stated minimum, the number of satisfactory work terms can be one less than the number of work terms remaining in the programme from point of entry. The exception to this condition occurs when a student is admitted with only five, four or three work terms remaining. In this situation all the work terms must be satisfactory.
Work Reports:

**Quantity** — In most programmes, the submission of work reports is a requisite for graduation and generally the minimum number is four. Provision is made for those situations where there are less than four work terms, or other special conditions.

**Quality** — The minimum number of work reports submitted in each programme must be graded as satisfactory or better with the provision that students who submit reports that are graded as unsatisfactory have the option of upgrading the existing or submitting new reports.

**Registration Through Final Term** — All work terms must be completed before the final academic term and the last work report must be submitted no later than the beginning of the final academic term. In all co-operative programmes, students must be registered in the programme from term of entry through the final academic term. The only exception occurs in programmes on a credit system where a student has enough credits to be able to register as a part-time student in the final term.

Co-operative Degree Designation

Since Architecture and Engineering are mandatory co-operative programmes, University of Waterloo graduates in these disciplines are known to have gone through the co-operative system. In Mathematics, Kinesiology, Recreation, Chemistry, Geology and Physics, students may graduate from either the regular or the co-operative programme. In recognizing the difference for one of theses disciplines where the choice is optional, graduates completing the co-operative plan requirements will receive a "co-operative" degree designation.

Conduct and Responsibilities

It is emphasized that during the work terms the student carries a responsibility to build and maintain one’s own 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 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.

Each student is expected to maintain communication with the Department on all matters pertinent to participation in the co-operative programme. After each work term, a return-to-campus interview with the student’s Co-ordinator is essential.

Students registered in any of the co-operative programmes should obtain the Department of Co-ordination and Placement’s booklet on controls and regulations concerning Seeking Employment and Employer Interviews, Work Terms, Work Reports and Graduation Requirements. The booklet clarifies, emphasizes and supplements the University’s requirements of co-op. students as outlined in this Calendar.

The foregoing has been written with the assistance of the Student Advisory Council to the Department of Co-ordination and Placement. 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 is available from high school guidance departments or from the Department of Co-ordination and Placement.
Industrial Advisory Council for Co-operative Engineering and Applied Science

The Industrial Advisory Council of the University of Waterloo was established in 195X 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 and Applied Science.

R. W. Sclater (Chairman)
The Sclater Group

D. W. Roughley (Vice-Chairman)
Regional Municipality of Hamilton-Wentworth

R. A. Carlyle (Secretary)
International Nickel Company of Canada Ltd.

G. C. Brown
The Price Company Ltd.

R. E. Dorsay
Imperial Oil Enterprises Ltd.

V. R. Duxbury
3M Canada Ltd.

R. C. Foss
Mosaic Incorporated

D. Frieseen
Dofasco

H. Hurlbut
Labatt Ontario Breweries

A. S. Jones
Luhrizol of Canada Ltd.

T. Larson
Borden Chemical Company (Canada) Ltd.

J. M. Lawrence
B.P. Refinery Canada Ltd.

J. F. MacLaren
James F. MacLaren Ltd.

D. McKenzie
Ford Motor Company Canada Ltd.

C. C. Midwinter
Sandwell & Company Ltd.

A. E. Peterson
Canada Post Office

K. H. Rapsey
Allen-Bradley Canada Ltd.

C. H. Sager
Department of National Defense

S. W. Sheldon
Standard Brands Ltd.

V. Skof
Frankel Structural Steel

A. E. Speers
Canadian National Railways

D. T. Stevenson
Babcock & Wilcox Canada Ltd.

W. D. Stover
Sheldons Engineering Ltd.

Organizations Employing Co-operative Engineering and Applied Science Students

Abex Corporations Ltd.
Abitibi Paper Company Limited
Abitibi Provincial Paper Ltd.
Acco Canadian Material Handling Systems
Acres Consulting Services Ltd.
The Adams Mine
Addiction Research Foundation
AES Data Limited
Armco Industries Limited
Ainley and Associates Limited
Air Canada
Albery, Pullerits, Dickson & Associates
Alcan Canada Products Ltd.
Alcan Wire and Cable Limited
Algoma Ore Division
The Algoma Steel Corporation Limited
Allan Crawford Associates
Allan C. Rundles Ltd.
Allen-Bradley Canada Limited
Allied Chemical Canada Ltd.
Aluminum Company of Canada Limited
AMF Canada Ltd./Potter Brumfield Div.
Amerock Limited
Ampex of Canada Limited
Anaconda Canada Limited
Anatek Electronics Co.
R. V. Anderson Associates Limited
Andrew Antenna Company Limited
Angelstone Limited
Anglo-Canadian Pulp & Paper Mills Limited
H. H. Angus & Associates Ltd.
Aptec Engineering Limited
Aquataine Company of Canada Limited
Armbrro Materials & Construction Ltd.
Armco Canada Limited
Associated Geotechnical Services Limited
Associated Tube Industries Limited
Atlas Steels Company
Atomic Energy of Canada Limited
Automotive Hardware Limited
BDH Chemicals Limited
B. A. C. M. Limited
Babcock & Wilcox Canada Ltd.
Bacon Engineering Limited
Barton Tubes Limited
Baton Broadcasting Limited
Bayly Engineering
Beak Consultants Ltd.
Beaver Engineering Limited
Beel Controls Limited
Bekaert Industrial Limited
Bell Canada
Bell Northern Research
Bennett & Wright Eastern Ltd.
Benson & Hedges Tobacco Co.
Bennett Paving & Materials Limited
Birmingham Construction Ltd.
Black & Decker Manufacturing Company Limited
Black & McDonald Limited
Bondar-Clegg of Canada Limited
Borg-Warner (Canada) Ltd.
Borough of Etobicoke
Borough of North York/Public Works Dept.
J. P. Bowman Limited
Bowmar Canada Limited
Bradstock, Reicher & Partners Limited
Brampton Hydro Electric Commission
Brant County Board of Education
Bright Wire Sales Ltd.
Brinkerhoff Drilling Canada Limited
Bristol-Myers Canada Limited
Bruce S. Evans Limited
B. P. Refinery Canada Limited
The Budd Automotive Co. of Canada Ltd.
Building Products of Canada Limited
R. J. Burnside & Associates
Butler Manufacturing Company (Canada) Ltd.
Butts, Magwood & Hall Ltd.
Canada Colors & Chemicals Limited
Canada Crushed Stone
Canada Glue Company Limited
Canada Machinery Corporation Limited
Canada Packers Limited
Canada Sand Papers Limited
Canada Valve Limited
Canadian Admiral Corporation Ltd.
The Canadian Blower & Forge Co. Ltd.
Canadian Blue Bird Coach Limited
Canadian Brass Limited
Canadian Broadcasting Corporation
Canadian Canners Limited
Canadian Carborundum Company Limited
Canadian Carbonization Research Association
Canadian Fram Limited
Canadian General Electric Co. Ltd.
Canadian General-Tower Limited
Canadian Gypsum Co. Ltd.
Canadian Industries Limited
Canadian Iron Ore Committee
Canadian Johns-Manville Company Limited
Canadian Liquid Air Limited
Canadian National Railways
Canadian Pacific
Canadian Pittsburgh Industries Ltd.
Canadian Refractories Division
Camadoam Stackpole Limited
Canadian Standards Association
Cadillac Development Corp. Ltd.
Camston Limited
Canbar Wood Tank Company
Canefco Limited
Canron Limited
Carling O'Keefe Limited
Carrier Air Conditioning (Canada) Ltd.
Catalytic Enterprises Limited
Centerline (Windsor) Limited
Central Dynamics Ltd.
Chemetics International Ltd.
Chicago Rawhide Products Canada Limited
Chinook Chemicals Eastern Limited
Chipman Chemicals Limited
Ciba-Geigy Canada Ltd.
Cimco Ltd.
City of Barrie
City of Brampton
City of Brantford
City of Brockville
City of Burlington
City of Cambridge
City of Chatham
City of Guelph
City of Hamilton
City of Kitchener
City of London
City of Mississauga
City of Niagara Falls
City of Oshawa
City of Peterborough
City of Port Colborne
City of St. Catharines
City of Sault Ste. Marie
City of St. Thomas
City of Sudbury
City of Thunder Bay
City of Toronto
City of Welland
City of Windsor
City of Waterloo
Clipsham Moreton Limited
Club House Foods Ltd.
Columbus McKinnon Limited
Cominco Ltd.
Computing Devices of Canada Limited
Comstock International Ltd.
Conair Canada Ltd.
Conesioga Engineering Limited
Consolidated-Bathurst Ltd.
Consolidated Canadian Faraday Limited
County of Brant
The Consumer's Gas Company
Consumers Glass Co. Ltd.
V. B. Cook Company Ltd.
Cooper-Bessemr of Canada Limited
Copeland Laboratories Limited
Corby Distilleries Limited
Corrosion Service Co. Ltd.
Cosmos Ehemlac Limited
Coulter Copper & Brass Limited
County of Dufferin
CPI Vampco Limited
R. L. Crain Limited
Crane Canada Ltd.
Crane Packing Company Ltd.
Crouse-Hinds of Canada Ltd.
<table>
<thead>
<tr>
<th>Organization Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrysler &amp; Latham</td>
</tr>
<tr>
<td>Cumming-Cockburn &amp; Associates</td>
</tr>
<tr>
<td>Dagmar Construction Limited</td>
</tr>
<tr>
<td>Dashwood Industries Limited</td>
</tr>
<tr>
<td>Data Crown Ltd.</td>
</tr>
<tr>
<td>Dayco (Canada) Limited</td>
</tr>
<tr>
<td>Decca Radar Canada (1967) Limited</td>
</tr>
<tr>
<td>Deleuw, Cather, Canada Limited</td>
</tr>
<tr>
<td>Delta-Benco Cascade</td>
</tr>
<tr>
<td>Deutz Diesel (Canada) Limited</td>
</tr>
<tr>
<td>Denison Mines Limited</td>
</tr>
<tr>
<td>Diamond Canapower L.</td>
</tr>
<tr>
<td>Diamond Clay Products Company Limited</td>
</tr>
<tr>
<td>Diesel Equipment Ltd.</td>
</tr>
<tr>
<td>Digital Methods Ltd.</td>
</tr>
<tr>
<td>M. M. Dillon Limited</td>
</tr>
<tr>
<td>Doehler Canada Limited</td>
</tr>
<tr>
<td>Dominion Aluminum Fabricating Ltd.</td>
</tr>
<tr>
<td>Dominion Bridge Company Limited</td>
</tr>
<tr>
<td>Dominion Cellulose Company Limited</td>
</tr>
<tr>
<td>Dominion Chain Limited</td>
</tr>
<tr>
<td>Dominion Foundries &amp; Steel Limited</td>
</tr>
<tr>
<td>Dominion Glass Co. Ltd.</td>
</tr>
<tr>
<td>Dominion Soil Investigations Ltd.</td>
</tr>
<tr>
<td>Domtar Chemicals Limited</td>
</tr>
<tr>
<td>Domtion Textile Limited</td>
</tr>
<tr>
<td>Domtar Construction Materials Ltd.</td>
</tr>
<tr>
<td>Domtar Fine Papers Limited</td>
</tr>
<tr>
<td>Domtar Packaging Limited</td>
</tr>
<tr>
<td>J. T. Donald &amp; Company</td>
</tr>
<tr>
<td>Dorr-Oliver-Long Limited</td>
</tr>
<tr>
<td>Dow Chemical of Canada Limited</td>
</tr>
<tr>
<td>Dresser Industries Products Limited</td>
</tr>
<tr>
<td>Dryden Paper Company Limited</td>
</tr>
<tr>
<td>Dufferin Construction Co.</td>
</tr>
<tr>
<td>Dufferin Materials &amp; Construction Limited</td>
</tr>
<tr>
<td>Dunlop Canada Limited</td>
</tr>
<tr>
<td>Dunlop, Farrow, Aitken, Architects &amp; Consulting Engineers</td>
</tr>
<tr>
<td>Duplate of Canada Limited</td>
</tr>
<tr>
<td>DuPont of Canada Ltd.</td>
</tr>
<tr>
<td>E &amp; B Cowan Consulting Engineers</td>
</tr>
<tr>
<td>East Gwillimbury Township</td>
</tr>
<tr>
<td>Eaton Yale Ltd.</td>
</tr>
<tr>
<td>Eastern Steel Products</td>
</tr>
<tr>
<td>Ebasco Services of Canada Ltd.</td>
</tr>
<tr>
<td>Ecodyne Limited</td>
</tr>
<tr>
<td>T. J. Ecsedi &amp; Associates Ltd.</td>
</tr>
<tr>
<td>The E. B. Eddy Company</td>
</tr>
<tr>
<td>Eddy Forest Products Limited</td>
</tr>
<tr>
<td>Edmunde Ntwahl Associates Ltd.</td>
</tr>
<tr>
<td>J. Edward Lanthier</td>
</tr>
<tr>
<td>R. A. Egan &amp; Associates Ltd.</td>
</tr>
<tr>
<td>Eldorado Nuclear Limited</td>
</tr>
<tr>
<td>Electric Reduction Co. of Canada Ltd.</td>
</tr>
<tr>
<td>Electronics Corporation of America (Canada) Limited</td>
</tr>
<tr>
<td>Ellis-Don Ltd.</td>
</tr>
<tr>
<td>The Engineering Group</td>
</tr>
<tr>
<td>Engineering Interface Limited</td>
</tr>
<tr>
<td>Envirotech Canada Ltd.</td>
</tr>
<tr>
<td>Erco Industries Ltd.</td>
</tr>
<tr>
<td>Eric Technological Products of Canada Ltd.</td>
</tr>
<tr>
<td>Ernst Leitz (Canada) Ltd.</td>
</tr>
<tr>
<td>Esso Chemical Canada</td>
</tr>
<tr>
<td>Falconbridge Nickel Mines Limited</td>
</tr>
<tr>
<td>The Falk Corporation of Canada Limited</td>
</tr>
<tr>
<td>Federal Pioneer Ltd.</td>
</tr>
<tr>
<td>Fermaar Paving Ltd.</td>
</tr>
<tr>
<td>Ferranti-Packard Limited</td>
</tr>
<tr>
<td>Fiberglas Canada Limited</td>
</tr>
<tr>
<td>Firestone Tire &amp; Rubber Co. of Canada Ltd.</td>
</tr>
<tr>
<td>Fischback &amp; Moore of Canada Ltd.</td>
</tr>
<tr>
<td>Fisher Controls Company of Canada Limited</td>
</tr>
<tr>
<td>Fleck Manufacturing Company</td>
</tr>
<tr>
<td>Flecto Coatings Limited</td>
</tr>
<tr>
<td>FMC of Canada Limited</td>
</tr>
<tr>
<td>Formosa Spring Brewery</td>
</tr>
<tr>
<td>Foseco Canada Ltd.</td>
</tr>
<tr>
<td>Forsythe Lubrication Associates Limited</td>
</tr>
<tr>
<td>Foundation General Engineering Construction Ltd.</td>
</tr>
<tr>
<td>Foundation of Canada Engineering Corp. Ltd.</td>
</tr>
<tr>
<td>E. S. Fox Ltd.</td>
</tr>
<tr>
<td>Foxboro Company Limited</td>
</tr>
<tr>
<td>Fram Canada Limited</td>
</tr>
<tr>
<td>Francis Hankin &amp; Company Limited</td>
</tr>
<tr>
<td>Frankel Structural Steel Limited</td>
</tr>
<tr>
<td>Franklin Mfg. Co. Canada Ltd.</td>
</tr>
<tr>
<td>Fullercon Limited</td>
</tr>
<tr>
<td>Funcafeh Vehicles Limited</td>
</tr>
<tr>
<td>Galt Metal Industries Limited</td>
</tr>
<tr>
<td>Gamsby &amp; Mannerow</td>
</tr>
<tr>
<td>Gandalf Data Communications Ltd.</td>
</tr>
<tr>
<td>Garrett Manufacturing Limited</td>
</tr>
<tr>
<td>Gaspe Copper Mines Limited</td>
</tr>
<tr>
<td>GEAC Computer Corporation Limited</td>
</tr>
<tr>
<td>General Foods Limited</td>
</tr>
<tr>
<td>General Motors of Canada Ltd.</td>
</tr>
<tr>
<td>Geonics Limited</td>
</tr>
<tr>
<td>The Giffels Group</td>
</tr>
<tr>
<td>Glaxo Canada Ltd.</td>
</tr>
<tr>
<td>H. Q. Golder &amp; Associates Limited</td>
</tr>
<tr>
<td>B. F. Goodrich Canada Limited</td>
</tr>
<tr>
<td>The Goodyear Tire &amp; Rubber Company of Canada Limited</td>
</tr>
<tr>
<td>Gore &amp; Storrie Limited</td>
</tr>
<tr>
<td>Gould Manufacturing of Canada Ltd.</td>
</tr>
<tr>
<td>Government of Canada</td>
</tr>
<tr>
<td>Government of Ontario</td>
</tr>
<tr>
<td>Grand River Conservation Authority</td>
</tr>
<tr>
<td>G. Granek &amp; Associates</td>
</tr>
<tr>
<td>Grandview Industries Ltd.</td>
</tr>
<tr>
<td>Grayco Limited</td>
</tr>
<tr>
<td>Great Canadian Oil Sands Limited</td>
</tr>
<tr>
<td>The Great Lakes Paper Company Limited</td>
</tr>
<tr>
<td>Great West Steel Industries Ltd.</td>
</tr>
<tr>
<td>Greb Industries Ltd.</td>
</tr>
<tr>
<td>Greenfield Construction Co. Inc.</td>
</tr>
<tr>
<td>The Griffith Laboratories Limited</td>
</tr>
<tr>
<td>GSW Research Centre</td>
</tr>
</tbody>
</table>
Co-ordination and Placement
Organizations Employing
Co-operative Engineering and Applied Science Students

GTE Automatic Electric (Canada) Limited
Group Eight Eng. Ltd.
Guelph Hydro
Guild Electric (Ontario) Ltd.
Gulf Minerals Canada Ltd.
Gulf Oil Canada Limited
Haessler & Dewey Ltd.
Hamilton Harbour Commission
Harbridge Development Corp. Ltd.
Hart Chemicals Ltd.
Hart Industries Ltd.
Hatch Associates Ltd.
Hawker Siddeley Canada Ltd.
Hayes-Dana Limited
Heath & Sherwood Drilling
Hi-Test Instruments Limited
Hi Tower Drilling
R. R. Higgins & Associates Limited
Holek-Vollmer Ltd.
Holstead, Orendorff & Redmond Limited
Honeywell Controls Limited
The Hoover Company Ltd.
Hospital for Sick Children
Hostess Foods Products Ltd.
Hovey & Associates Ltd.
Hover-Jak Ltd.
C D Howe Co. Ltd
Hudson's Bay Oil & Gas Limited
Hudson Bay Exploration & Dev. Co. Ltd.
Husky Floor Machine Co. Ltd.
Hydraulic Machinery Co. Ltd.
Hydro-Electric Commission of Welland
Hydro Mississauga
Hy-Hoe Corporation Ltd.
IBM Canada Limited
ICN-Empire
Imperial Oil Ltd.
Imperial Tobacco Co. (Ontario) Ltd.
Imperial Tobacco Products Limited
Inducon Consultants of Canada Limited
Industrial Grain Products Ltd.
Inglis Co. Ltd.
Inspec-Sol Ltd.
International Minerals & Chemical Corp. (Canada) Ltd.
The International Nickel Company of Canada Ltd.
International Systcoms Ltd.
Interroyal Corporation Limited
Intersteel Consultants Ltd.
Intra-Space International Inc.
Iron Ore Company of Canada
ITT Canada Limited
ITT Grinnell Co. of Canada Ltd.
James F. MacLaren Limited
Jarro Manufacturing Company Limited
Jerrold - A Division of General Instrument of Canada Limited
Jervis B. Webb Company of Canada Ltd.
John Deere Welland Works
John T. Hepburn Co. Ltd.

Johnson Matthey & Mallory Limited
S. C. Johnson And Son. Limited
G. N. Johnston Equipment Company Limited
Joiner Homes Limited
Joseph E. Seagram & Sons Limited
Joy Manufacturing Company (Canada) Ltd.
Kanmet Limited
Kaufman Footwear Limited
Kearney-National (Canada) Ltd.
Keith, Jenkins & Associates Limited
Kerr Addison Mines Ltd.
Kilborn Engineering Ltd.
Kimberly-Clark of Canada Limited
Kimberly-Clark Pulp & Paper Co. Ltd.
Kenting Earth Sciences Ltd.
K. H. King Associates Ltd.
King Hydraulic Power Limited
R. S. Kirkup & Son
Kitchener-Waterloo Hospital
The Kleinfeldt Group Ltd.
Knox Martin Ketch Ltd.
Koehring-Waterous Limited
Konvey Construction Company Limited
Korlin Limited
Labatt Breweries of Canada Limited
Lackie Bros. Ltd.
Lakefield Research of Canada Limited
Lear-Siegler Industries Limited
Leco Industries Ltd.
J. D. Lee Engineering Limited
Lilly Eli & Co. (Canada) Ltd.
Lindsay CATV System Ltd.
Litton Systems (Canada) Limited
Lloyd-Truax Limited
M. Loeb Limited
W. P. London and Associates Ltd.
Long Spruce Constructors
Looby Construction Limited
Lubrizol of Canada Ltd.
The Lummus Company Canada Limited
Lunar Company Limited
3M Canada Limited
M & T Products of Canada Ltd.
MacMillan Bloedel Research Ltd.
L. Matmets & Associates
Malcolm Condensing Company Limited
Manitoba Forestry Resources Ltd.
Manitoba Hydro Limited
Mansfield-Denman General Limited
A. D. Margison and Associates Limited
Marshall Macklin Monaghan Limited
Marshland Engineering Limited
V. K. Mason Construction Limited
Massey-Ferguson Industries Limited
Mattabi Mines Limited
Mathews Conveyor Company Limited
Maxim Electrical Construction Company Ltd.
McAsphalt Engineering Services
McConnell & Mitsche
Co-Ordination and Placement
Organizations Employing
Co-operative Engineering and Applied Science Students

McCormick Rankin & Associates Limited
H. J. McFarland Construction Co. Ltd.
McGeorge & Barry Limited
McGrath Engineering Limited
McKee Brothers Limited
McNamara Marine Limited
McLean Foundry Limited
Metex Corporation Limited
Mickelson Associates
Microsystems International Ltd.
Millhaven Fibres Limited
MLW Industries Limited
Molson's Brewery (Ontario) Limited
Molson's Brewery (Quebec) Limited
Monteith Ingram Engineering Ltd.
Monteith & Sutherland Ltd.
Montgomery Elevator Limited
Motorola Canada Ltd.
Motorola Electronics Sales Limited
Mountain Cablevision Limited
MTD Products Canada
Municipality of Metro Toronto
The National Cash Register Co. of Can. Ltd.
Nisbet, Letham Limited
Noranda Mines Limited
Noranda Research Centre
Northern Electric Company Limited
Northern Engineering Services Co. Ltd.
Northland Engineering Limited
North York Hydro Office
Norwich Pharmaceutical Co. Ltd.
O & W Electronics Limited
Oakville Public Utilities Commission
The Ontario Cancer Institute
Ontario Housing Corp.
Ontario Hydro
Ontario Malleable Iron Co. Ltd.
The Ontario-Minnesota Pulp and Paper Co. Ltd.
The Ontario Paper Company Limited
Ontario Research Foundation
Ontario Transportation Development Corp.
Ottawa Construction Management Services
Otis Elevator Company Limited
Outboard Marine Corporation of Canada Limited
Oxford Regional Centre
Pamour Porcupine Mines Ltd.
Papeterie Reid Limited
Paul Theil Associates
Peabody Engineering of Canada Ltd.
Pentagon Construction Co. Ltd.
Peter F. McGaw & Associates
Petrosina Canada Limited
Philip Doyle Limited
Philips-Lau Products Limited
Philips Planning & Engineering Ltd.
Philips Electronics Industries Ltd.
Picker X-Ray Mfg. Ltd.
Pigott Construction Company Limited
Pilkington Brothers Canada Limited
Pirelli Cables Limited
C. A. Pitts General Contractor Ltd.
Plax Canada Limited
Plibrico Canada Limited
T. G. Pneutech Limited
Polysar Limited
Pratt & Whitney Aircraft of Canada Ltd.
Pre-Con Company
Preston Sand & Gravel Co. Ltd.
The Price Company Limited
Prince George Pulp & Paper Limited
Pro-Eco Limited
The Procter & Gamble Company of Canada Ltd.
The Proctor & Redfern Group
Proto Tools of Canada Limited
Provincial Crane Division
Brantford, Public Utilities Commission
Public Utilities Commission of Ingersoll
Public Utilities Commission of Woodstock
Purolator Limited
The Quaker Oats Co. of Canada Ltd.
Raytheon Canada Limited
RCA Limited
Read Voorhees & Associates Ltd.
Red-D-Mix Concrete Company
Regional Municipality of Halton
Regional Municipality of Durham
Regional Municipality of Hamilton-Wentworth
Regional Municipality of Niagara
Regional Municipality of Peel
Regional Municipality of Sudbury
Research Cottrell Canada Limited
Reuter-Stokes Canada Ltd.
Richards-Wilcox of Canada Limited
Rio Algom Mines Limited
The Robbins & Myers Company of Canada Limited
Rogol Electric Company Limited
B. M. Ross and Associates Limited
P. S. Ross & Partners
Roxton Furniture Limited
Rumble Contracting Ltd.
G. D. Russel Construction Ltd.
Ryback, Smith and Ginsler Limited
Salada Foods Ltd.
Sandwell and Company Limited
Sarco Canada Limited
Savage Shoes Limited
Schering Corporation Limited
Schultz Construction Limited
H. Seward & Co. Limited
Scintrex Surveys Limited
Selco Exploration Company Ltd.
Semco Instruments Co. Ltd.
Seneca Manufacturing (St. Catharines) Ltd.
G. M. Sernas & Associates
Shaw Pipe Industries Ltd.
Sheldons Engineering Limited
Shell Canada Limited
Sherritt Gordon Mines Ltd.
Co-ordination and Placement
Organizations Employing
Co-operative Engineering and Applied Science Students

Simon-Day Limited
A. G. Simpson Company Limited
Simpsons-Sears Limited
Simmons-Tecsult Limited
Sinclair Radio Laboratories Ltd.
C. R. Snelgrove Co. Ltd.
Sonoco Products Company of Canada Limited
Sigmund Soudack & Associates Ltd.
Southdown Engineering Company
Southam Printing Company Limited
Spruce Falls Power & Paper Company Limited
St. Anne-Nackawic Pulp & Paper Ltd.
St. Clair Chemical Limited
St. Joseph's Hospital
St. Lawrence Cement Co. Ltd.
St. Mary's Cement Co.
Stanton Pipes (Canada) Limited
Stauffer Chemical Company Canada Ltd.
Steed & Evans Limited
The Steel Company of Canada Limited
Steele's Wire Springs Limited
Steep Rock Iron Mines Limited
Steffler Metal Products Limited
Sterley of Canada (Holdings) Ltd.
Stephens-Adamson
Sterling Varnish Co. (Canada) Ltd.
Stone & Webster Co. Ltd.
Sudbury Hydro
Sullivan Strong Scott Limited
Sunnybrook Hospital
Sun Oil Company Limited
Sutcliffe Company
Switzer Engineering Services Ltd.
Tamblyn Mitchell & Partners Ltd.
Taylor Instrument Companies of Canada Ltd.
Tec Contractors Ltd.
Teklogix Limited
Telesat Canada
Tembec Forest Products Inc.
Tempo Audvision Incorporated
Temprite Industries Limited
Texaco Canada Limited
Texaco Exploration Canada Limited
Texas Gulf Canada Limited
J. E. Thomas Specialties Limited
Thorco Contracting Ltd.
TLM Conveying Systems Ltd.
Toronto-Hydro Electric System
Toronto Transit Commission
Totten, Sims, Hubicki (Canada) Ltd.
Town of Markham
Town of Oakville
Township of Elliot Lake
Trans Canada Pipe Lines Limited
Trans Northern Pipe Line Limited
Trecan Ltd.
Trench Electric Limited
Triton Engineering Services Ltd.
Underwood McLellan & Associates Ltd.
Underwriters' Laboratories of Canada
Union Carbide Canada Ltd.
Union Drawn Steel Company Limited
Union Gas Company of Canada Limited
Union Miniere Explorations and Mining Corp. Ltd.
Uniroyal Chemical – Division of Uniroyal Ltd.
Uniroyal Limited
Unit Rig & Equipment Co. (Canada) Ltd.
Uni-Tel Limited
Universities and Colleges
McMaster University Medical Centre
Royal Military College of Canada
Sheridan College of Applied Arts and Technology
St. Clair College of Applied Arts and Technology
University of Toronto
University of Western Ontario
Urban Transportation Development Corp.
Valhalla Executive Centre
Vanbots Construction Company
Varian Associates of Canada Ltd.
V. M. E. Associates Limited
Victaulic Company of Canada Limited
Volker-Craig Limited
Wabush Mines
Walbar Machine Products of Canada Ltd.
P. J. Wallbank Manufacturing Co. Ltd.
B. P. Walker Associates Ltd.
Walker, Fedy, McCargar, Hachborn
W. L. Wardrop & Associates
Western Controls Incorporation
Westinghouse Canada Limited
Weyerhaeuser Canada Ltd.
White-Cockshutt Farm Equipment
Whitehall Laboratories Ltd.
William Trow & Associates Limited
R. E. Winter & Associates
Wm. Roberts Electric & Mechanical Limited
The W. C. Wood Company Limited
Worthington (Canada) Ltd.
X-Ray Assay Laboratories Limited
Xerox of Canada Ltd.
M. S. Yolles Associates Ltd.
York Steel Construction Ltd.
Organizations Employing Co-operative Mathematics Students

AGT Data Systems Limited, DCF Systems Limited
The Algoma Steel Corporation Limited
Loftus A. Allan & Company
Allen, Miles, Fox & Johnston
Alphatekt Systems Limited
Aluminum Company of Canada Limited
Aluminum Goods
Atomic Energy of Canada Limited
Automatic Electric Canada Limited
B.A.C.M. Limited
Bank of Canada
Bank of Nova Scotia
Bata Limited
Beallor Beallor & Burns
W. J. Beattie & Company
Beaver Engineering Limited
The Becker Milk Company Limited
Bell Canada
Bell Northern Research
Boards of Education
   Brant County
   Carleton County
   The Cochrane-Iroquois Falls
   Essex County
   Etobicoke
   Hamilton
   Hastings County
   Lincoln County
   North York Borough
   Ottawa
   Peel County
   Renfrew County
   Sault Ste. Marie
   Scarborough
   Sudbury
   Timmins
   Waterloo County
   Wellington County
   York Borough
   York County
Bouris, Wilson, Scott & Proctor
Brunton, Browning, Day & Partners
Budd Automotive Company of Canada Limited
Burns Foods Limited
Burnsides Petrie & Company
Burroughs Business Machines Limited
Campbell, Sharp, Nash & Field
Canada Permanent Trust Company
Canada Systems Group (EST) Limited
Canadian Fram Limited
Canadian General Electric Company Limited
Canadian Imperial Bank of Commerce
Canadian Motor Industries Holdings Limited
Canadian National Telecommunications
Canadian Pacific
Canadian Pittsburgh Industries Limited
Canadian Tire Corporation Limited
Canadian Trailmobile Limited
Canfarm Data System
C.C.M.
Charles A. Kench & Associates Limited
Chrysler, Shillington & Company
Canadian Industries Limited
City of Sault Ste. Marie
City of Sudbury
City of Toronto
Clark, Stark & Diegel
Clarkson, Gordon & Company
Co-operators Insurance Association
Cochrane Tool & Design
Cole Rubin Pinkelstein & Green
Combine Insurance Company of America
Comtech Group Limited
Confederation Life Insurance Company
Consumers Gas Company Limited
Control Data Canada Limited
Coopers & Lybrand
Cossar, Hector, Payne & Company
Coutts Hallmark Cards
Cox, Hyatt & Company
The Crown Life Insurance Company
Daciuk & Tinsdale, Hamilton
L & W Data Systems Limited
Data Crown Limited
De Havilland Aircraft of Canada Limited
Deloitte, Haskins & Sells
Dominion Foundries & Steel Limited
The Dominion Life Assurance Company
Douglas, Hostetler & Dawber
Dow Chemical of Canada Limited
Draper Dobie & Company Limited
D. A. Dunlop & Company
Dunwoody & Company
Economic Council of Canada
Euston Mining Limited
Eddy Forest Products Limited
Electrohome Limited
Ellis-Don Limited
Enns, Graham & Company
The Excelsior Life Insurance Company
Facelle Company Limited
Falconbridge Nickel Mines Limited
Fiberglas Canada Limited
Financial Post
Firestone Tire & Rubber Company of Canada Limited
Ford Keast Giles Smith & Phillips
Ford Motor Company of Canada Limited
Fox Glicksman & Company
Gardner, McDonald & Company
Gates Rubber of Canada Limited
Gaviller & Company
GEAC Computer Corporation Limited
Gellman, Hayward & Partners Limited
General Foods Limited
General Motors Canada Limited
Co-ordination and Placement
Organizations Employing
Co-operative Mathematics Students

George Deeth
George A. Welch & Company
George Harrower & Associates Inc.
The Globe and Mail Limited
Goodyear Tire & Rubber Company of Canada Limited
Gore Mutual Insurance Company
Government of Canada
Government of Ontario
Graham Goebelle
Grand & Toy Limited
Gray, Butcher, Frost & Company
Greer, Fleming, Roland & Company
Group Five Consulting Limited
Gulf Oil Canada Limited
Harbinson, Glover, & Company
Harding Carpets Limited
Archibald H. M. Harper
M. A. Hassel
Walter J. Heaton
Hewlett-Packard (Canada) Limited
Hilborne & Company
Hiram Walker & Sons Limited
Honeywell Limited
Horne, Booth, Lyons, Wands & Lawrence
Hyde - Houghton & Company
IBM Canada Limited
Imperial Life Assurance Company Limited
Imperial Oil Limited
Imperial Tobacco Company of Canada
The Independent Order of Foresters
Informetrica Limited
Integrated Mini Systems Limited
International Harvester Company of Canada Limited
The International Nickel Company of Canada Limited
ITT Canada Limited
Jarrett Gould Elliot & Company
Johnson Richard & Company
Joscelyn, Laughlin, Harper, Tory & Associates
Kimbly Clark of Canada Limited
Kime & Company
Kodak Canada
Langnis, Hanick & Company
Laventhal, Kreksstein, Howath & Howath
M. Loeb Limited
London Life Insurance Company
Lough Lewis & Associates
3M of Canada
MacGillivray & Company
A. F. MacLaren & Company
The Manufacturers Life Insurance Company
Maritime Life Assurance Company
Massey Ferguson Limited
McCann, Swinerton, Newland & Company
McCay, Duff & Company
McColl, Turner & Company
L. J. McGuinness & Company Limited
McMahon, Millard, Graham & Kentner
The Merchantile & General Reinsurance Company

Millard, Rouse & Rosebrugh
Mindustrial Corporation Limited
Minicomputer Business Systems
Molson Industries Limited
Morris, Burk, Friedman & Luborsky
Multiple Access Limited
Municipality of Metropolitan Toronto
The Mutual Life Assurance Company of Canada
National Cancer Institute of Canada
The National Life Assurance Company of Canada
Neil Coburn
New Brunswick Telephone Company
Noranda Mines Limited
North America Life Assurance Company
Northern & Central Gas Corporation Limited
Ontario Credit Union League Limited
The Ontario Institute for Studies in Education
Ontario Hydro
Osborne & Osborne
Outboard Marine Corporation of Canada Limited
Peat, Marwick, Mitchell, & Company
Perlmutter, Orenstein, Giddens, Newman & Company
Phillips Electronic Industries Limited
Polycom Systems Limited
Polysar Limited
Price-Waterhouse & Company
Proctor & Gamble Company of Canada Limited
P. S. Ross & Partners
Quasar Systems Limited
Reed Paper Limited
Richardson, Bond & Wright Limited
Ross, Pope & Company
Roth & Hymers
The Royal Bank of Canada
Royal Insurance Group
Saddington, Greenfield & Company
J. M. Schneider Limited
S.D.I. Associates
Seaway Midwest Limited
Shell Canada Limited
Simpson Sears Limited
Smith, Klymas, Selks & Company
Smith, Nixon & Company
Software Brokers Incorporated
Solursh & Sapiro
The Sovereign Life Assurance Company of Canada
Springer Chapman & Company
The Steel Company of Canada Limited
Sweep Rock Mines
Sudbury Hydro
Sun Oil Company Limited
Systems Approach Limited
Systems Dimensions Limited
Telesat Canada
Tessier, Smith & Partners
Texaco Canada Limited
Tomenson Alexander Limited
Thorne Riddell & Company
The Toronto Dominion Bank
Co-ordination and Placement
Organizations Employing Co-operative Architecture Students

Toronto Hydro – Electric System
The Toronto Mutual Life Insurance Company
Toronto Transit Commission
Touche. Ross & Company
Towers, Perrin, Forster, Crosby (Canada) Limited
Trans Canada Pipe Limited
Travelers Life Insurance Company of Canada
TSC Computer Limited
Union Gas Company of Canada Limited
Uniroyal Research Labs
United Co-operatives
Universities & Colleges
  Alberta College
  Ashbury College
  Bishop’s College School
  Laurentian University
  Loyalist College
  St. Andrews College
  St. Clair College
  University of Ottawa
  University of Toronto
  Wilfrid Laurier University
  York University
VanSickle & Fox
B. J. Vincent Company
G. H. Ward & Partners
Welch & Brooks
Wilkinson & Company
Wilson, Masin & McLaren
Winspear, Higgins, Stevenson & Company
Woods, Gordon & Company
Workmen’s Compensation Board
Xerox of Canada Limited

Organizations Employing Co-operative Architecture Students

Adamson Associates
Agniew Peckham Associates
Air Canada
Akitt & Swanson, Architects
Alexander Benedek, Architect
Andrew Volgyesi, Architect
Anthony Butler, Architect
Anthony L. Kemp, Architect
Architects Consortium
Arco Planning Consultants Limited
Arcop Associates
Arnott MacPhail Johnstone & Associates Limited
Arthur Erickson, Architect
Ball Brothers Limited
Bank of Montreal
Bell Canada
Blood & Houghton
Brant County Board of Education
Bregman & Hamann, Architect
Brian E. Pye, Architect
Brook, Carruthers & Shaw, Architects
Built Environment Co-Ordinators Limited
Campeau Corporation Limited
Canadian Imperial Bank of Commerce
Central Mortgage & Housing Corporation
Clifford & Lawrie, Architects
Cluff & Cluff, Architects
Dawson & Szynaski
A. J. Diamond, Architect
Dominik, Thompson, Laframboise, Mallette
Don Hancock, Landscape Architect
Donald E. Skinner, Architect
Dubois, Binkhardt, Strong
Donlop, Farrow, Atiken, Arch. & Con. Eng.
Ferdinand Wagner, Architect
Fisher, Tedman & Glaister, Architects
Fraser & Macie, Architects
Frick Bellinger Associates
Glos Architects, Engineers & Planners
Gore & Storrie Limited
Govan, Kaminker, Langley, Keenleyside, Melick, Devonshire, Wilson, Architects
Government of Canada
Government of Ontario
Grand River Conservation Authority
Harley Little Associates Limited
Harold Freure Limited
Harry Smith, Architect
Hennessey Watson, Associates
Henry Fliss, Architect
Home Planners Incorporated
Horton, Ball, Walter, Fedy, McCargar, Hachborn
Imperial Oil Limited
Jackson Ypes & Associates
John Andrews, Architect
Co-ordination and Placement
Organizations Employing Co-operative Human Kinetics & Leisure Studies Students

Kilborn Engineering Limited
Killick, Metz, Field, Associates
Kyles, Kyles & Garratt, Architects
Lebensold, A. Fleck, Nichol, Hughes
Lingwood & Robertson, Architect-Engineer
Lipson & Dahkin, Architects
Lithwick, Lambert, Sim & Johnston & Moy, Architects
Lower Trent Region Conservation Authority
MacDonald & Zurberec
Mark, Musselman, McIntyre, Combe, Architects
Marshall, Merrett, Stahl, Elliott, Mill & Ross, Architects
Martin, Edge, Architects
Mathers & Haldenby, Architects
Matsui, Baer, Heidman, Vanstone
McNab, Burkley, Logan, Young
Meek, Klausen, Seryage, Walker
Michael Torsney, Architect
Moffat, Moffat & Kinoshita
Moffat & Duncan, Architects
Moshe Safdie, Architect
The Niagara Parks Commission
A. Norman McRoberts, Architect
Norr, Architects
Ontario Housing Corporation
Otonabee Conservation Authority
Page & Steele, Architects
Parkin, Architects, Engineers, & Planners
M. Paul Wiegand, Architect
Prack Partners
Y & R Properties
Quadrinc Limited
Ranta & Tett, Architects
Ray & Elizabeth Bradbury, Architects, & Landscape Architects
Robert L. Langlois, Architect
Robinson & Heinrichs
Ryan & Lee
Scherrer & Hicks, Chartered Architects
Shore, Tifhe, Henshel, Irwin, Architects & Engineers
Snider, Huigey & March, Architects
Somerville, McMurrich & Oxley, Architects
Stafford, Haensli, Architects
Stan H. Butcher, Architect & Town Planner
I. Stecura, Architect
R. Stewart Smith, Architect
Stone & Kohn
Swain & Rupnow, Consulting Engineers
Thom Partnership
Thompson, Berwick, Pratt & Partners
Toronto Malton Implementation Team
Toronto Transit Commission
Towend, Stecura, Baleshta & Saville, Architects
University of Western Ontario, Physical Plant
Victor C. Dale, Architect
Wall & Yamamoto, Architects
Webo, Zerafa, Menkes, & Housden, Arch. & Eng.
Wilfred Sorensen, Architect
William Kachmaryk, Architect

Organizations Employing Co-operative Human Kinetics & Leisure Studies Students

Alcoholism & Drug Addiction Research Foundation
Ausable-Bayfields Conservation Authority
Boards of Education
Brant
Hastings
Ottawa
Peel
Renfrew
Waterloo County
Wellington County
Borough of Etobicoke
Borough of Scarborough
Boyne River Natural Science School
Boys’ Club of Greater Niagara
Camp Tawingo
Camp Onondaga
Cedar Glen
Central Peel Secondary School
City of Barrie
City of Brampton
City of Brantford
City of Burlington
City of Hamilton
City of Kitchener
City of Mississauga
City of Orillia
City of Owen Sound
City of Peterborough, City Hall
City of Sudbury
City of Thunder Bay
City of Timmins
City of Toronto
City of Woodstock
C.P.R.I. Childrens Psychiatric Research
Dominion Foundries & Steel Limited
Dr. MacKinnon Phillips Hospital
Ecole Secondaire Theriault
Elliot Lake Centre for Continuing Education
Erindale Secondary School
Family Service Association
Fern Resort
The Fitness Institute
Goderich Psychiatric Hospital
Gordon Graydon Memorial Secondary School
Government of Northwest Territories
Government of Ontario
Grand River Conservation Authority
Grandview Lodge
Grandview School
Halton Region Conservation Authority
Hamilton Psychiatric Hospital
G. H. Hicks Treatment Centre
Homewood Sanitarium
Huronia Hockey
Co-ordination and Placement
Career Planning and Placement

Huronia Regional Centre
Kettle Creek Conservation Authority
Kingston Psychiatric Hospital
Kitchener-Waterloo Hospital
Lakehead Psychiatric Hospital
Lakeshore Psychiatric Hospital
Linhaven Home for the Aged
Lutherwood
Mainland Valley Conservation Authority
March of Dimes Ability Fund
Meadowvale Recreation Centre
Merrymount Children's Home
Midwestern Regional Centre
Muskoka Centre
Nepean Parks & Recreation
Ontario Association for the Mentally Retarded
Ontario Crippled Children’s Centre
Ontario Housing Corporation
Ontario Society for Crippled Children Camp
Oxford Regional Centre
Parks Canada
Parks, Recreation & Community Centre Board
Participation House
Parkwood Hospital
Pine Ridge
Port Credit Secondary School
Prince Edwards Heights Hospital
Queen Street Mental Health Centre
Quintin Canada Limited
Recreation Department, Palmerston
The Regency Racquets Club
Rideau Regional Hospital School
Roland Mitchener Secondary School
Southampton Nursing Home
Southwestern Regional Centre
St. Clair Region Conservation Authority
St. Thomas Psychiatric Hospital
Sunnybrook Hospital
Sunset Home for the Aged
Timmins High & Vocational School
Town of Dundas
Town of Ingersoll
Town of Mount Forrest
Town of Newmarket
Town of Stoney Creek
Town of White River Municipal Buildings
Township of Pickering
Township of Terrace Bay
Universities & Colleges
Appleby College
Cambrian College
Conestoga College
Loyalist College
Ontario Police College
Sault Ste. Marie College
Sudbury College
Valleyview Home for the Aged
Waterloo Ski Club
West Scarborough Boys’ Club
Whitby Psychiatric Hospital
Wilmet Recreation Department
Woolwich Recreation Department
YWCA
Ottawa
Hamilton
Kitchener-Waterloo
Metropolitan Toronto
Storer Camps
YWCA
'Metropolitan Toronto
Ottawa

Career Planning and Placement

Career Planning Administrator
T. H. Fitzgerald, B.A. (St. Lawrence)

Post Graduate Careers Information Officer
G. L. White, B.A.Sc. (Toronto), P.Eng., F.C.I.C.

Students at all academic levels are assisted 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 for students are held on job-hunting techniques, resume writing and how to take an interview. These sessions help bridge the gap between the academic environment and the search for employment.

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

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.

Career Planning and Placement strives to give the best possible service by opening as many communication channels as possible among students, employers, faculty and staff.

The offices are located on the first floor of the Ira G. Needles Hall.
The University Libraries

Main Entrance – Dana Porter Arts Library
The University Libraries

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

Assistant to the Librarian – Administration
A. Dunnet, B.B.A. (U.N.B.)

Assistant to the Librarian – Special Projects
M. Virtue, B.A. (Guelph), M.L.S. (Dalhousie)

Business Administrator
J. Jorgensen, B.A. (Toronto)

Systems Development Librarian
G. Damon, B.A. (Maine), M.S.L.S. (Case Western)

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

Support Services

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

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

Cataloguing Department Head
J. Scanlon, B.A., B.L.S. (Toronto)

Assistant Head
P. Stoksik, B.A., B.L.S. (Toronto)

Cataloguers
T. Canini, B.A., M.A. (Helsinki), M.L.S. (Western)
A. Chan, B.A. (Hong Kong), M.L.S. (Western)
C. Hagstrom, B.A. (Lakehead), M.A. (Western), M.L.S. (Western)
R. Ho, B.A. (Wisconsin-Madison), M.S.L.S. (Case Western)
G. Raaphorst, B.A. (Ottawa), M.L.S. (McGill)
M. Wan, B.S.Sc. (Hong Kong), M.A., M.L.S. (Western)

Serials Department
Head
B. Bruder, B.A. (Waterloo Lutheran)

Cataloguer
G. Louden, B.A. (Temple), M.L.S. (Toronto)

Reader Services

Assistant Librarian for Reader Services
B. MacNeil, B.Sc. (Laurentian), M.L.S. (McGill)

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

Reference Department Head
T. Eadie, B.A. (Queen's), M.A. (Queen's), M.L.S. (Western)

Reference Librarians
J. Beglo, B.A. (Waterloo Lutheran), M.L.S. (Toronto)
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), M.L.S. (Western)
A. Slade, B.A. (Victoria), B.L.S. (British Columbia)

Government Publications
Department Head
C. Presser, A. B. (Hunter), M.L.S. (Pratt)

Librarian
J. Boettger, B. A. (Waterloo), B.L.S. (British Columbia)

Engineering, Mathematics and Science Divisional Library
Co-ordinator
C. Presser, A. B. (Hunter), M.L.S. (Pratt)

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

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

Reference Librarians
N. Bastedo, B.A. (Rollins), M.A. (Toronto), M.L.S. (Western)
W. MacPherson, B.Sc., M.L.S. (Dalhousie)
D. Morton, B.Sc. (Western), M.L.S. (Western)
J. Parrott, B.Sc. (Queen's), M.Sc., B.L.S. (Toronto)
I. Rodin, B.Sc. (McGill), M.L.S. (Western)
B. Toth, B.A. (Queen's), M.L.S. (McGill)

Environmental Studies Library
Head
P. Brown, B.A. (Queen's), M.L.S. (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. Public services located on the first floor include a large reserve reading room with seating for 160 readers, a rare book room, a listening room with facilities for both phonodiscs and audio cassettes and eight typing cubicles. 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, and microforms, are located on the third 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 fourteen hundred places for readers.

The Arts Library collections number 780,000 items, including books and periodicals in the Humanities and Social Sciences, 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 subscribes to 3,750 periodicals.

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 220,000 items, including books, journals, and many kinds of special materials, which include technical reports, microforms, documents and maps. The library has 2,850 subscriptions to current periodicals; 1,800 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 40,000 maps, supported by 3,500 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.

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

Choir performing Beethoven's 9th Choral Symphony
The Faculty of Arts

The graduate in Arts is generally and liberally educated and has not been trained for a specific task in a specific profession. The holder of the Honours B.A. is usually qualified to enter professional programmes to begin professional training. To be liberally educated is no mean accomplishment; the world has increasing need of men and women so educated. The goal of a liberal education – acquaintance with some of the major ideas and forces that shape our civilization and the ability to think clearly, critically, and creatively – is important and desirable in itself.

Qualified women and men are both encouraged to apply.

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

A) General Programmes

B) Honour 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 and Social Development Studies.

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. Descriptions of the single honours programmes and each discipline’s requirements in joint honours programmes are outlined on pages 71 through 87. Students interested in programmes and courses emphasizing Canadian material should examine the Canadian Studies Programme on page 72 and the Canadian Studies section of the Calendar, in Chapter 14.

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. Information regarding approved specialized fields can be obtained from the Ontario Ministry of Education.

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 I 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, Yr. 3, and those with 15 or more, Yr. 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 such 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 evaluation 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>

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.

Note

When a failed course is repeated, the two marks are not averaged together. Rather both marks are entered with all other marks in calculating the student's cumulative overall average.

d) Students may request that their performance in any given Arts course be marked either as Credit (Cr) or Fail (F). The instructor of the course and the student's department must agree to this arrangement at the outset of the course and the student must communicate the decision in writing to the Arts Faculty Examinations and Standings Committee before the end of the three week drop and add period.

In satisfaction of the minimum degree requirements students in general programmes may present up to three full course equivalents with a grade of Credit (Cr) in courses outside their major. Students in Honours Programmes may present up to four full course equivalents with a grade of Credit (Cr) in courses outside their Honours Area.

Students considering teaching careers should especially note that the Ministry 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.

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

Regular full-time students in the General Arts programme normally enrol, in each academic term, in five or six half-courses equivalents. Full-time students in the General Arts programme may enrol in more than six half-course equivalents per academic term only with the consent of the Examinations and Standings Committee.

Regular full-time Students in the Honours Arts programmes normally enrol, in each academic term, in five or six half-course equivalents. (See departmental Honours Programmes for specifications and exceptions.) Students in Honours Programmes may not enrol in more than one-half course equivalent per academic term in excess of the number specified for their programme except with the permission of the Examinations and Standings Committee.

4 Reduced Programmes

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 . After these times reduced programmes require the approval of the appropriate Undergraduate Office, and of the Examinations and Standings Committee, and they must be consistent with the drop-add regulations.

5 Part-time Studies

Students may pursue degree studies (in both General and Honours Programmes) 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.

6 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 the field of specialization. If at any time a
student's overall average falls between 50 and 60 or the average in the student's field of specialization below 65, the student will be granted conditional status for one year, during which period the student must make reasonable progress toward obtaining good standing or will be asked to withdraw.

b) To be considered in good standing in an Honours Programme, a student must maintain a cumulative overall average of at least 60%. In addition, a student must maintain a cumulative average of at least 75% in all courses taken in the Honours discipline unless the department specifies a higher average. A student in a Joint Honours Programme must maintain a cumulative average of at least 75% in all the courses taken in the two honours disciplines unless the departments specify a higher average.

If an Honours degree candidate's major average falls below the prescribed minimum, such candidate will be considered for the General degree and the regulations in (a) above will apply. If, subsequently the student raises his average to the required level, he may, through his Department Chairman, petition the Examinations and Standings Committee to review his case.

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 the student will not profit by further study.

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

7 Grade Appeal Procedures

1) If a student wishes to appeal a course grade, the student should (as soon as possible and at the latest within six months of receipt of the grade) try to work the matter out informally with the instructor concerned. If the problem cannot be resolved in this way, the student may submit a formal, written appeal to the appropriate department chairman or head of the affiliated colleges or dean of the federated college. Because of their familiarity with problems specific to their disciplines, departmental or collegial review bodies offer the appellant the best opportunity for a thorough and a fair review of his appeal.

Whether or not a student wishes to proceed informally or formally, he may secure advice and assistance in his appeal either from the Undergraduate Office of the Faculty of Arts or from officers of the Arts Society.

2) The review procedures adopted by departments and colleges are critical. Departments and colleges must work out such procedures and have them easily available to anyone interested. When an appeal is made the department or college shall carefully discuss the procedures with the appellant to determine that they are clearly understood and acceptable to all parties. The review procedures used in a specific case, with any modifications agreed to, should be signed by all parties to indicate they understand the procedures, and the procedures should then be ratified by the Arts Faculty Examinations and Standings Committee. It is understood that the decision reached by the review committee on the substantive academic issues raised by the appeal is final and subject to change only under the terms outlined in the following note. The decision of the review committee and the reasons for the decision should be communicated in writing to the appellant.

Note
If a student appeals beyond the department or college, he moves away from a pool of academic competence, and, in effect, formally requests a review of the procedures used in hearing his appeal. A written request should be submitted to the Arts Faculty Examinations and Standings Committee.

The Committee shall review the petition and transmit it with relevant documentation to the Arts Faculty Appeals Committee which shall comprise the Associate Dean (Undergraduate Affairs), a senior Professor appointed by the Arts Faculty Council Executive Committee, and a third or fourth year honours student designated by the Arts Society. The Arts Faculty Appeals Committee shall review the departmental or collegial procedures and shall have access to all relevant documents and the right to interview persons concerned. The main purpose of the Committee is to ascertain that decisions were reached using appropriate procedures and that both sides had adequate representation and a fair hearing. The decisions and the reasons for them shall be reported to both the appellant and the Examinations and Standings Committee.

Arts Programmes

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. It is the student's responsibility to ascertain that all requirements for graduation have been met. Any exceptions in graduation requirements requested by a student must be approved in writing by the Examinations and Standings Committee of the Arts Faculty Council.
Group A and Group B Requirements

All Arts students in all Arts Major and Honours Programmes (see below for requirements for non-majors) must 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, Polish, Russian, Spanish, Ukrainian (See Note)
- **Group A (iii)**: Drama, Fine Arts, Religious Studies
- **Group B**: Anthropology, Economics, Geography, Political Science, Psychology, Sociology

**Note 1**
Other foreign languages may be used to meet the Group A (ii) requirement. This includes courses as Religious Studies 105J Elementary Hebrew, Religious Studies 106P New Testament Greek, Arts 190*191* or 192*193* Introductory Chinese, Arts 290*291* or 292*293* Intermediate Chinese.

**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 for advanced work.

The Faculty of Arts recommends that its students take at least one course in mathematics or the natural sciences.

**Note 1**
Space limitations may, from time to time, imply that students admitted to the University or otherwise in good standing, are not guaranteed course and programme selections of their choice.

**Note 2**
Each student's programme must be approved on or before registration date by a faculty advisor from the Faculty of Arts.

**Note 3**
In Year 1, a student must normally complete the introductory course in the department in which he will major in later years.

**Note 4**
"Courses" refers to courses which extend for one full academic year (September through April). Two half-year (term) courses are the equivalent of one full course; half (term) courses are marked with * in the course description section.

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) 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.

It is important that students settle down in their schedule of courses just as quickly as possible. Students usually find that courses they add late in the second or third week of classes pose special problems in catching up with the work already covered.
Year 1
The General Programme
Students in Year 1 normally choose five courses (two and a half each term) for a total of five credits for the year. The usual pattern of courses is two from Group A and two from Group B, with one or two more as electives. (Students are advised that a six course work load is quite heavy.) At the end of Year 1, students in the General Programme must choose one of the following subjects as their major field of study:

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

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

Year 2
Students in Year 2 of the General Programme choose at least five courses in consultation with their departmental advisor:

a) a minimum of two further courses in the major subject
   (See notes);
b) three other courses (See notes).

Year 3
Students in Year 3 must choose five courses in consultation with their departmental advisor:

a) a minimum of two further courses in the 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 credits with a 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

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 Drama, 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 Arts Faculty Undergraduate Office.

Minor Programmes
Students enrolled in Honours Programmes in Arts or other faculties may elect a minor in an Arts discipline. All minor programmes in Arts require successful completion of at least five credits in the minor discipline with an overall cumulative average of 65% in those credits.

Minor in Asian Studies
To meet requirements for a minor in Asian Studies, a student must complete 5 credits from the following list of courses with a cumulative average of 65%. At least 3 of the credits must be from 3 different discipline areas of Anthropology, Sociology, Philosophy, Political Science, History, Religious Studies, and Chinese language and literature courses under the Arts listing. Courses in the minor cannot also count in the honours discipline.

Anthropology 236J* Social and Cultural Change in South East Asia
Arts 190*/191* Introductory Chinese, or Arts 192*/193* Introductory Chinese
Arts 220R*/221R* Chinese Thought and Culture
Arts 290*/291* Intermediate Chinese, or Arts 292*/293* Intermediate Chinese
Arts 320R*/321R* Special Topics in Chinese Thought and Culture
Arts 391*/392* Classical Chinese, or Arts 392*/393* Classical Chinese
History 103*/104* The Emergence of the Third World
History 269R* History of Modern Revolution
History 282 East Asian History
History 375 History of China
History 440 Senior Seminar on Far East Asian History
Arts
Honours Programmes

Philosophy 365*/366* Oriental Philosophy
Political Science 102* Imperialism in International Relations (section taught by A. Kapur)
Political Science 281*/282* International Politics 1 and 2 (section taught by A. Kapur)
Religious Studies 110* Religions of Mankind
Religious Studies 213* Hinduism
Religious Studies 214* Buddhism in India, China, and Japan
Religious Studies 215* Chinese Religions
Religious Studies 269* Myths and Symbols of the Religions of India
Religious Studies 313* Modern Religious Movements in India
Religious Studies 314* Zen Buddhism
Religious Studies 353* Ethics in Indian Thought
Sociology 203* Introduction to Comparative Social Thought

Honours Programmes

In Year 1 a student must normally complete the introductory course in the subject in which such student 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
The student’s programme must include a year (two half course equivalents) of
Archaeology
Linguistics
Social-cultural Anthropology
Physical Anthropology
Honours theory (theory oriented courses at the 400 level)

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
Three 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
Honours Programmes

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.

Note 1
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.F.S. Geography Requirements will be found under Geography Joint Honours Programmes.

Note 2
Students intending to qualify for the Type A Certificate for teaching high school must elect a minimum of nine courses in Geography.

Note 3
Students are advised to consult the undergraduate officers of both Departments before formulating their programme of study.

Honours Programmes in Canadian Studies
Recommended Programme

Year 1
A French language course: consult Department of Classics and Romance Languages
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 one other full course chosen from among those specifically recommended for students concentrating their programme in Canadian Studies (see note 4)

Arts
Honours Programmes

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 one other full course 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 programmes 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 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 14 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 14 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. 101*/102*
Three other courses.

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

Year 3
Senior Greek or Latin course.
C. Civ. 270, 351*/352*
Three other courses.

Year 4
Two other C. Civ. courses
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. 101*/102*
Three other courses.

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

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

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

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.

Note 2
Students are advised that History 340 is acceptable for Classics credit.

Honours Drama and Theatre Arts

1) A total of twenty courses (forty half courses) including Faculty of Arts Group A and B requirements with an overall cumulative average of at least C- and a cumulative major average of B.
2) At least ten of the students courses (twenty half courses) must be in Drama and Theatre Arts.
3) Drama 101* and 102* are the required pre-requisites for most Drama and Theatre Arts courses.
4) In addition Students must satisfy the following requirements:
   A) Drama 221*
   B) Drama 243* or 244*
   D) Drama 371* and 372*
   F) Drama 409*
   G) Drama 499 (this is a full year course)
   H) Any three other Drama courses or other approved courses in related departments.

Note 1
See Faculty of Arts requirements for other required classes.

Note 2
The Honours B.A. programme in Drama will enable the student to proceed towards the Ontario College of Education Type A Certificate provided at least two full courses in another teaching subject are acquired (see current calendar requirements).

Note 3
For a description of Drama 499 see Course Description.

Joint Honours Programmes, Drama and Theatre Arts

1) Seven and a half of the student’s courses (fifteen half 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) In addition students must satisfy the following requirements:
   A) Drama 221*
   B) Drama 243* or 244*
   C) Drama 371* and 372*
   E) Drama 409*
   F) Drama 499. This is a full year course. Also see note 4 below.
   G) Three other half courses in drama.
Arts
Honours Programmes

Note 1
Joint Honours programmes other than those already approved may be arranged by consultation with the Drama and Theatre Arts group and the Department concerned.

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

Note 3
The Joint Honours programme in Drama and another teaching subject will enable the student to proceed towards the Ontario College of Education Combined Type A Certificate.

Note 4
Whether a student does the Senior Seminar (499) or not will depend upon the requirements of other departments. If the other department requires the equivalent of a Senior Seminar of its Joint Honours students the Drama Group would waive the 499 requirement. Instead the student would take any two other (one full) Drama classes. If the other department does not have a Senior Seminar requirement then the student may elect to take Drama 499 or two other (one full) Drama Classes. For a description of Drama 499, see Course Descriptions.

Honours Economics
Prerequisite
It is desirable, but not mandatory, that students planning to enter Honours Economics should offer a minimum of one Ontario Year 5 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*
Political Science 101*/102*
English 109* or 140*
Philosophy 140*
Two electives

Year 2
Economics 201*, 202*, 221*, 231*
Economics 211* or Math 130
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*
Two half courses in Economics at 300 level or above
Three electives

Co-operative Program in Economics
The student can earn an economics degree by following either the general or honours option in the traditional manner by attending the University during the Fall and Winter terms of each year.

Under a second option in the honours programme offered by the Department of Economics, the student attends the first two years during the fall and winter terms, and at the end of the second year serves a work term in industry or government in the spring term and alternating terms thereafter. The co-operative option therefore offers a mix of on-the-job experience and academic work. This option is available only to honours students who attain high standing at the end of the fall term of their second year in economics. For the first year, students enrol in the Faculty of Arts in the usual way.

Honours Applied Economics (Co-op)

Year 1
Economics 101*, 102*, 191*, 192*
Mathematics 73A, 73D
Either Mathematics 83*, 84*, or
Mathematics 119A, 119B
Two electives (four half courses)

Year 2
Economics 201*, 202*, 233*, 231*, 241*
Either Mathematics 81 or
Mathematics 120A, 120B
Either Economics 211*, 221* or
Mathematics 223a, 223b
One and one-half electives (3 half courses)

Term 3A
Economics 263*, 301*
One additional half course in Economics at the 300 level
Mathematics 515*
One-half elective (one half course)

Term 3B
Economics 302*, 303*
One additional half course in Economics at the 300 level
One elective (two half courses)

Term 4A
Economics 402*, 421*
One and one-half elective (three half courses)

Term 4B
Economics 401*, 422*
One and one-half elective (three half courses)
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*, 191*, 192*, 193*, 194*
Math 73a, Math 73d, or Math 132a, Math 132b
English 140* or English 210*
Elective (one full course)

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

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

Year 4
Economics 393*, 394*, 491*, 492*, 493*,
Three electives (six half-courses)

Economics Joint Honours Programmes
The core courses in economics for any joint honours programme normally are:
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, Sociology, 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 263* must be taken along with the above core courses.

Note 4
Economics and Mathematics
Substitute Economics 311*, 321*, for Economics 211*, 221*.
Economics 421*, 422* to be included in 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 towards 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.

Note 5
Economics and Sociology
Students may take either Economics 221* or Sociology 202*.

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

Honours English
English Requirements
Although either 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.

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 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.

Note 2
The heart of this curriculum will reside in the conferences between student and adviser. 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*, 415*; 400; one more from 305, 310, 330, 350, 372, 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 in an English Joint Honours Programme must maintain a minimum average of 70% (with no more than three half course equivalent grades below B–) in the English component of their programmes together with a combined 75% average in both areas of specialization (that is, English and the other discipline).
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, 362*, 363*
Two other English full course equivalents.

Honours Fine Arts
To fulfill the requirements for an honours degree in Fine Arts, all students must take at least 20 Fine Arts courses. Courses in music and dance cannot be included in this group. Specific requirements for the various options are as follows (select one):

Studio Option
All students must take Fine Arts 110*, and 111*, both of which must be taken prior to the fourth year; 120*, 224*, or 225*; and 226*. Students must also choose two from the following group: Fine Arts 227*, 324*, 325*, 326*, 327*, 328*, 329*. In addition, 420*, 421*, 490*, and 491* must be taken in fourth year. Of the 20 required half courses, at least 12 must be studio courses, and at least four of the 20 must be on the third year level.

Art History Option
All students must take Fine Arts 110*, and 111*, both of which must be taken prior to the fourth year; two half courses in studio work, one of which must be 120*, and the art history courses 210*, 211*, 212*, and 213*. In addition, 390a* must be taken in the third year; and 472*, 473*, 490*, and 491* must be taken in the fourth year. Of the 20 required half courses, at least 12 must be art history courses, and at least four of the 20 half courses must be on the third year level.

Film History Option
All students must take Fine Arts 110* and 111*, both of which must be taken prior to the fourth year, and 120*. In addition, 470*, 471*, 490*, and 491* must be taken in the fourth year. Of the 20 required half courses, at least 10 must be film history courses, and at least four of the 20 half courses must be on the third year level.

Film Making Option
All students must take Fine Arts 110* and 111*, both of which must be taken prior to the fourth year, and 120*. In addition, 434*, 435*, 490*, and 491* must be taken in the fourth year. Of the 20 required half courses, at least 8 must be film making courses, and at least four of the 20 half courses must be on the third year level.
Fine Arts Joint Honours Programmes

Programmes of this nature are possible in art history and film history only. All students must take Fine Arts 110* and 111*, both of which must be taken prior to the fourth year, and 120*. Students majoring in art history must take 390a* in the third year; in addition, 472*, 473*, 490*, and 491* must be taken in the fourth year. Students majoring in film history must take 470*, 471*, 490*, and 491* in the fourth year. Fine Arts courses other than those mentioned above are required for this degree but since programmes will vary, these other courses must be chosen with the help of a faculty advisor from the Department of Fine Arts.

Honours French

Recommended Programme

Year 1
French 190 or French 191
Four more courses

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

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 the student intends to enter the teaching profession, French 250, 300 and 401*/402* should be completed.

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

Note 3
With the permission of the department, the student may spend the 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 69) 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
- History
- Latin
- Mathematics
- 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 191

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.

Note 1
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).

Note 2
Those planning to enter the teaching profession should complete French 250, 300, 401*/402*.

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

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

Note 5
The degree requirements of the Faculty of Arts (see page 69) must be 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. 152R* 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.)

Year 2
Env. S. 200* Field Ecology
Geog. 201* Some Basic Topics of Climatology and Geomorphology
Geog. 202* Some Basic Topics of Economics 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. 204* Soviet Union
Geog. 205* Africa
Geog. 220 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. 381* The Nature of Geography
Geog. 391* Field Research
Two full credits of Geography electives.
Two credits chosen after consultation with the Department.

Year 4
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, German and Slavonic Languages, 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 secondary 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 case 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*, 121*/122* or 151*/152*
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
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 the 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)
- German and Geography

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

Note 3
With the permission of the departments concerned, the student of German may spend one of the 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 is acceptable. A Level 1 programme course in History is recommended. Political Science 101 is also recommended to students intending to major in History.

Year 2
Three Honours History courses, preferably including History 250 (see note 1)
Three other courses (see note 2)

Year 3
Three Honours History courses (see note 1)
Two other courses (see note 2)

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

Note 1
All Honours History candidates must complete 10 full History courses with a B average, as follows: normally one Introductory History course, plus at least eight Honours History (or programme) courses, and one other History course (which may be either a programme or non-programme course). History 250 is highly recommended. 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 range, at least two of which must be Senior Seminars. To ensure breadth they must include at least one full course from each of the columns as follows:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>255</td>
<td>263*</td>
<td>251A</td>
<td>277</td>
</tr>
<tr>
<td>251*</td>
<td>264*</td>
<td>251A</td>
<td>277</td>
</tr>
<tr>
<td>258</td>
<td>269R</td>
<td>265</td>
<td>282</td>
</tr>
<tr>
<td>260</td>
<td>355*/356*</td>
<td>266</td>
<td>284*/285*</td>
</tr>
<tr>
<td>340</td>
<td>357*/358*</td>
<td>267G*</td>
<td>268G* 291</td>
</tr>
<tr>
<td>343G*/344G*</td>
<td>295</td>
<td>351A</td>
<td></td>
</tr>
<tr>
<td>347G*/348G*</td>
<td>362</td>
<td>352</td>
<td>370</td>
</tr>
<tr>
<td>353</td>
<td>364R*/</td>
<td>380</td>
<td>372</td>
</tr>
<tr>
<td>Classics 365*/366*</td>
<td>381</td>
<td>374G*</td>
<td></td>
</tr>
<tr>
<td>366*</td>
<td>368</td>
<td>383</td>
<td>390</td>
</tr>
<tr>
<td>361</td>
<td>384</td>
<td>383</td>
<td>390</td>
</tr>
<tr>
<td>363</td>
<td>386*/387*</td>
<td>391</td>
<td></td>
</tr>
<tr>
<td>395</td>
<td>398</td>
<td>392</td>
<td></td>
</tr>
<tr>
<td>397</td>
<td>389</td>
<td>393</td>
<td></td>
</tr>
</tbody>
</table>

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 and 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 or Arts discipline to take a minor in History. A minor consists of 3 History courses of which one must be a Level 2 programme course and not more than one may be at the 100 level.
History Joint Honours Programmes

1) An Introductory History Course (preferably a Level I programme course)

2) Four Honours History courses selected from the 200 or 300 range in consultation with a department advisor. These courses must be selected from at least two of the ABCD columns (see above, "Honours History, Note 1"), and at least one of them must be in the 300 range.

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

4) A Minimum of 22 courses are required for all joint honours programmes with History. The A and B requirements of the Faculty of Arts must be fulfilled.

Combined programmes presently exist with Philosophy, Geography, German, Russian, English, Political Science, Sociology, Anthropology, Religious Studies, Classics, Fine Arts, Psychology, and French. The History Department is prepared to consider others for keenly interested students who otherwise meet Honours standards.

Not all joint 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 Secondary 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 60) must be met for the B.A. degree.

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 call or write either of these advisors for further information.

The Honours Programme
For the core of the Medieval Studies Programme, each student must take eight courses from the list given, and at least one course from each of five of the eight subject fields specified.


The General Programme
For the core of a Medieval Studies Programme, each student must take seven courses from the above, at least one course from each of four of the eight subject fields specified.

Honours Philosophy
Twenty full course equivalents
Ten in Philosophy, including 221*/222*, one of 240, 241* or 340, 280*/281*, 282*/283*, 499 (tutorial)
Ten others, including Group A and B requirements (see page 69.)
St. Jerome’s students (See chapter 14, Department of Philosophy course descriptions information).

Philosophy Joint Honours Programmes
Students interested in Joint Honours Programmes other than those listed here should consult with the undergraduate officer in Philosophy.

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 one of 140*, 240, 241* or 340.
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 243* and 362*)

Honours Philosophy and English
Philosophy Requirements
Seven full-course equivalents in Philosophy, including 221*/222*, one of 140*, 240, 241* or 340, 280*/281*, 282*/283*, Philosophy 331.

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 one of 140*, 240, 241* or 340, 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 69).

Honours Philosophy and Literature
Recommended Programme
Year 1
French 191 (or German 121*/122*)
English 101
A Social Science
two of
A Natural Science
Mathematics
History
Another language
Another Social Science
Arts Honours Programmes

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 the student may substitute French 191 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 Department or by an appropriate department of the Faculty of Mathematics 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*, one of 140*, 240, 241* or 340, 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
Seven full-course equivalents in Philosophy, including 221*/222*, 280*/281*, 282*/283*, one of 240, 241* or 340 and 362*

Psychology Requirements (See Psychology Joint Honours Requirements)

Other Requirements
Either Philosophy or Psychology 499
Seven full courses equivalents, including A and B requirements (see page 69).

Honours Philosophy and Religious Studies
Philosophy Requirements
Seven full-course equivalents in Philosophy, including one of 140*, 240, 241* or 340, 221*/222*, one full course equivalent in the history of Philosophy, and 335*

Religious Studies Requirements (See Religious Studies Joint Honours Requirements)

Other Requirements
Eight full course equivalents to make a total of 22 full course equivalents, including either Philosophy or Religious Studies 499, and A and B requirements (see page 69).
Honours Philosophy and Sociology

*Philosophy Requirements*
Seven full-course equivalents in Philosophy, including 221*/222*, one of 140*, 240, 241* or 340, 280*/281*, 282*/283*, and 362*.

*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 69).

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

Honours Political Science

*Recommended Programme*

Year 1
Political Science 101*/102*
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 101*/102*
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
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*
Among the six Political Science courses above the 100 level, students must select at least one-half course in each of four 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*
The equivalent of two and one half additional full courses in Psychology (see note 1)
The equivalent of two additional full courses

Year 4
Psychology 498 or 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.
Honours Psychology with Early Childhood Education and Care Option
At the end of this programme the student will have completed all of the formal university training required by the Association of Early Childhood Education (Ontario) and the Ministry of Community and Social Services for working in a preschool and day care setting. The other principal requirement for the Early Childhood Education Certificate is one year of full-time teaching experience in the Ontario preschool setting. In order to receive the degree in Honours Psychology with Early Childhood Education and Care Option the student must have a minimum of 22 courses.

Recommended Programme

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

**Year 2**
- Psychology 211*/203* or 207*
- Psychology 241*/242*, 283*/284*
- Health Studies 140*
- The equivalent of two and one half additional full courses.

**Year 3**
- Psychology 285*, 311*/341*, 321
- Psychology 393*/293* or 295*
- Recreation 200*
- The equivalent of two additional full courses.

**Year 4**
- Psychology 421
- Psychology 498 or 499
- Psychology 453*/Dance 364*
- Health Studies 345*/440*
- The equivalent of one additional full course

**Note**
Students must obtain a minimum of 9 Psychology courses with letter grades to meet the requirements for the honours degree. Psychology 321 and Psychology 421 are offered on a Credit-Fail basis only.

Psychology Joint Honours Programmes
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* 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 498 or 499 or the Honours Thesis course in the related discipline.

Joint Honours programmes other than these 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 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 five first year courses that meet the general requirements of the Faculty of Arts and include one of the following full-course equivalents in R.S.:

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

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

a) Two full-courses (or the equivalent) from one of the following groups and one from the other:

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinduism</td>
<td>Judaism</td>
</tr>
<tr>
<td>Buddhism</td>
<td>Christianity</td>
</tr>
<tr>
<td>Chinese Traditions</td>
<td>Islam</td>
</tr>
</tbody>
</table>

b) Two full-courses (or the equivalent) at the 398-level or above.

c) At least one Senior Seminar.

**Note**
Total number of courses for the degree, twenty.

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 or R.S. courses – honours requires 10, joint honours 7.

Religious studies has Joint Honours Programmes with Classics, English, History, Psychology, Social Development Studies, Sociology and Philosophy.
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 69.

Russian Joint Honours Programmes

English and Russian
French and Russian
German and Russian
History and Russian
Political Science and Russian
Geography and Russian
Philosophy 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 69.

Honours Social Development Studies

Year 1
Interdisciplinary Social Science 120R*, Social Work 120R*, Sociology 120R*, Psychology 120R*

At least two half courses from among Interdisciplinary Social Science 121R*, Social Work 121R*, Sociology 121R*, Psychology 121R*

The equivalent of two additional full courses

Year 2
Interdisciplinary Social Science 250R*/251R*
At least two half courses from among:
Interdisciplinary Social Science 220R*, 221R*
Social Work 220R*, 221R*, 222R*
Sociology 220R*, 221R*, 205*
Psychology 220R*, 221R*

The equivalent of two full courses from chosen theme area (see note 1)

The equivalent of one additional full course

Year 3
Interdisciplinary Social Science 320R*, Social Work 326R*
At least two half courses from among:
Social Work 320R*, 321R*, 322R*
Sociology 325R*, 326R*, 327R*/328R*
Psychology 322R*/323R*

The equivalent of two full courses from chosen theme area (see note 2)

The equivalent of one additional full course

Year 4
Interdisciplinary Social Science 469R, 399R

The equivalent of three additional full courses

Note 1
Each student must successfully complete four full credits related to one of the multidisciplinary theme areas listed below. Programme requirements provide the knowledge prerequisite for most theme area courses but in some instances additional prerequisite courses must be taken. All students will be expected to make a rational selection of theme courses designed to fit their needs and plans. In light of the above, careful planning of the sequence of courses should be made with the advice and approval of Renison faculty advisors.

The listing of approved courses under each of the four theme areas will be subject to periodic change to reflect new courses and changed calendar descriptions. In addition to these suggested courses students may request approval for other courses (e.g., transfer credits, independent study courses) which can be shown to be related to the theme area.
# Theme Areas

<table>
<thead>
<tr>
<th>School</th>
<th>Work</th>
<th>Community</th>
<th>Mental</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engl 208C*</td>
<td>Econ 351*</td>
<td>Anth 333*</td>
<td>Engl 108H*</td>
<td></td>
</tr>
<tr>
<td>Health 140*</td>
<td>HRCS 230*</td>
<td>CivE 110*</td>
<td>Health 349*</td>
<td></td>
</tr>
<tr>
<td>141*</td>
<td>ISS 368R*</td>
<td>Econ 343*</td>
<td>HRCS 201*</td>
<td></td>
</tr>
<tr>
<td>440*</td>
<td>Plan 322*</td>
<td>Engl 108B*</td>
<td>202*</td>
<td></td>
</tr>
<tr>
<td>Hist 203H</td>
<td>PSci 321*</td>
<td>EnvS 252*</td>
<td>282*</td>
<td></td>
</tr>
<tr>
<td>ISS 367R*</td>
<td>Psych 333*</td>
<td>Geog 225R*</td>
<td>300*</td>
<td></td>
</tr>
<tr>
<td>Phil 311*</td>
<td>340</td>
<td>251*</td>
<td>320*</td>
<td></td>
</tr>
<tr>
<td>312*</td>
<td>359*</td>
<td>349*</td>
<td>355*</td>
<td></td>
</tr>
<tr>
<td>Psych 211*</td>
<td>364*</td>
<td>449*</td>
<td>Psych 218*</td>
<td></td>
</tr>
<tr>
<td>214*</td>
<td>Soc 302*</td>
<td>Health 345*</td>
<td>285*</td>
<td></td>
</tr>
<tr>
<td>241*</td>
<td>308*</td>
<td>Hist 203C*</td>
<td>334*</td>
<td></td>
</tr>
<tr>
<td>242*</td>
<td>315*</td>
<td>HRCS 252*</td>
<td>340</td>
<td></td>
</tr>
<tr>
<td>316*</td>
<td>339*</td>
<td>ISS 221*</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>321*</td>
<td>340*</td>
<td>MEnv 350*</td>
<td>353*</td>
<td></td>
</tr>
<tr>
<td>341*</td>
<td>341*</td>
<td>420</td>
<td>354*</td>
<td></td>
</tr>
<tr>
<td>393*</td>
<td>342*</td>
<td>Phil 425*</td>
<td>359*</td>
<td></td>
</tr>
<tr>
<td>Soc 207G*</td>
<td>402*</td>
<td>Plan 156*</td>
<td>365*</td>
<td></td>
</tr>
<tr>
<td>218*</td>
<td>542*</td>
<td>330*</td>
<td>368R*</td>
<td></td>
</tr>
<tr>
<td>230G*</td>
<td>342*</td>
<td>Rec 250*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2221*</td>
<td>343*</td>
<td>252*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>252*</td>
<td>PSci 343*</td>
<td>254*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>307G*</td>
<td>344*</td>
<td>306*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>316*</td>
<td>Psych 340</td>
<td>RS 275G*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>350*</td>
<td>Rec 312</td>
<td>Soc 215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS 262R</td>
<td>Soc 225R*</td>
<td>303*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>226R*</td>
<td>373*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>275G*</td>
<td>404*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>290G*</td>
<td>410*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>301*</td>
<td>SocWk 369R*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>324*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Course Descriptions may be found in Chapter 14.

### Social Development Studies Joint Honours Programme

Social Development Studies Requirements

1. Four introductory half courses in the core area: ISS 120R*, Soc 120R* and SocWk 120R*
2. Methodology: ISS 250R*/251R*
3. ISS 320R* plus the equivalent of 2½ courses at the 200 level or above.
4. A Senior Seminar, ISS 499.

**Note**

The student will be expected to develop an elective theme area of three full courses equivalents.

There is a joint honours programme with Religious Studies.

### Honours Sociology

#### Recommended Programmes

- **Year 1**
  - Sociology 101*
  - One other half course in Sociology at 200 level
  - Four elective full year courses (or equivalent half courses)

- **Year 2**
  - Sociology 202*
  - Two full year courses in sociology (or equivalent half courses)
  - Two and one half 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, Economics, English, History, Philosophy, Political Science, Psychology, Mathematics and Recreation. The usual recommended programme in Sociology for joint honours is seven and one half full courses 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 191*/192* (students with little or no Spanish will take Spanish 101*/102* in the first year and Spanish 191*/192* and 255*/256* in the second year)
Four more courses

Year 2
A minimum of three full courses or equivalent in Spanish including 255*/256*.
Two more courses

Year 3
A minimum of three full courses or equivalent in Spanish including 336*.
Two more courses

Year 4
A minimum of three full courses or equivalent in Spanish including 441*/442* and 498*.
Two more courses

Note 1
Before graduation, the student must complete a minimum of ten full courses or equivalent in Spanish of which the following courses are obligatory: 255*/256*, 336*, 441*/442*, 498*. If he intends to enter the teaching profession, he is expected to complete 191*/192*, 251*/252*, and 351*/352*.

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 69) must be met for the B.A. degree.

Note 6
Students in year 4 must have the permission of the Department to enrol in Spanish courses on the 100 or 200 level.

Spanish Joint Honours

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

Classical Studies
English
French
German
History
Latin
Sociology

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

Recommended Programme (Spanish)

Year 1
Spanish 191*/192* (students with no high school Spanish will take Spanish 101*/102* in first year and Spanish 191*/192* in the second year)

Year 2
Three full courses in Spanish or equivalent including 255*/256*.

Year 3
Two full courses in Spanish or equivalent including 336*.

Year 4
Two full courses in Spanish or equivalent including 441*/442* and 498*.

Note 1
Before graduation, students in combined honours programmes must complete a minimum of eight full courses (or equivalent) in Spanish of which the following courses are obligatory: Spanish 255*/256*, 336*, 441*/442*, 498*.

Note 2
Those planning to enter the teaching profession are expected to complete Spanish 191*/192*, 251*/252* and 351*/352*.

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 69) must be met for the B.A. degree.
Faculty of Engineering

Engineering students conduct an experiment
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.

A more detailed explanation of the Co-operative programme is given in Chapter 5, as well as specific requirements as noted under the examinations and promotions section of this chapter.

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 entail five years of undergraduate study on the co-operative system.

The Degrees 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.

Admission

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. They also complete the last term of 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 the various terms are shown in the academic calendar on page...

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 Year 5

Applicants must present the following Mathematics courses - Relations and Functions, Calculus, Algebra, as well as Chemistry and Physics in their overall Year 5 programme. Applicants who do not have these specific Year 5 courses but who have obtained a high overall standing, including at least Relations and Functions, Calculus, and Physics are encouraged to apply for admission.

Admission As An Adult Student

It is recommended that applicants attempt to obtain standing in Ontario Year 5 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. To discuss admissibility and appropriate qualifying work applicants are advised to contact the Assistant Registrar for the Faculty of Engineering.

Admission to Advanced Standing

Because of the co-operative nature of the Engineering programme, no student will be admitted above Year 3. A student thus admitted will be required to...
register in the January term 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.

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 or 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 makes promotion decisions which may be reviewed by the Engineering Faculty Council. 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. Also, there are individual department rules regarding the grading and averaging of non-technical elective 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.

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 normally to repeat all of 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 normally be required to repeat all 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 will 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 participation in the co-operative programme.

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.
- CR – Performance was Satisfactory.
  - Student was Exempt from taking the course because of previous work.
  - Student is given a Pass with no specific mark or grade assigned.
- NCR – Performance was Unsatisfactory.
- INC – Student obtained permission not to write because of illness or death in family, etc. The exam is Deferred to a later date.
  - The course and project cannot be completed until the next term thus mark is Postponed in meantime.
  - Course work is Incomplete.
- DNW – Student Did Not Write the exam and did not officially drop the course.

12) Students who feel that assigned grades or the promotion decision do not reflect a just evaluation of their achievement, or who have done poorly because of sickness or unavoidable absence, may appeal faculty decisions. All appeals should be addressed to the Chairman of the Engineering Examinations and Promotions Committee, Registrar’s Office, University of Waterloo. Reasons in support of the appeal must be provided. Doctor’s certificates and similar supporting documents where appropriate should be included with the student’s statement. It is to the student’s advantage to file his appeal as early as possible, preferably before the Examinations and Promotions Committee meets to discuss the grades affected. Appeals must normally be submitted no later than three weeks after the promotion decisions are mailed by the Registrar’s Office.

13) Changes to a student’s original registration form may be permitted at the discretion of a student’s department. All such arrangements must be indicated and approved before the end of the normal “Change Period”, which is a period of three weeks at the beginning of each term. After the end of the three week period, only exceptional cases for change will be considered.

Undergraduate Co-operative Work Term Reports

Satisfactory work reports and work terms 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 2B or 3A with only 3 work terms remaining, only 3 satisfactory work reports would be required.

2) All work reports shall be submitted to the Department of Co-ordination 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 report 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 Department of Co-ordination. 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 Department of Co-ordination.

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 students wish, they may submit the additional reports and the evaluations of these reports will be added to their 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 term performance and/or reports. Students with an “NCR” designation on any work report will not be promoted until they have cleared this condition.
Academic Programmes

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.

For further enlargement of the programmes, refer to the Admissions Bulletin.

Year 1 Engineering Programmes

All students enrolling in Year 1 are required to choose one of the following three programmes:

a) General Engineering
b) Chemical Engineering
c) Systems Design

Students enrolling in General Engineering must register in the courses indicated in the following table:

**Term 1A**
- Mathematics 12
- Mathematics 21
- Ch.E. 102 (see course description on page 211)
- Physics 11 (see course description on page 352)
- GE. 111 (see course description on page 269)
- GE. 113 (see course description on page 269)
- One of GE. 102 (see course description on page 269)
- GE. 103 (see course description on page 269)
- Phil. 125K (see course description on page 346)
- Sci. 110K (see course description on page 384)

**Term 1B**
- Mathematics 12
- Mathematics 21
- GE. 111 (see course description on page 269)
- GE. 120 (see course description on page 269)
- GE. 121 (see course description on page 269)
- GE. 122 (see course description on page 269)

Students enrolling in Chemical Engineering register for the same courses as above except in the 1A term, they take Ch.E. 100 (see course description on page 211) in lieu of GE. 111 and GE. 113, and in the 1B term, they take Ch.E. 101 (see course description on page 211) in lieu of GE. 111 and GE. 120.

Students in Chemical Engineering and Systems Design may transfer to Civil, Electrical or Mechanical Engineering (see Admissions Bulletin for conditions of transfer and make-up requirements).

Note

*Detailed course descriptions commence in Chapter 14. Courses beginning with GE (General Engineering) can be found on page 269.*
Chemical Engineering

The basic objective of the undergraduate programme is to provide the student with an education appropriate for a career in the chemical industry, or for future studies in Science or Engineering, or 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 the following six options.

Biochemical and Food Engineering
This option deals with the processing of systems where biochemical phenomena are important. It is concerned with waste treatment, food processing and fermentation operations which manufacture microbial products such as alcoholic beverages, yeasts, antibiotics, vitamins, and enzymes. The usefulness of these studies is obvious in a world with increasing food and health problems, and for the Canadian economy in which agricultural products play a significant role.

Extractive and Process Metallurgy
This option involves the application of chemical engineering principles to metallurgical processes in order to improve many of the pyrometallurgical, electrolytic and hydrometallurgical processes presently used in Canada. Chemical metallurgy is inter-related with these principles for overall process design and development.

Pollution Control Engineering
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 and Engineering
This option has 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 Ontario chemical industry is directed towards polymers (plastics, elastomers, synthetic fibres).

Transport Processes
This option is a further development of a core area of chemical engineering. Within it aspects of fluid flow, heat transfer, mass transfer and reaction kinetics, which are important in most chemical and allied industries, are studied.

Mathematical Analysis and Control
This option also deals with the further development of a core area of chemical engineering. It involves studies in optimal control, economic and process optimization, and simulation.

Guide to Undergraduate Chemical Engineering Course Numbers
The code for the course 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 Code</th>
<th>Course Title</th>
<th>Lectures (hr/wk)</th>
<th>Labs/Projects (hr/wk)</th>
<th>Tutorials (hr/wk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ChE 220</td>
<td>Applied Mathematics</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 230</td>
<td>Physical Chemistry 1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 232</td>
<td>Inorganic Chemistry 1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chem 26</td>
<td>Organic Chemistry 1</td>
<td>3</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Math 22</td>
<td>Calculus 2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 211</td>
<td>Transport Processes 1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 231</td>
<td>Physical Chemistry 2</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ChE 233</td>
<td>Physical-Chemical Laboratory</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Chem 36</td>
<td>Organic Chemistry 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 31</td>
<td>Differential Equations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 312</td>
<td>Transport Processes 2</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>ChE 320</td>
<td>Applied Mathematics 2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 330</td>
<td>Chemical Engineering Thermodynamics</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ChE 332</td>
<td>Inorganic Chemistry 2</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ChE 334</td>
<td>Instrumental Methods Laboratory</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ChE 313</td>
<td>Transport Processes 3</td>
<td>3</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>ChE 315</td>
<td>Chemical Engineering Laboratory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 331</td>
<td>Chemical Reaction Engineering</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ChE 420</td>
<td>Process Dynamics and Control 1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 442</td>
<td>Engineering Economics</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ChE 482</td>
<td>Technical Seminar and Process Design</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>ChE 280, 281</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>380, 381</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>480, 481</td>
<td>General Awareness Seminar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ChE 007</td>
<td>General Awareness Seminar</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### B) Elective Courses

In addition to the core courses listed above, a minimum of 13 elective courses must be taken. The usual sequence of technical (T) and non-technical (NT) electives is as follows:

<table>
<thead>
<tr>
<th>NT</th>
<th>T</th>
<th>T or NT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2B</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3B</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4A</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4B</td>
<td>(i)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 &amp; one of ChE 583, 585</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii) 2</td>
</tr>
</tbody>
</table>

Four to six of these courses may be chosen from non-technical electives, of which at least three are to be (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 510 Prediction of Physical-Chemical Properties
   - ChE 515 Two-Phase Flow Operations
   - ChE 517 Performance of Separation Processes

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 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)

Other Research and/or Design Projects
ChE 583 Process Systems Design
ChE 585 Technical Elective Project

Academic Programme for Each Term (1976-77)

Year 2A, Fall and Winter
Math 22, Chem 36, ChE 220, ChE 230, ChE 232.
Non-technical elective

Year 2B, Spring and Fall
Math 31, Chem 36, ChE 211, ChE 231, ChE 233.
Non-technical elective

Year 3A, Winter and Spring
ChE 312, ChE 320, ChE 330, ChE 332, ChE 334.
Non-technical elective

Year 3B, Fall and Winter
ChE 313, ChE 315, ChE 331, Technical elective,
Non-technical elective

Year 4A, Spring and Fall
ChE 420, ChE 482, 2 Technical electives. Technical or
Non-technical elective

Year 4B, Winter 1976
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.

Detailed course descriptions are given in Chapter 14.

Civil Engineering

Civil Engineers plan, design, and supervise the construction of such facilities as bridges, buildings, railways, highways, dams, water supply streams, and waste disposal systems. The curriculum provides a modern approach to the subject based on a thorough grounding in mathematics, natural sciences, and socio-economic concepts.

Although 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 the 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

<table>
<thead>
<tr>
<th>Civil Engineering Core Courses</th>
<th>Lectures hrs/wk.</th>
<th>Labs or Tutorials hrs/wk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE 200 Civil Engineering Project 1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CE 203 Statics</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CE 204 Dynamics</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CE 205 Mechanics of Deformable Solids 1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CE 206 Mechanics of Deformable Solids 2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 221 Calculus</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 222 Differential Equations</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 224 Probability and Statistics</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CE 265 Structure and Properties of Materials</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CE 280 Fluid Mechanics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CE 291 Survey Camp†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CE 292 Socio-Economic Aspects of Civil Engineering</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 298 Seminar</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CE 299 Seminar</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CE 300 Civil Engineering Project 2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CE 303 Structural Analysis 1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 304 Structural Analysis 2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CE 315 Structural Design 1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CE 342 Urban Transport Planning 1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 353 Geology and Soil Mechanics</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CE 354 Soil Mechanics and Foundations</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 375 Sanitary Engineering</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 381 Hydraulics</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CE 393 Environmental Engineering</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CE 398 Seminar</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CE 399 Seminar</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CE 400 Civil Engineering Project 3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CE 498 Seminar</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CE 499 Seminar</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

### 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 525 Introduction to Finite Element Methods
- 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
Engineering
Electrical Engineering

CE 583 Water Distribution and Collection Systems
CE 584 Technological Forecasting and Long-Range Planning
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.

C) Other Courses
These courses are not intended for Civil Engineering students at any level:

CE 110 Urban Transport Problems and Prospects

Academic Programme for Each Term

Year 2A (Fall and Winter terms)
CE 203, CE 204, CE 205, CE 221, CE 265, CE 291*, CE 292, CE 298

Year 2B (Spring and Fall terms)
CE 200, CE 206, CE 222, CE 224, CE 280, CE 291*, CE 299

Year 3A (Winter and Spring terms)
CE 303, CE 342, CE 353, CE 381, CE 393, CE 398

Year 3B (Fall and Winter terms)
CE 300, CE 304, CE 315, CE 354, CE 375, CE 399, Elective

Year 4A (Spring and Fall terms)
CE 498, Five Electives

Year 4B (Winter term)
CE 400, CE 499, Four Electives

*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 twenty 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 or research project. In addition, students are required to take one non-technical elective course in each of the 2B, and 3A terms and a general elective course in each of the last three 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 seminars) 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 twenty 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. Two non-technical electives must be successfully completed; however the mark is not included in the term average. General electives in the last three 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 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 90).

The student must register his course load at the start of each term. Departmental permission at the time of registration will be required for departures 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 91) and the student will be examined on the course for which he is registered at the time of examination.
### Academic Programmes for Each Term (1976-77)

#### Note
Students may depart from this programme within the framework of the rules given above, and within the constraints of the timetable.

**Term 2A, Fall and Winter**
EE 201, EE 203, EE 205, EE 221, EE 241, EE 233, EE 293

**Term 2B, Fall and Spring**
EE 202, EE 206, EE 261, EE 271, EE 294, ME 50, Non-technical elective

**Term 3A, Winter and Spring**
EE 301, EE 316, EE 317, EE 342, EE 351, EE 362, Non-technical elective

**Term 3B, Fall and Winter**
EE 302, EE 324, EE 352, EE 372, EE 380, General elective

**Term 4A, Fall and Spring**
EE 401, plus 1 General elective, Five Technical electives from: EE 418, EE 425, EE 427, EE 435, EE 446, EE 454, EE 463, EE 473, EE 481, EE 499 A, Math 44

**Term 4B, Winter**
EE 402, plus General elective, Four Technical electives from: EE 407, EE 419, EE 426, EE 434, EE 436, EE 443, EE 453, EE 459, EE 464, EE 474, EE 482, EE 499 B

#### Service Courses
Mech Eng 2A EE 14 Electrical Engineering 1
Mech Eng 3A EE 32 Electrical Engineering 2

*General elective can be any course that is not a repeat of course material already taken. The undergraduate course descriptions will be found in Chapter 14.

### Programme
**(a) Core (Years 2 & 3)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Lect.</th>
<th>Lab.</th>
<th>Tut.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE 203</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 205 (Math 25)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 206 (Math 35)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 221</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 233</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 241</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 261</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 271</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 293</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 294</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 316</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 317</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 324</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 342</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 351</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 352</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 362</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 372</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE 380</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ME 50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Concepts of Electrical Engineering
Advanced Calculus for Electrical Engineers 1
Advanced Calculus for Electrical Engineers 2
Principles of Digital Logic Circuits
Physical Electronics
Electric Networks 1
Energy Processing and Conversion
Electric & Magnetic Fields
Instrumentation and Measurement 1
Instrumentation and Measurement 2
Probability & Statistics
Signal Analysis Methods
Principles of Digital Computers
Electric Networks 2
Electronics 1
Electronics 2
Dynamic Energy Conversion
Transmission Lines and Electromagnetic Fields
Introduction to Systems & Control
Thermodynamics
(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 407</td>
<td>Numerical Methods</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>EE 418</td>
<td>Signal Analysis and Frequency Domain Methods</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>EE 419</td>
<td>Communication Systems</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<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 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>
</tbody>
</table>

With the approval of the Department, students may take technical courses offered by other departments.

(c) Non-Technical

<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 201</td>
<td>Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EE 202</td>
<td>Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EE 301</td>
<td>Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EE 302</td>
<td>Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EE 401</td>
<td>Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>EE 402</td>
<td>Seminar</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note
The laboratory hours are approximate indications of the average time per week the students will spend in the laboratory.
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. Mechanical Engineers are required in the field of power generation where they could 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. They are 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 found 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 industrial and manufacturing 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 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>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 1</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>3</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 53</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></td>
<td></td>
</tr>
<tr>
<td>ME 62</td>
<td>Fluid Mechanics 2</td>
<td>3</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 and 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 Courses

#### a) Non-technical Electives

Students entering the programme will take three non-technical electives. The marks obtained in these courses will not enter the calculation of term averages. However, for graduation the minimum average mark for three non-technical electives is 60%.

#### 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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 52</td>
<td>Air Conditioning</td>
</tr>
<tr>
<td>ME 54</td>
<td>Thermodynamics 2</td>
</tr>
<tr>
<td>ME 55</td>
<td>Refrigeration Engineering</td>
</tr>
<tr>
<td>ME 56</td>
<td>Heat Transfer 2</td>
</tr>
<tr>
<td>ME 58</td>
<td>Internal Combustion Engines</td>
</tr>
<tr>
<td>ME 59</td>
<td>Energy Conversion</td>
</tr>
<tr>
<td>ME 62</td>
<td>Fluid Mechanics 2</td>
</tr>
<tr>
<td>ME 64</td>
<td>Industrial Aerodynamics</td>
</tr>
<tr>
<td>ME 555</td>
<td>Thermodynamics 3</td>
</tr>
<tr>
<td>ME 557</td>
<td>Combustion 1</td>
</tr>
</tbody>
</table>

---

### b) Solid Body Mechanics and Mechanical Design Option

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 22</td>
<td>Mechanical Design 1</td>
</tr>
<tr>
<td>ME 523</td>
<td>Mechanical Vibrations</td>
</tr>
<tr>
<td>ME 525</td>
<td>Mechanical Vibrations</td>
</tr>
<tr>
<td>ME 527</td>
<td>Mechanics of Deformable Solids 3</td>
</tr>
<tr>
<td>ME 528</td>
<td>Experimental Mechanics</td>
</tr>
<tr>
<td>ME 626</td>
<td>Creep, Fatigue and Brittle Fracture</td>
</tr>
<tr>
<td>SD 543</td>
<td>Human Factors Engineering</td>
</tr>
<tr>
<td>SD 544</td>
<td>Ergonomics</td>
</tr>
</tbody>
</table>

---

### c) Production/Industrial Option

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME 46</td>
<td>Polymer Processing</td>
</tr>
<tr>
<td>ME 48</td>
<td>Analysis and Design of Manufacturing Systems</td>
</tr>
<tr>
<td>ME 541</td>
<td>Deformation Processes</td>
</tr>
<tr>
<td>ME 542</td>
<td>Mechanics of Machining Processes</td>
</tr>
<tr>
<td>ME 543</td>
<td>Metal Casting Processes</td>
</tr>
<tr>
<td>ME 544</td>
<td>Welding Processes</td>
</tr>
<tr>
<td>ME 548</td>
<td>Numerical Control of Machine Tools 1</td>
</tr>
</tbody>
</table>
MS 31 Industrial Statistics and Design of Experiments
MS 43 Economics of Enterprise and Benefit/Cost Analysis
MS 44 Industrial Psychology
MS 46 Optimization Models for Policy Analysis
MS 47 Stochastic Models of Industrial Operations
ME 22 Mechanical Design 1
ME 35 Industrial Metallurgy
ME 534 Properties of Polymers
SD 543 Human Factors Engineering
SD 544 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 541 Deformation Processes
ME 543 Metal Casting Processes
ME 527 Mechanics of Deformable Solids 3
ME 544 Welding Processes
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 541 Deformation Processes
ME 54 Thermodynamics 2
ME 528 Experimental Mechanics
ME 563 Turbomachines

Academic Programmes for Each Term (1976-77)

Year 2A, Fall 1976, and Winter 1976
ME 1, MS 21, ME 15, ME 19, ME 12, ME 200, EE 14

Year 2B, Spring 1976 and Fall 1976
ME 3, ME 4, MS 23, ME 20, ME 30, ME 50

Year 3A, Spring 1977 and Winter 1977
ME 5, ME 21, ME 40, ME 51, ME 60, ME 300, 1 Non-technical elective

Year 3B, Fall 1976 and Winter 1977
ME 53, ME 62, EE 32, ME 44, 2 technical electives

Year 4A, Spring 1976 and Fall 1976
ME 82, ME 400, ME 560, 3 technical electives
1 Non-technical elective

Year 4B, Winter 1977
ME 82, 7 technical electives, 1 Non-technical elective
Systems Design

The Department of Systems 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 and 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-economics 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 lecture material, to develop skills in solving problems that cut across the traditional disciplines, and to develop 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 the student for a further year of advanced study to the M.A.Sc. degree if desired, or for a meaningful career in industry or government with the 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 by a procedure for devising special options outside of these areas as 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 the technical elective courses so that 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 a student 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/her 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 options 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
2 elective courses, from the option core

4B
Systems Design Workshop
1 free elective course
4 technical option courses, at least two from the option core

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.

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.
Option Core Courses
3A SD333 Experimental Design
3B SD332 Mathematical Programming
4A SD411 Systems Operations 2
   SD433 Conflict Analysis
4B SD412 Topics in Operations Research
   SD432 Analysis of Large Systems

Systems Theory and Computer Option
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 SD353 Time Domain Models for Physical Systems
1B either SD324 Principles of Digital Computers
   or SD352 Algorithms for Computer-Aided Systems Analysis
4A SD521 Analog and Hybrid Computing Systems
   SD451 Multi-Terminal Representations and Piecewise Analysis of Physical Systems
   SD463 Structures and Design
4B Two Courses from:
   SD522 Computer-Aided Design 2
   SD452 Introduction to Linear Control Systems
   SD454 Hydraulic Systems
   SD456 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 opportunity to devise a coherent, "minor" study in an area of the student's 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 the student's chosen option area while the remainder are chosen by the student to provide insight into particular applications of the option discipline.

In all cases elective course selections are subject to approval by the department. A student is promoted on the basis of a final average which includes all elective courses.

1A
(Fall Term)
SD111 Calculus 1
SD113 Linear Algebra
SD121 Digital Computation
SD131 Engineering Economics
SD161 Systems Behaviour
SD181 Statics
SD183 Graphics and Design

1B
(Spring Term)
SD112 Calculus 2
SD114 Theory and Applications of Probability
SD142 Introduction to Ergonomics
SD162 Systems Design Methodology
SD182 Dynamics
SD184 Electricity and Magnetism
SD192 Systems Design Laboratory 1

2A
(Winter Term)
SD211 Applicable Mathematics for Systems Design 1
SD213 Theory and Applications for Statistics
SD221 Numerical Analysis and Computation
SD261 Systems Design Workshop 1
SD281 Mechanics of Deformable Solids
SD291 Systems Design Laboratory 2
1 free elective

2B
(Fall Term)
SD212 Applicable Mathematics for Systems Design 2
SD252 Physical Systems 1
SD262 Systems Design Workshop 2
SD292 Systems Design Laboratory 2
2 courses chosen from:
SD282 Thermodynamics
SD284 Fluid Mechanics
SD286 Introduction to Biochemical and Polymer Systems
1 free elective
3A (Spring Term)
SD311 Systems Operations 1
SD351 Physical Systems 2
SD361 Systems Design Workshop 3
SD381 Materials Engineering
SD364 Form and Function in Design
1 technical elective
1 free elective

3B (Winter Term)
SD322 Computer Simulation of Systems
SD362 Systems Design Workshop 4
SD364 Manufacturing Science
SD382 Applied Electronics
SD392 Systems Design Laboratory 4
1 technical elective
1 free elective

4A (Fall Term)
SD421 Computer-Aided Design I
SD431 Economics of Engineering Design
SD461 Systems Design Workshop 5
3 technical electives or 2 technical electives and
1 free elective.

4B (Winter Term)
SD462 Systems Design Workshop 6
4 technical electives
1 free elective

Technical Electives
The technical electives should be chosen in consultation with the Associate Chairman in light of the preceding discussion on the structuring of options.

3A
SD341 Ergonomics of Special Environments
SD333 Experimental Design
SD353 Time Domain Models for Physical Systems

3B
SD366 Aesthetic and Perceptual Aspects for Design
SD332 Mathematical Programming
SD324 Principles of Digital Computers
SD352 Algorithms for Computer-Aided Systems Analysis

4A
SD443 Human Engineering and Rational Design
SD463 Structures and Design
SD411 Systems Operations 2
SD433 Conflict Analysis
SD521 Analog and Hybrid Computing Systems
SD451 Multi-Terminal Representations and Piecewise Analysis of Physical Systems

4B
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
SD412 Topics in Operations Research
SD432 Analysis of Large Systems
SD452 Introduction to Linear Control Systems
SD454 Hydraulic Systems
SD456 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.
Department of Management Sciences

Activities and Scope
The Department of Management Sciences, Faculty of Engineering, was established in 1969, as a graduate department and has subsequently 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 fields of study.

Undergraduate Programmes
At the present time the Department is involved in two major activities in undergraduate teaching: i) a Management Sciences Option involving four MS courses; ii) Production/Industrial Engineering Option (jointly with the Department of Mechanical Engineering). Students completing courses in either of these options may be eligible for admission with advanced standing to the Department's M.A.Sc. programme.

Management Sciences Option
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 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 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 an 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 programme is intended to introduce several approaches and different considerations in relation to managerial decision making. Enrolment in these courses will normally start in term 3B and will be primarily for engineering students who will take all four courses offered.

Production/Industrial Engineering Option
This option, offered jointly with the Department of Mechanical Engineering, provides the student with an understanding of (industrial) organizations in terms of their processes, behavioural and economics dimensions and the use of mathematical models in the design and control of operations.
Faculty of Environmental Studies

Model on display, School of Architecture
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 utilize the best of traditional teaching approaches combined with newer and innovative techniques derived from a broad range of disciplines.

The Faculty of Environmental 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 Studies and Geography Departments are interdisciplinary 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.

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 Studies 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.Arch. – Professional Architecture (2 years, with co-operative work terms following completion of B.E.S. Pre-professional Architecture).
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).
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.

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 Year 5 Mathematics course for admission to programmes in Environmental Studies, Year 5 Geography is similarly recommended for those applying to the Geography Departments. For applicants to the Geography Departments. For applicants to the School of Architecture, Functions and Relations, Calculus, Physics, and English at the Year 5 level are required.
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.

Transfer Credit
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 Institutions 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.

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 from work during term are used in part in determining standing. At the discretion of the chairperson 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 to write, for medical reasons, 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 1) 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; 2) 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 grading, the University Grading System described on page 16 will be used.

b) 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.

c) Students receiving an Incomplete standing in any course will be allowed 4 months from the completion date of the course to clear the Incomplete. Any Incomplete standing not cleared within this period will automatically be converted to a grade of F-.

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 the chosen field of specialization (unless otherwise specified in a departmental Honours programme). If an Honours programme candidate’s average falls below the prescribed minimum, the individual
can be given conditional standing if in the opinion of the School or Departmental Promotions Committee the person can attain Honours standing before graduation. If not, the student, 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 the chosen field of specialization. If at any time a student's average falls below C- (60.0) or the average in the field of specialization below C (63.0), the individual 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 course credits 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.

3) Additional Regulations, School of Architecture Examinations and Promotions

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 (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 half courses in any single term; 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-courses (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.

Appeals
Appeals against School decisions concerning grades and promotions made under these regulations may be submitted in writing to the Chairperson 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/she wishes to concentrate should study the Calendar carefully. After examining the suggested departmental programme, the student should read the descriptions of individual courses in order to have a more comprehensive idea of what the content of any programme would include. The student should consult his/her High School Guidance Officer, Chairperson 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 the 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.

The calendar is designed to enable students to make a wise choice of the programmes and courses while at the University of Waterloo. 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.

### Courses in the Natural Resources – Ecology Theme

The following courses provide a possibility for students to orient their programmes to whatever extent they wish to stress natural resources and ecology. Students are encouraged to see the Chairman of the Natural Resources – Ecology Committee (Dean's Office).

#### Ecology-Biology

- **ES 200* Ecology**
- **Geog/Plan 357* Conservation and Resource Management**
- **Arch 385* Resources & Design**
- **Bio 130 Biosphere (non lab)**
- **Bio 131 Biosphere (lab)**
- **Bio 236 Biosphere Natural**

#### Physical

- **Geog 102* Physical Geography**
- **Geog 201* Physical Geography**
- **Geog 300* Geomorphology of Southern Ontario**
- **Geog 301* Climatology**
- **Geog 302* Geomorphology**
- **Geog 303* Water**
- **M-Env 356* Canadian Non-Renewable Resources**
- **Geog 408* Hazards**
- **Geog 460 Land Dereliction**
- **E.Sci. 130 Lithosphere – products and processes**
- **E.Sci. 438 Lithosphere – geology and engineering**

#### Human

- (Economic, Social, Policy)
  - **M-Env 357* Resource Use**
  - **M-Env 331 International Environment**
  - **Geog 356* Resource Management**
  - **Geog 410* Recreation**
  - **Geog 411* Investment & Resources**
  - **M-Env 445* Technology and Policy**
  - **Geog 413* Behavioural**
  - **Geog 414* Resource Management**
  - **M-Env 410* Environmental Assessment**

In addition are some basic techniques – Surveying and mapping, cartography, statistical analysis, air photo interpretation, computer science, field methods, cost benefit (resources-economics).
School of Architecture

Nature of the Programme
Architecture, traditionally, is the art, science and technique of modifying the physical environment to satisfy the needs and aspirations of people. 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/her action upon the environment he/she modifies and the realization that, in so doing, the student 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 the student, 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.

Degrees
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 School 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 instructors.

Bachelor of Environmental Studies (Pre-Professional Architecture) 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 Recommended Core Programme for course arrangement, page 116. See Chapter 14 for course descriptions.

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) degree or equivalent 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 studio project problem selected and programmed by the student. Students’ presence is required at studio courses.

Note
Students are expected to defray costs of materials in connection with studio projects.

See Recommended Core Programme for course arrangement, page 116. See Chapter 14 for course descriptions.
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, of eight months each.

Note
The "off-term" in the Bachelor of Environmental Studies pre-professional programme 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/she 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 charts.

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 today.

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.

Class Terms Chart

<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>
</tr>
</thead>
<tbody>
<tr>
<td>Terms</td>
<td>W SF</td>
<td>W SF</td>
<td>W SF</td>
<td>W SF</td>
<td>W SF</td>
<td>W SF</td>
<td>W SF</td>
<td>W SF</td>
<td>W SF</td>
<td>W SF</td>
</tr>
<tr>
<td>1971</td>
<td>1A</td>
<td>1B</td>
<td>2A</td>
<td>2B</td>
<td>3A</td>
<td>3B</td>
<td>4A</td>
<td>4B</td>
<td>5A</td>
<td>5B</td>
</tr>
<tr>
<td>1972</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1974</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1979</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Programme for the Degree of Bachelor of Environmental Studies (Pre-Professional Architecture)

<table>
<thead>
<tr>
<th>Theme Areas</th>
<th>Term 1 (1A)</th>
<th>Term 2 (1B)</th>
<th>Spring</th>
<th>Term 3 (2A)</th>
<th>Winter</th>
<th>Term 4 (2B)</th>
<th>Spring</th>
<th>Term 5 (3A)</th>
<th>Winter</th>
<th>Term 6 (3B)</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems and Measures</td>
<td>Arch 102</td>
<td>Arch 101</td>
<td>Off</td>
<td>Arch 103</td>
<td></td>
<td>Arch 212</td>
<td>FE</td>
<td>Arch 266</td>
<td></td>
<td>Arch 372</td>
<td>FE</td>
</tr>
<tr>
<td></td>
<td>Math</td>
<td>Statistics</td>
<td></td>
<td>Computer Science</td>
<td>Simulation</td>
<td></td>
<td></td>
<td>Theory of Structures 1</td>
<td></td>
<td>Theory of Structures 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Arch 112</td>
<td>Arch 111</td>
<td></td>
<td>Arch 163</td>
<td></td>
<td>Arch 262</td>
<td></td>
<td></td>
<td></td>
<td>Arch 363</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer Science</td>
<td></td>
<td></td>
<td>Statics</td>
<td></td>
<td>Strength of Materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.S. 190</td>
<td>Arch 206</td>
<td></td>
<td>E.S. 200 or FE</td>
<td></td>
<td>Arch 233</td>
<td></td>
<td></td>
<td></td>
<td>Arch 367</td>
<td></td>
</tr>
<tr>
<td>Ecology</td>
<td>Man and His Environment</td>
<td></td>
<td></td>
<td>Ecological Interpretation</td>
<td>Human Ecology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culture</td>
<td>Arch 147</td>
<td>Arch 143</td>
<td></td>
<td>Arch 266</td>
<td></td>
<td>Arch 549</td>
<td></td>
<td>Renaissance to Revolution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iconography</td>
<td></td>
<td></td>
<td>Foundations of Europe</td>
<td></td>
<td>Arch 346 or FE</td>
<td></td>
<td>Romanticism and 20th Century</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td>Arch 192</td>
<td>Arch 193</td>
<td></td>
<td>Arch 297</td>
<td></td>
<td>Arch 297</td>
<td></td>
<td></td>
<td></td>
<td>Arch 392</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design Fundamentals</td>
<td></td>
<td></td>
<td>Design Concepts and Studio</td>
<td></td>
<td></td>
<td></td>
<td>Design Concepts and Studio</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
*This indicates as shown in the small squares the credit value of the courses.

Bold blocks indicate elective courses.
TE (Theme Elective) constitutes any course in the Faculty of Environmental Studies.
FE (Free Elective) constitutes any course in any Faculty at the University of Waterloo.
Department approval of electives is mandatory.
Department of Geography

Nature of the Programme

Geography is concerned with both the natural and man-made environment, studying how man has shaped it according to the human need, 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 multi-disciplinary 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/her particular needs, whether he/she 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 Urban and Regional Planning and Man-Environment Studies given by the faculty with academic and practical experience in urban and regional planning, resource management, conservation, and environmental design.

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.

The Department of Geography also offers an Honours Co-operative Programme. Students will be admitted to the Co-Operative Programme after spending their first year in one of the other Geography programmes on the basis of academic standing and interviews. The Co-op programme involves alternative terms of practical work experience and academic study. Co-op Geography students will enter their first work term in the Winter of the second year. Students anticipating entry to the Honours Co-operative Programme should be aware that a number of specific courses are required in the first year. The minimum number of work terms required for a Co-operative degree is normally four. Inquiries for additional information regarding Co-operative studies should be directed to the Department Chairman.

Students should note that geography courses are open to any student in the University wherever prerequisites are met. 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 Co-op Geography Programme is not available in the Faculty of Arts.

The Department of Geography has both Master's (M.A.) 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 physical geography, 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 most subjects 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 Geop. 102* are given in both fall and winter terms. It is immaterial which of these courses is taken first as neither is sequential to the other.
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 course 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 Physical Geography
Geography 202* Some Basic Topics of Economic 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
Note that it is not necessary for all three techniques courses to be taken during the second year.
and one of:
Geography 203* Some Basic Topics of Cultural and Regional Geography
Geography 204* Soviet Geography
Geography 205* Africa
Geography 220 World Regional Geography
and additional credits so that a student should have completed by the end of second year, 11 course credits.

Year 3
Geography 391* Field Research
Geography 381* The Nature of Geography
Two course credits of geography electives
Two course credits chosen after consultation with the Department

Year 4
Geography 490 Senior Honours Research Essay
and additional course credits so that a student should have a minimum of 21 full course credits

Environmental Studies

Geography

Note 1
While twenty-one full course 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 course credits maximum.

Note 2
The minimum and maximum number of full course 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 course 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 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 course 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.
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, Biology, Canadian Studies, Earth Sciences, Economics, English, German, History, Man-Environment Studies, Mathematics, Political Science and Russian. 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 the 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
    - German, History
    - Political Science
    - Man-Environment Studies
    - Russian
- B.E.S. or B.A. or B.Math
- B.E.S. or B.Sc.

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 Type "A" certificate for teaching secondary school require a minimum of nine course 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.

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
- Geography 103* 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
- Four course 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 Physical Geography
- Geography 202* Some Basic Topics of Economic and Urban Geography
- Geography 203* Some Basic Topics of Cultural and Regional Geography
- Geography 204* Soviet Geography
- Geography 205* Africa
- Geography 220 World Regional Geography
- and additional credits so that's student should have completed by the end of the second year 10 full course 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 course credits is the minimum requirement for the degree of Bachelor of Environmental Studies (General Geography). However, an enriched programme of up to eighteen course credits may be arranged.

Note 2
A minimum of five geography course credits constitutes a Geography Major but up to eight geography course 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 course credits in Faculties 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

Nature of the Programme
Man-Environment Studies is a four year honours degree programme oriented towards study of the many dimensions of human interrelationships with various environments including natural and managed landscapes, buildings and cities, small groups, communities and whole societies. Through problem and issue oriented enquiry into such complex interrelationships along with related study in the contributory academic disciplines, ample scope is provided for acquiring a broad-based education which recognizes to a degree the need for contemporary “relevance” in the approach and content of higher education.

More important is the educational process sought from a thematic programme such as man-environment studies, which is not artificially constrained by conventional boundaries of academic disciplines. This educational process derives from the recognition that many of the complex interrelated problems of the contemporary world and the future will require attention from people who not only have specialized technical abilities, but who also have the perspective, awareness and understanding necessary to exercise these abilities effectively in co-operation with others and take some measure of responsibility for the human, social and other implications of the results.

The Man-Environment Studies programme does not in itself concentrate on a technical or pre-professional field to meet specifications for particular jobs. However, by investigating a wide range of subjects and problems inherent in the theme of man-environment interrelationships, students obtain a clearer understanding of the range of options open to them for specialized study and can thereby decide more knowledgeably how best to proceed. The programme offers a good base and considerable flexibility from which more specialized qualifications can be sought in a number of related areas through concurrent and, especially, through graduate study.

Graduates holding the B.E.S. degree in Man-Environment Studies have found employment in a range of government agencies in fields such as natural resources management, pollution control, social services planning, and urban affairs as well as with private corporation and consulting firms in the communications industry and environmental design; with other universities as full-time teaching or research assistants, and with community agencies in various social programmes and as community organizers. Others who have graduated from man-environment studies have gone on to post-graduate work in programmes such as urban and metropolitan studies, natural resources administration, regional planning, environmental engineering, law, systems design, teacher training, adult education, and communications studies.

The Department is unique in having a multi-disciplinary faculty whose formal education and experience range 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, chemistry, chemical engineering, communications science, earth sciences, economics, fine arts, geography, mathematics, physics, planning, political science, psychology, sociology and social work, as well as a variety of experience in such diverse areas as the planning of education systems, ecological research, geological investigations, economic studies, urban affairs, technology assessment, and work with various international organizations.

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. Although there are no formal arrangements for a co-operative programme in Man-Environment Studies, students are encouraged to relate aspects of their academic programme to summer and other employment or to involvement in community organizations in order to incorporate this experiential learning into a university-based educational process.

For many students a “theme” oriented programme of this kind offers a more satisfying undergraduate education than traditional alternatives. Man-Environment Studies started at Waterloo in 1969 and as an undergraduate degree programme it is unique in Canada although similar ones have become established in the United States, Europe and Australia.

Bachelor of Environmental Studies (Honours Man-Environment Studies)

About one half of the 22 courses required for the B.E.S. degree are designated as a core of required courses. The remainder are free electives chosen by each student to develop the mix of subjects and skills best suited for achieving individual educational or career preparation objectives.

Most required courses are taken in the first two years. The first year introductory courses examine major environmental themes from the viewpoints of the natural and social sciences. They also introduce techniques for investigating environmental questions and provide experience in conducting a systematic enquiry through the device of small group projects. In the second year, further work in natural ecology and social sciences helps to introduce other perspectives and themes running through man-environment studies such as a systems mode of understanding relationships and the “futures” implications of the problems considered. Additional course work on information or data handling is required and each student also conducts an individual or group project selected from a wide range of possible topics and problem areas.
The core requirements for years three and four are also project-oriented, comprising a "seminar-workshop" and senior honours assignment respectively. Arrangements to receive extra credit for project work have been provided for those who learn most effectively through undertaking self-directed work under the guidance of faculty and other advisors. The fourth year also requires participation in one from among several honours seminars which provide the occasion for students to draw together much they have learned and direct it to one of the broad sub-areas within man-environment studies.

The stress given to project-oriented learning within the programme reflects the importance attached to having students develop increasingly sophisticated abilities for coping with situations that are inherently complex, value-laden, ambiguous and uncertain. Project-oriented learning provides the occasion to practice skills in problem definition, information and data gathering, analysis and synthesis of material, and presentation of results in a suitable format using the most appropriate communications media. Skills of this nature can be refined, adapted and applied in whatever context or situations students choose during and after their university years. An increasing number of students incorporate work with government agencies, community organizations and other groups into projects they select for their third and fourth year project assignments and in a few cases, well conceived and executed projects have lead to employment in a variety of organizations.

Elective courses can be chosen from anywhere in the university and options start from the first year in the programme. Faculty will advise on this, but essentially there are four broad options as follows:

a) Students may combine Man-Environment Studies with one academic discipline to the extent that some form of a joint honours degree can be awarded. Arrangements to do this have been approved with seven other academic programmes in the university and more are being considered. Students interested in this type of option should make certain they consult with the Undergraduate Officer.

b) Students may concentrate study in an associated field to the extent it becomes a "minor" (5 full courses or equivalent) within honours Man-Environment Studies.

c) Students may develop a coherent sequence of courses from electives offered by the Department in combination with courses offered elsewhere to concentrate on one of several possible sub-areas emerging within man-environment studies, i.e. human and community studies, resource and environmental management, policy and decision-making at the interface of technology and society.

d) Students may choose instead to explore whatever range of subjects interest them in addition to Environmental Studies.

In each case students should give careful consideration to their choices in terms of the educational goals and possible careers they may wish to pursue after obtaining a B.E.S. degree. They would also do well to seek information and advice on the kind of undergraduate courses favoured by different graduate programmes either as absolute prerequisites for them or expressed preferences.

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 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.

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 Social Sciences
- M-Env 150 (Y) Environmental Issues: Methods and Techniques
- M-Env 190 (Y) Seminar-Workshop
- Electives: Two full credits: Four half-year courses or equivalent

**Year 2**
- Env.S 200* Field Ecology
- M-Env 241* Social Change, or other half-year course in social sciences
- M-Env 271* Introduction to Quantitative Research Methods, or one other introductory methods course approved by the Department (see Undergraduate Officer)
- M-Env 290 (Y) Seminar-Workshop
- Electives: Three and one-half full credits or equivalent (i.e. seven half-year courses)

**Year 3**
- M-Env 390 (Y) Seminar-Workshop (credit value can be increased to 2 by consent of Faculty)
- Electives: Three or four full credits or equivalent (i.e. six or eight half-year courses)
Year 4
M-Env 490 (Y) Senior Honours Assignment (credit value can be increased to 2 or 3 by consent of Faculty)
One of the following Honours Seminars:
M-Env 410 (Y) Environmental Management
M-Env 445 (Y) Technology Assessment and Policy Analysis
M-Env 470 (Y) Environmental Teaching and Learning
M-Env 480 (Y) Special Topics Seminar
Electives: One to three full credits or equivalent

Joint Honours
Joint programmes have been approved between the Department of Man-Environment Studies and the Departments of Economics, Geography, German and Slavic Languages and Literature (for Russian), Philosophy, Political Science, Psychology, Sociology and Anthropology. Joint programme arrangements have also been made with the Faculty of Mathematics and a special Honours Man-Environment Studies (with Biology Option) programme has been arranged with the Department of Biology.

These programmes lead to degrees from the Faculty in which the student is registered. Students from other departments choosing one of these joint programmes must complete the equivalent of seven full courses in man-environment studies. The Department of Man-Environment studies is prepared to work out other programmes for interested students who meet honours standing.
School of Urban and Regional Planning

Bachelor of Environmental Studies (Honours Urban and Regional Planning Programme)

Nature of the 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 Urban and Regional 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 Urban and Regional 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.

Students with advanced standing will be considered for admission to Year 2 and 3.
### Honours Urban and Regional Planning Recommended Programme

<table>
<thead>
<tr>
<th>Year</th>
<th>Required Planning Courses</th>
<th>Required Elective Courses</th>
<th>Elective Planning Courses</th>
<th>Other Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td><em>Plan 100</em> – Introduction to Urban Planning Concepts and Techniques</td>
<td>One-half credit from each of the eight categories in the list of Year 1 Required Elective Courses (see below)</td>
<td><em>Plan 159</em> – Graphics for Planning</td>
<td>Students may select other electives from any of the University Year 1 offerings – Required and Elective Courses together must total 6 credits</td>
</tr>
</tbody>
</table>

Before making a final selection in these courses, students should check that prerequisites have been covered for courses they might wish to take in year 2, 3 and 4.

### Year 1 Required Elective Courses

<table>
<thead>
<tr>
<th>Theme Areas</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ecology</td>
<td><em>Biol 131</em> Introduction to Biology</td>
</tr>
<tr>
<td>2 Administration</td>
<td><em>PSci 101</em> Introduction to Politics 1</td>
</tr>
<tr>
<td>3 Design</td>
<td><em>Arch 142</em> Inconography 1</td>
</tr>
<tr>
<td>4 Habitat</td>
<td><em>ES 195</em> Introduction to Environmental Problems</td>
</tr>
<tr>
<td>5 Methodology</td>
<td><em>Anth 103</em> Nature of Language</td>
</tr>
<tr>
<td>6 Sociology</td>
<td><em>Soc 101U</em> Introduction to Sociology</td>
</tr>
<tr>
<td>7 Economics</td>
<td><em>Econ 101</em> – Introduction to Economics</td>
</tr>
<tr>
<td>8 Philosophy</td>
<td><em>Arts 120G</em> Focal Issues in Contemporary Society</td>
</tr>
<tr>
<td></td>
<td><em>Arts 121G</em> Focal Issues in Contemporary Society</td>
</tr>
<tr>
<td></td>
<td><em>Arts 122G</em> Quest for Meaning in the 20th Century</td>
</tr>
<tr>
<td></td>
<td><em>Engl 108</em> B Utopia and Anti-Utopia</td>
</tr>
<tr>
<td></td>
<td><em>Engl 108</em> H Isolation and Alienation</td>
</tr>
<tr>
<td></td>
<td><em>History 101R</em> Western Civilization</td>
</tr>
<tr>
<td></td>
<td><em>History 105</em> The Meaning of Civilization</td>
</tr>
<tr>
<td></td>
<td><em>Phil 110</em> Problems</td>
</tr>
<tr>
<td></td>
<td><em>Phil 125</em> Fundamentals of Social and Political Philosophy</td>
</tr>
<tr>
<td></td>
<td><em>Phil 140</em> Fundamentals of Logic</td>
</tr>
<tr>
<td></td>
<td><em>Phil 150</em> Knowledge and Reality</td>
</tr>
</tbody>
</table>

*If taught, otherwise *Soc 101
<table>
<thead>
<tr>
<th>Year</th>
<th>Required Planning Courses</th>
<th>Required Elective Courses</th>
<th>Elective Planning Courses</th>
<th>Other Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>ES 200</em> – Field Ecology</td>
<td></td>
<td><em>Plan 222</em> – Canadian Regional Issues</td>
<td>Required and Elective Courses together to total 6 full credits</td>
</tr>
<tr>
<td></td>
<td><em>Plan 256</em> – Principles of Environmental Design</td>
<td>and at least 2 of:</td>
<td><em>Plan 230</em> – The Small Group in the Planning Process</td>
<td>List of &quot;Non-Planning Suggested Electives&quot; obtainable from Undergraduate Officer</td>
</tr>
<tr>
<td></td>
<td><em>Plan 271</em> – Introduction to Quantitative Research Methods</td>
<td><em>Plan 258</em> – Readings and Research in Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Plan 307</em> – Social Survey Techniques if taught, otherwise Soc 321U* Research Methods</td>
<td><em>Plan 272</em> – Computer Programming in Environmental Studies</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>and at least 2 of:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Plan 255</em> – Planning Surveys and Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Plan 358</em> – Regional Planning and Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Plan 357</em> – Conservation and Resource Management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 3</strong></td>
<td><em>Plan 300</em> – Seminar/Workshop Project in Urban and Regional Planning</td>
<td>Two full credits from list of Required Elective Courses (see following page)</td>
<td><em>Plan 301</em> – Planning Design</td>
<td>Required and Elective Courses together to total 6 full credits</td>
</tr>
<tr>
<td></td>
<td><em>Plan 391</em> – Field Research Methods and Projects</td>
<td></td>
<td><em>Plan 316</em> – Multivariate Statistics</td>
<td>List of &quot;Non-Planning Suggested Electives&quot; obtainable from Undergraduate Officer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 317</em> – Nonparametric Statistics</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 318</em> – Spatial Analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 319</em> – Regional Planning Techniques</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 330</em> – Urban Social Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 332</em> – The Sociology of Regions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 333</em> – The Sociology of Regional Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 344</em> – Principles of Recreation Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 360</em> – Technology in Urban and Regional Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 370</em> – Land Development Planning</td>
<td></td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
<td><em>Plan 456</em> – Political and Administrative Processes in Urban and Regional Planning</td>
<td>One full credit from list of Required Elective Courses (see following page)</td>
<td><em>ES 400</em> – Environmental Law</td>
<td>Required and Elective Courses together to total 6 full credits</td>
</tr>
<tr>
<td></td>
<td><em>Plan 480</em> – The Philosophy and Methodology of Urban and Regional Planning</td>
<td></td>
<td><em>Plan 414</em> – Housing Policies</td>
<td>List of &quot;Non-Planning Suggested Electives&quot; obtainable from Undergraduate Officer</td>
</tr>
<tr>
<td></td>
<td><em>Plan 490</em> – Senior Honours Essay (2 full course credits)</td>
<td></td>
<td><em>Plan 430</em> – Social Policy Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 470</em> – Concepts and Ideas in Contemporary Urban Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><em>Plan 475</em> – Projects, Problems and Readings in Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*Plan 476 – Projects, Problems and Readings in Planning</td>
<td></td>
</tr>
</tbody>
</table>
### Year 2-4 Required Elective Courses

#### Urban Theme
- These courses are subject to availability

#### Regional Theme
- These courses are subject to availability

#### Resource Theme
- These courses are subject to availability

#### Year 2
- **Plan 230**: The Small Group in the Planning Process
- **Plan 272**: Computer Programming in Environmental Studies
- **Anth 247**: Urban Anthropology
- **Geog 201**: Some Basic Topics of Physical Geography
- **Geog 202**: Some Basic Topics of Economic and Urban Geography
- **Geog 251**: Urban Areas in North America
- **Geog 270**: Introduction to Cartography and Air Photo Interpretation
- **Hist 265**: Canadian History 2
- **PSci 260**: Canadian Government and Politics
- **Soc 240**: Collective Behaviour
- **Soc 241**: Social Movements

#### Year 3
- **Plan 301**: Planning Design
- **Plan 330**: Urban Social Planning
- **Plan 360**: Technology in Urban and Regional Planning
- **Plan 370**: Land Development Planning
- **Arch 302**: Economics
- **Civ E 342**: Urban Transport Planning
- **Civ E 393**: Environmental Engineering
- **Econ 343**: Urban Economics
- **Econ 357**: Environmental Economics
- **Geog 349**: The City as a System 1
- **Geog 350**: Regional Urban Systems 1
- **PSci 343**: Urban Politics 1
- **P.Sci. 344**: Urban Politics 2
- **Soc 301**: Urban Sociology
- **Soc 360**: Political Sociology

#### Year 4
- **Plan 414**: Housing Policies
- **Plan 430**: Social Policy Planning
- **Plan 470**: Concepts and Ideals in Contemporary Urban Planning
- **ES 400**: Environmental Law
- **Geog 449**: City as a System
- **Arch 554**: Development and Financing
- **Civ E 543**: Land Use Models
- **ES 400**: Environmental Law
- **Geog 412**: Advanced Economic Geography 2
- **Geog 422**: Canada
- **Geog 450**: Regional Urban Systems 2
- **Geog 452**: Problems of Rural Land Use
- **PSci 428**: State and Economic Life
- **Civ E 543**: Land Use Models
- **ES 400**: Environmental Law
- **Geog 408**: Special Topics in Climatology and Natural Hazards
- **Geog 410**: Recreation Geography
- **Geog 411**: Resource Studies
- **Geog 414**: Resources Management Workshop
- **Geog 452**: Problems of Rural Land Use
- **Geog 460**: Land Dereliction and Rehabilitation
- **M-Env 431**: Comparative Approaches to Environmental Management
- **Rec 410**: Planning of Recreation Facilities
- **Rec 434**: Park Management
Environmental Studies
School of Urban and Regional Planning

Additional Information
The four year Honours programme is recognized by the professional association of planners in Canada (the Canadian Institute of Planners) and an increasing number of employers as a satisfactory preparation for a wide range of careers.

Note 1
It is possible to gain admission to Year 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 2
Planning 156* (Fall and Winter terms) and Planning 342* and 343* are intended for students in the other disciplines and may not be taken for credit by Planning students.

Note 3
No more than 8 first year credits will be allowed toward the 24 required to graduate. The number of electives from the required list in each of the 4 years apply not merely to each year in question. For example, a student in Year 4 can also pick from the required list in Year 2 and 3 so long as the total required electives in all 4 years at graduation meets the minimum number (within the 8 credit guideline for Year 1).

Note 4
Students in Year 1 and 2 should be aware of prerequisites in other depts., where Year 1 courses are needed in order to be able to take more advanced courses later.

Note 5
A student wishing to register for a readings and research course (Planning 258*, 475 and 476) must first make arrangements with a faculty member to provide the necessary supervision and guidance.

Note 6
Plan 307* if available, otherwise Soc 321U* may be taken in Year 2 or Year 3.

Note 7
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 8
Not all the courses listed herein are offered each year. Students should consult the School prior to registration.

Note 9
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 10
For some courses, participating students may be expected to make a small financial contribution to defray materials/travel costs, e.g. Plan 139* (Graphics for Planning), Plan 300 (Seminar/Workshop Project in Urban and Regional Planning), Plan 357* (Conservation and Resource Management), Plan 391* (Field Research Methods and Projects).

Note 11
Where a student selects 2 of: 255*, 358* and 357* and then picks up the third option - that third course will be considered as one of the additional elective planning courses required for either Year 2 or 3.

Note 12
Students who enter the Planning School under the pre-existing 4-year programme course outline, contained in the calendars of 1972-73, 1973-74 or 1974-75, may elect to meet the requirements of either the old or new programme of the School outlined in the 1975-76 calendar.

Note 13
Students in the Planning School are required to participate fully in all four years of the programme. Students are normally expected to carry a load of six credits in each of those years. However, students interested in taking extra courses are free to take a seven credit load in any given year without approval from the School; preregistration for more than seven credits may only be done with the undergraduate officer's approval. If the student has accumulated more than the required minimum number of credits for proceeding into the next year of the programme (Year 2-six credits, Year 3-12 credits, Year 4-18 credits) he may elect to reduce his load and will be permitted to take a minimum of 5 credits in any given academic year through Year 4.
All required courses should be taken in the year indicated.

Note 14
Leave of absence may be negotiated with the approval of the undergraduate officer.

Note 15
A variety of items are covered in the Undergraduate Affairs Policy Manual available from the undergraduate officer. Policy areas covered include: Admission, Courses, Examinations, Records and Transfers, Registration, Appeals and Discipline, Academic Standing

Note 16
For information on awards refer to Chapter 4.
Faculty of Human Kinetics and Leisure Studies

Testing apparatus in Kinesiology lab
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 (1968-72). Within this faculty, the Department of Kinesiology, the Department of Recreation, and the Dance Group offer academic programmes and conduct research, whereas the Department of Athletics conducts 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. Five 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, Dance, Health Studies or Recreation in which they had a special interest. The future promises even greater opportunities for specialized study by the individual students.

Kinesiology Programme

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 adherent 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.

A special Honours Option in Health Studies offers seventeen Health Studies courses. Graduates of this option are capable of performing in such career areas as Public Health, Community Health Education, Private Health Agencies, Teaching and Research.

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 Programme

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 Administration, Therapeutic Recreation Services, Outdoor Recreation and Education, or Leisure Studies. A Joint Honours Programme with Sociology is available as is a Recreation-Business Option with Wilfrid Laurier University.

Graduates of the Recreation Degree Programme are found in diverse settings, including hospitals, municipalities, schools, national and provincial parks, youth agencies, and university graduate programmes. All are eligible to apply for the Municipal Recreation Directors’ Interim Type “A” Certificate from the Sports and Recreation Branch, Ministry of Culture and Recreation.

Dance Programme

The honours programme in Dance offers students the unique opportunity of studying dance from the perspective of the humanities, the social sciences, and the biological sciences, as well as that of the performing arts. This orientation, which represents a marked departure from the strictly performance oriented approach which is taken in most programmes of dance at universities in Canada and the United States, allows the student a wider range of career choices than do the traditional programmes.

Degrees

Graduates of all Kinesiology programmes will receive either an Honours or General Bachelor of Science degree in Kinesiology. Recreation programme graduates are awarded an Honours Bachelor of Arts degree in Recreation. Those students who graduate from the Dance programme will receive an Honours Bachelor of Science Degree in Dance.

Graduates who have pursued their studies in a Co-operative programme and who have successfully completed 4 work terms, 4 work reports, and who indeed do finish the Co-operative programme, will have the words “Co-operative Programme” added to their University diploma.
Human Kinetics and Leisure Studies
Examinations and Standings

Systems of Study

Co-operative System
The co-operative system is one whereby after the first eight month academic year the student spends alternate four month terms in academic study and related work experiences.

Arrangements for work assignments are made through the Department of Co-ordination of the University which provides the liaison between the campus and the field situation. Students should refer to Chapter 5 of the Calendar for further details concerning the co-operative programme.

Regular System
In regular programmes students attend school for two consecutive four month terms each year for four years.

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 Year 5
Applicants to any of the Kinesiology programmes are advised to select a Year 5 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 the Year 5 programmes.

Adult Students
Adult students are also advised to take the courses indicated above, or their equivalent.

Advanced Standing
It is not usual for students transferring to H.K.L.S. programmes to be granted credit for courses taken elsewhere in which they have received a grade of C- or better. All transfer students will be required to complete at least the equivalent of two years of study at Waterloo (i.e. at least 11 full year courses) regardless of the number of courses that are presented for transfer.

Examinations and Standings

The Faculty of Human Kinetics and Leisure Studies currently 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 term courses will be considered Year 1; those who have passed at least 12 term courses but fewer than 22 will be considered Year 2; those with at least 22 but fewer than 32, Year 3; and those with 32 or more, Year 4.

1) Final Examinations
a) The faculty constitutes the examining body for all examinations. All examination results are considered by the Undergraduate Affairs Committee and subsequently by the Faculty Council. The results are issued to individual students by the Registrar. Appeals against faculty decisions made under these regulations should be made in writing to the Chairman, Undergraduate Affairs Committee within one month of publication of the official mark reports.

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 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 D- 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 the 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.

c) Students defaulting examinations, except for properly certified reasons, do not have make up privileges, and must repeat the entire course. If a student has a Doctor's certificate covering the precise period of absence, with legitimate medical grounds, it must be submitted to the Chairman of the Undergraduate Affairs Committee within one week of the scheduled examination.

d) All examinations which receive failing grade are automatically re-read.

2) Standing
a) The Faculty has endorsed the letter grade system outlined on page 16 of this calendar.
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 while enrolled in the faculty (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>C-</td>
<td>C-</td>
</tr>
<tr>
<td>(Health Studies Option)</td>
<td>C-</td>
<td>C-</td>
</tr>
<tr>
<td>Kinesiology General</td>
<td>C-</td>
<td>C-</td>
</tr>
<tr>
<td>Recreation Honours</td>
<td>C-</td>
<td>B-</td>
</tr>
<tr>
<td>Dance Honours</td>
<td>C-</td>
<td>C-</td>
</tr>
</tbody>
</table>

*All courses designated Kinesiology or Health Studies will be included in the major average.

If a student fails to meet either of the above required cumulative averages the person may be designated on probation for the following year. A General student on probation must improve his/her standing to at least the minimum overall level noted or else will be required to withdraw from the Faculty. An Honours student on probation may elect to transfer to the General programme in good standing (if this is possible) or may endeavour to improve the 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 on probation may be required by the student's major Department to repeat certain courses which have been done poorly or may elect to do so himself in order to improve performance in subsequent years.

If a regular (full-time) student, even in good standing, fails more than two full-year courses or their equivalent in a given year the student may be transferred to the General programme or else may be asked to withdraw if the 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.

**Programme selection**

Full-time students: All first year students must take a minimum of 12 term courses. In subsequent terms, a student will normally take at least 5 courses.

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 (10 terms) 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 and Programme Changes**

a) Up to the end of the first three weeks of lectures, the initials of the faculty advisor (beside the course), plus the faculty advisor's signature are necessary to carry out a course drop on the registration form.

b) After the first three weeks of classes any course may be dropped provided the course instructor initials the drop, and the Associate Chairman for Undergraduate Affairs signs the registration form. This policy will permit course drops only up to the date which is 4 weeks prior to the last day of lectures.
Academic Programmes
Department of Kinesiology

Listed below are the course combinations leading to the Honours and General degrees in Kinesiology and the Honours Degrees in Health Studies. Students are encouraged to make full use of the advisory system of the Department in planning their programmes.

Degree Requirements Honours and General Programmes

a) Required Kinesiology courses: (14)
   (Kinesiology 116* is required of all students not presenting Year 5 Chemistry for Admission).

b) Required courses from other departments: (7)
   Physics 103* or Physics 104* (see note), Biology 110*, 203* and 204*, 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 Year 5 for admission. Physics 104* is for students who have taken Year 5 Physics.

c) Kinesiology Electives: (10)
   Ten courses from those offered in the Department in addition to the required courses. These may include Health Studies courses.

d) Electives: (13)
   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, Dance and Recreation.

Honours Programme
Each student in the Honours Programme must include in his/her programme at least seven (7) courses from one of the following two areas of concentration:

a) Kinesiological Sciences:

b) Applied Kinesiology:

General Programme
The ten (10) elective courses in Kinesiology may be made up of any combination of Kinesiology and/or Health Studies courses.

Course Sequence – Honours and General Programmes
Year 1
(Common to Regular and Co-operative Programmes)

<table>
<thead>
<tr>
<th>Fall</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kin 102*</td>
<td>Kin 103*</td>
</tr>
<tr>
<td>Psych 101*</td>
<td>Another Psych or Soc</td>
</tr>
<tr>
<td>Soc 101*</td>
<td>Biol 110*</td>
</tr>
<tr>
<td>Phys 103* or 104*</td>
<td>Kin 116* (if no Year 5 Chemistry)</td>
</tr>
<tr>
<td>Two electives</td>
<td>Two or three electives</td>
</tr>
</tbody>
</table>

Co-operative Programmes

<table>
<thead>
<tr>
<th>Term 2A Fall</th>
<th>2B Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kin 200*, 222*</td>
<td>Kin 321*, 330*, 335*</td>
</tr>
<tr>
<td>Biol 203*</td>
<td>Two electives</td>
</tr>
<tr>
<td>Two electives</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term 3A Winter</th>
<th>3B Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kin 355*</td>
<td>Kin 300*, 317*</td>
</tr>
<tr>
<td>Biol 204*</td>
<td>Three electives</td>
</tr>
<tr>
<td>Three electives</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term 4A Spring</th>
<th>4B Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kin 431*</td>
<td>Kin 432*, 470*</td>
</tr>
<tr>
<td>Five electives</td>
<td>Four electives</td>
</tr>
</tbody>
</table>

Regular Programmes

<table>
<thead>
<tr>
<th>Year 2 Fall</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kin 200*, 222*</td>
<td>Kin 321*, 335*</td>
</tr>
<tr>
<td>Biol 203*</td>
<td>Biol 204*</td>
</tr>
<tr>
<td>Two electives</td>
<td>Two electives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3 Fall</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kin 300*, 317*, 330*</td>
<td>Kin 355*</td>
</tr>
<tr>
<td>Two electives</td>
<td>Four electives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 4 Fall</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kin 431*</td>
<td>Kin 432*, 470*</td>
</tr>
<tr>
<td>Five electives</td>
<td>Four electives</td>
</tr>
</tbody>
</table>
Honours Health Studies

Students may apply for admission directly into the Honours Health Studies Programme, co-op or regular.

44 Term courses

**Degree Requirements**

a) Required Health Studies courses: (13)

b) Required Kinesiology courses: (5)
   - Kinesiology 200*, 222*, 300*, 317*, 330*.

c) Required courses from other departments: (9)

d) Electives: Seventeen (17) term courses selected in consultation with the student's advisor.

---

**Health Studies Year 1 Common**

<table>
<thead>
<tr>
<th>Course</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 140*</td>
<td>HS 141*</td>
</tr>
<tr>
<td>Psych 101*</td>
<td>Psych 211*</td>
</tr>
<tr>
<td>Soc 101*</td>
<td>Kin 116* (if necessary)</td>
</tr>
<tr>
<td>Biol 131</td>
<td>Biol 131</td>
</tr>
<tr>
<td>Two electives</td>
<td>Two (or Three) electives</td>
</tr>
</tbody>
</table>

**Regular Programme Year 2**

**Year 2**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 240*</td>
<td>HS 241*</td>
</tr>
<tr>
<td>Kin 200*, 222*</td>
<td>Biol 246*</td>
</tr>
<tr>
<td>Biol 245*</td>
<td>Three electives</td>
</tr>
<tr>
<td>One elective</td>
<td></td>
</tr>
</tbody>
</table>

**Year 3**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 349*, 410*</td>
<td>HS 345*, 346*, 348*</td>
</tr>
<tr>
<td>Kin 330*, 317*</td>
<td>Biol 204*</td>
</tr>
<tr>
<td>Biol 203*</td>
<td>One elective</td>
</tr>
</tbody>
</table>

**Year 4**

<table>
<thead>
<tr>
<th>Fall</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 431*, 440*</td>
<td>HS 432*, 445*</td>
</tr>
<tr>
<td>Kin 300*</td>
<td>Four electives</td>
</tr>
<tr>
<td>Three electives</td>
<td></td>
</tr>
</tbody>
</table>

---

**Co-operative Programme**

**Year 2**

<table>
<thead>
<tr>
<th>2A Fall</th>
<th>2B Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 240*</td>
<td>HS 345*, 348*</td>
</tr>
<tr>
<td>Kin 200*, 222*</td>
<td>Kin 330*</td>
</tr>
<tr>
<td>Biol 245*</td>
<td>Two electives</td>
</tr>
<tr>
<td>Biol 203*</td>
<td></td>
</tr>
</tbody>
</table>

**Year 3**

<table>
<thead>
<tr>
<th>3A Winter</th>
<th>3B Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 241*</td>
<td>HS 410*, 440*</td>
</tr>
<tr>
<td>Biol 246*</td>
<td>Kin 300*, 317*</td>
</tr>
<tr>
<td>Biol 204*</td>
<td>One elective</td>
</tr>
<tr>
<td>Two electives</td>
<td></td>
</tr>
</tbody>
</table>

**Year 4**

<table>
<thead>
<tr>
<th>4A Spring</th>
<th>4B Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 349*, 346*, 431*</td>
<td>HS 432*, 445*</td>
</tr>
<tr>
<td>Three electives</td>
<td>Four electives</td>
</tr>
</tbody>
</table>
**Academic Programme**

**Honours Dance**

Forty-four term courses are required for the honours degree in Dance.

**Degree Requirements:**

a) Required Dance Courses (10):

b) Required Kinesiology Courses (6):

c) Required Courses from Other Departments (10):
   - Biol 110*, Phys 103*, Psych 101*, Soc 101*, Phil 100,
     Fine Arts 150G*, 151G*, and two courses from Drama
     101*, 102*, Fine Arts 110*, 111*.

d) Five electives in Dance to be selected from:

e) Other Electives: The remaining 13 term courses must
   include at least 8 term courses outside the faculty of
   Human Kinetics and Leisure Studies.

---

**Academic Programmes**

**Department of 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 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 (22):

1) Required:
   - Recreation 100*, 101*, 204*, 210*, 220*, 230*, 250*,
     270*, 300*, 371*, 400*, 470*, 471*.

b) Each student normally must include in his programme the five (5) courses listed in one of the following areas of concentration (see note):
   - Therapeutic Recreation: Recreation 200*, 252*, 253*,
     254*, 361*.
   - Recreation Administration: Recreation 316*, 320*, 334*,
     410*, 434*.
   - Outdoor Recreation: Recreation 331*, 332*, 334*, 432*,
     434*, 435*.

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 3 or 4 additional recreation electives to meet the required total of 22.

B) Courses outside the Department of Recreation

1) Required: (8)
   - Psychology 101* and Sociology 101*
   - Any two of English 109*, 140*, 141*, 209*, 210*
   - Any four of Business 121*, Kinesiology 200*,
     Economics 101*, Geography 101*/Environmental
     Studies 195*, Planning 156* or a course in the
     Fine or Performing Arts.

2) Electives: (14)

C) Additional Requirements

Practical Experience. To complete the requirements for a degree, all students must complete a faculty approved work term, normally at least three months duration, or successfully petition the Department for exemption on the basis of experience.
Human Kinetics and Leisure Studies
Recreation

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 204*, 210*, 270*
2 Recreation electives
5 electives

Year 3
Recreation 300*, 371*
5 Recreation electives
5 electives

Year 4
Recreation 400*, 470*, 471*
2 Recreation electives
5 electives

Honours Recreation and Sociology
The Joint Honours programme in Recreation and Sociology has the following requirements:

Required Recreation Courses (13)
100* Introduction to the Study of Leisure & Recreation
101* Introduction to Leisure Services
204* Leisure and Recreation in Historical Perspective
210* Organization and Administration of Recreation Services
220 Recreation in Programme Development
230* Introduction to Outdoor Recreation & Education
250* Introduction to Therapeutic Recreation Service
270 Statistical Techniques Applied to Leisure Studies
300* Philosophy of Leisure
371* Research Design Applied to Leisure Studies & Services
400* Seminar in Recreation & Leisure
470* Research Project
471* Research Project

Non-Departmental Required Courses (5):
Psychology 101 Introductory Psychology
Planning 156 Introduction to Urban & Regional Planning Concepts
Science 351 Human Biology
Geography 195 Geography & Environmental Problems
English 140 The Use of English

Recreation Electives (7):
Students must elect any seven advanced courses in Recreation.

Sociology Electives (9):
Students must elect any nine advanced courses in Sociology.

Non-Departmental Electives (5):
Students must elect any five courses outside of Recreation or Sociology which relate to their major area of study.

Honours Recreation and Business Option
In this special honours Recreation programme, students take business courses at Wilfred Laurier University. The 44 term courses in this programme must include:

a) The 22 term courses required of all Recreation students.
b) The 8 outside courses required of all Recreation students.
c) Eight (8) Business/Economics Courses which must include Business 121, 212R, 383R, 388, 398 and 471R.
d) Six (6) Electives.

Required Sociology Courses (5):
Sociology 101 Introduction to Sociology
320 Research Methods 1
321 Research Methods 2
425 Sociological Theory
426 Sociological Theory
Summer concert in Humanities Courtyard
An Alternative in University Education
An Opportunity to Develop an Individual Programme of Learning

Integrated Studies, a small undergraduate programme of less than 100 students, is an opportunity established within the University of Waterloo in 1969 for students able to structure and pursue their own programmes of study.

This alternative in undergraduate education is distinctive in that the students develop their own programmes which are to some degree both integrated and independent, and the students play a predominant role in the operation of the overall programme.

Integration
By integration, it is primarily meant that students explore interdisciplinary study, particularly in a theme or project approach. Student programmes are expected to cross the boundaries of traditional disciplines bringing a variety of subject matter together in a distinctive focus. Students are encouraged to seek out connections among disciplines in ways not specifically promoted by regular university programmes.

Other aspects of integration are also of concern within the programme. Most students consciously attempt to integrate their learning with their life situation and interests; normally their studies directly reflect this interest. Attempts are also made to integrate a wide variety of approaches to available resources. In addition, many seek to overcome the apparent separation of the university and community. Finally, students are integrated with faculty and staff in the programme’s shared decision making process.

Independence
By independence, it is not intended that students work in isolation; indeed we hope for an active community of learning. Students are expected, however, to have the independence to provide the basic thrust for the structure of their studies and to devise programmes utilizing more than the course offerings of the various faculties of the University.

Shared Decision Making
The operation of the programme, with the exception of matters pertaining to the degree, is handled by Operations Council which consists of all members of the programme, its students, Resource Persons and staff. It is responsible for such items as budget development, student project assistance, recommendations for the hiring of personnel, admission of students and year end reviews. Council normally meets every second week. To make Council functional, in view of its potential size, volunteer committees examine issues of concern and submit recommendations for Council’s decisions.

Approach to Resources
In designing their studies, the students have access to the wide resources of the community and the University, including its full array of courses. They decide which resources they require and what approach they wish to pursue. That might entail taking no formal courses at all, or perhaps auditing several and taking some for credit, or a variety of other combinations. The students might work on an individual basis with professors or graduate students from the many university departments or with the programme’s own Resource Persons. Groups of students may also work together in a common approach to any given subject or theme. Then, students are also free to pursue studies privately utilizing the libraries and other facilities.

Resource Persons
The programme’s Resource Persons serve as tutors or advisors to assist the students with the development of their studies. As they are normally broadly experienced in interdisciplinary study, they are capable of delineating connections among areas of knowledge. From their knowledge of the University and the community they can direct students to specialized areas of expertise or particular facilities which might serve to further the students’ interests.

Resource Persons 1975-1976
J. M. Jamieson
L. Kendall
J. E. Miller
G. H. Miller
M. Tabor

Year End Reviews
Students are encouraged to document the structure and pursuit of their studies as their programmes develop. They are required to report yearly to the programme on this development indicating the nature of their studies, resources used (personnel, facilities and materials) and to provide a critical evaluation of their educational year indicating particular achievements and difficulties. They are also encouraged to include examples of their work and evaluations by others.

Programmes of Study
The following are examples of some approaches to study interests:

Ray focussed his studies on drama as a system of education by drawing upon architecture, sociology, developmental psychology, philosophy of education, and theatre practice. He worked independently with advice from faculty in the drama department and the Ontario Institute for Studies in Education and a programme Resource Person. He has also taken regular drama courses in criticism and literature and, as a particular application of his concern to ‘learn by doing’, he has been the director of an alternative educational resource centre.

After a preliminary background in science, Marg came to centre her studies on child development working under the.
The responsibility students in this programme must assume for the pursuit of their studies ensures that graduates will possess a high level of organizational skills, self-discipline and motivation combined with their attested educational development. These capabilities have prepared them well for further endeavours. Graduates of Integrated Studies have gone on to teachers college, graduate study, employment with the government and business and, as would be expected, a variety of other unconventional opportunities.

Admission Requirements
Students applying to the programme are required to complete the appropriate formal application form (See Chapter 2 of this calendar), and submit academic transcripts from previous educational institutions. In addition, they must provide an autobiographical letter indicating:
1) their previous learning experience,
2) their reasons for wishing to enter Integrated Studies, and
3) an indication of the type of exploration proposed.
Candidates are also encouraged to submit letters of reference assessing their ability to pursue their proposed programmes.

All applicants residing within a reasonable distance of the University are then interviewed by the Admissions Committee consisting of students and programme staff. Decisions on the remaining applicants are made solely on the submitted material.

Those interested in this alternative approach to university education are urged to visit the programme to meet with the people currently involved in its operation. In addition, members of Integrated Studies would be happy to visit schools or groups of students to discuss the programme.

For further information J. E. Faquiere, Assistant Registrar, or T. W. Smyth, Coordinator.
Faculty of Mathematics

Mathematics students use computer to plot graphic illustration.
Faculty of Mathematics

Mathematics at the University of Waterloo was established 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 Mathematics, Combinatorics and Optimization, Computer Science, Pure Mathematics, and Statistics. Students may specialize in General and Honours programmes in various areas within these departments and may obtain the degree of Bachelor of Mathematics (B.Math) upon successful completion of a three-year Pass degree programme, a four-year General degree programme, or a four-year Honours degree programme.

The Faculty offers both regular and co-operative programmes in mathematics. The co-operative mathematics programmes, available to Honours and General students, involve re-arrangements in the scheduling of academic terms so as to permit considerable practical experience.

Applicants may also register for the regular programme (not the co-operative programme) through St. Jerome's College. St. Jerome's offers some of the courses leading to a B.Math degree in conjunction with the University.

The graduate school in the Faculty of Mathematics is very strong. Many graduate degrees are conferred each year and active research is carried on in many areas. For information concerning graduate programmes in Mathematics, please consult the University of Waterloo Graduate Studies Calendar.

Brochures
The Faculty of Mathematics publishes a brochure which is specifically designed for Ontario high school students. Copies of this are available in school guidance offices. They may also be obtained by writing to the Assistant Registrar or the Associate Dean, Undergraduate Affairs, Faculty of Mathematics.

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 the student 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 the fourth year the student 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 except) 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.


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 consists primarily of the study of finite sets, and their subsets, whose structure arises from practical questions of transportation theory, communications theory, linear programming, electrical networks, and statistics. Combinatorial mathematics traces its roots to the study of puzzles and games of antiquity. But it is the contemporary environment, and in particular the development of the computer, which has provided the impetus to bring this field to maturity. It now plays a significant role in the analysis of questions of both pure and applied mathematics. One important area of Combinatorial Mathematics is Graph Theory, where a graph or network consists of vertices and edges that join pairs of vertices. Included in graph theory is one of the most famous of all unsolved problems in mathematics, the Four Colour Problem. A second area of Combinatorial Analysis is the study of counting or enumeration of sets of objects. As one wit has put it, it is Combinatorics that counts.
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 has 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 Computer Science Department

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, formal languages, artificial intelligence, real-time computing, and data communications.

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.

The Department of Pure Mathematics

Pure Mathematics is the study of mathematics both for its own sake and that of possible future applications. 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 appliers 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 precisely, and to continue educating oneself (major parts of our objectives), are available in any field of endeavour.

The department has a special interest in 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 following undergraduate courses are offered by the department. Note that some of the analysis courses are offered in conjunction with the faculty in 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.

<table>
<thead>
<tr>
<th>Course</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory</td>
<td>230</td>
</tr>
<tr>
<td>Algebra</td>
<td>341, 443, 464, 445a/b, 446a/b, 447a/b, 444a/b</td>
</tr>
<tr>
<td>Analysis</td>
<td>351, 352, 452a/b, 451a/b</td>
</tr>
<tr>
<td>Functional Equations</td>
<td>470</td>
</tr>
<tr>
<td>Geometry</td>
<td>361, 362, 363, 464, 462, 444a/b, 461, 465a/b</td>
</tr>
<tr>
<td>Logic and Foundations</td>
<td>432, 430</td>
</tr>
<tr>
<td>Number Theory</td>
<td>441</td>
</tr>
<tr>
<td>Topology</td>
<td>367, 467</td>
</tr>
</tbody>
</table>
Department of Statistics

Statistics is the branch of modern applied mathematics which deals with the collection and analysis of data. Statistical methods are extensively used in biology, medicine, health sciences, agriculture, business, economics, engineering, and many other fields. Claims based on statistical arguments appear daily in the press, and it is difficult to assess these intelligently without some knowledge of statistical methods.

The statistician's first job is to determine what numbers to collect, and how to collect them so that they will be without biases and distortion. These problems are dealt with in the Design of Experiments and Sample Surveys. Statistical inference is concerned with inferring what the population is like on the basis of a small amount of data (the sample). The link between population and sample is provided by probability theory, which forms an important part of the Statistics curriculum. Often the purpose for collecting data is to assist in reaching a decision, and decision theory is also a part of Statistics.

Many other areas of pure and applied mathematics find applications in Statistics. Calculus and linear algebra are used extensively in the undergraduate programme; abstract algebra, combinatorics, difference and differential equations, analysis, and measure theory are required in more advanced work. Most statistical analyses involve the computer, and a good background in Computer Science is highly desirable.

The Department also offers courses and programmes in Actuarial Science, which is the application of mathematics and statistics to financial problems, with particular emphasis on life insurance and benefit programmes. The courses offered provide theoretical preparation for the first five examinations of the Society of Actuaries, and include studies of such subject areas as mathematics of finance, life contingencies, theory of risks and demography.

Students can also gain valuable background knowledge in economics, finance, administration, and law by carefully selecting their electives.

Degrees

Mathematics Degrees

The Faculty of Mathematics offers several programmes leading to the following degrees: Bachelor of Mathematics (Pass), Bachelor of Mathematics (General) and Bachelor of Mathematics (Honours); details of these programmes appear in a later section. The basic distinction between these degrees lies in the number of mathematics courses required. The student who wants a modest amount of mathematics and an approximately even balance between mathematics and non-mathematics courses will usually choose the Pass programme, the student who wants a wider coverage of mathematics but does not intend to be a specialist will normally elect the General programme while the person who wishes to concentrate on mathematics and possibly go on to graduate study will require an Honours degree.

The table below lists the degree requirements in terms of credits; one credit is awarded for successful completion of an eight month (two terms) course and half credit is given for successful completion of a four month (one term) course.

<table>
<thead>
<tr>
<th>B.Math Degree Requirements</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>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 that students transferring from other post-secondary institutions require 6 U of W math credits.
‡‡15 is replaced by 14 in the Co-op Chartered Accountancy and Business Administration Options, by 14! in the Honours Applied Mathematics with Physics Minor and by 12 in certain joint Honours programmes; for details see pp. 82.
+++The averages quoted are calculated from the marks of all courses taken while registered in the Faculty of Mathematics, whether passed or failed.

Admission

General admission requirements and procedures are outlined in detail in Chapter 2. The following requirements relate specifically to programmes in the Faculty of Mathematics.

Applications from Ontario Year 5

Applicants will normally include Relations and Functions, Calculus, and Algebra in their six Year 5 credits offered for admission. A minimum average of 60% is required for admission to the regular programme; a somewhat higher average is required for the co-operative programme.

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 should, however, have covered the material of the Ontario Year 5 mathematics courses, either through a local high school or through the Correspondence Branch of the Ontario Ministry of Education and should provide evidence of being able to profit from a mathematics programme. Each application will be considered on its own merits by the Admissions Committee (See also Part-time Studies).
Advanced Standing

1) Transfer Credits
Students transferring into the Faculty of Mathematics either from outside or from within the University of Waterloo will normally be given transfer credit for a course previously taken if (1) a mark of at least 60% or equivalent has been obtained, (2) a mark of at least 50% has been obtained in a non-mathematics University of Waterloo course or in a University of Waterloo mathematics course taken in a section specifically designated for mathematics students.

A mark of 50-59% in a mathematics course equivalent to a course required for a B.Math degree could give the student exemption from that requirement but not a credit towards the degree.

A maximum of six transfer credits per academic year previously taken will be given.

2) Cumulative Averages
Courses taken prior to a student's admission to the Faculty of Mathematics will not normally count in the student's subsequent cumulative averages. However, if the student were registered in a Joint Honours Mathematics programme in another University of Waterloo Faculty, subsequent cumulative averages would include all courses that would have been acceptable for credit for a student registered in the Faculty of Mathematics. All courses taken previously by students being re-admitted to the Faculty of Mathematics count in their subsequent cumulative averages if they had interrupted their studies after September 1969.

3) Co-operative Programmes
It is normally not possible to transfer into a co-operative programme beyond the second-year level. Students applying for transfer at the second-year level must have credit in courses equivalent to the first-year Calculus, Algebra, and Computer Science required of University of Waterloo mathematics students. Past experience has indicated that very few places in the co-operative programmes are available at the second-year level for students applying from other institutions. Applicants in this category who cannot be admitted to a co-operative programme will be considered automatically for the regular programme.

Part-Time Studies

Students wishing to work towards a degree in Mathematics on a part-time basis must meet the regular admission requirements.

Applicants who do not meet these requirements may be admitted as non-degree, part-time students at the discretion of the Admissions Committee. After completing the equivalent of two full mathematics courses, they may apply for degree candidacy. If regular admission is granted, any credits earned as a non-degree, part-time student will count towards B.Math degree requirements.

The B.Math Pass degree may be obtained entirely by part-time studies. The B.Math General degree requires at least two full-time terms on campus; the B.Math Honours degree requires at least four full-time terms on campus.

Mathematics courses are not normally offered in the evenings or on Saturdays, although a reasonable cross-section of elective courses is available in the evenings during the Fall/Winter sessions. Many part-time students take courses via the University of Waterloo Correspondence Programme. (See page 16 for more details of this programme; a separate brochure is available.)

Feas, Financial Assistance
See Chapters 3 and 4.

Standings and Promotions

An academic year comprises two academic terms. Full course refers to a course lasting two terms. Two half courses (term courses), not necessarily in the same subject, constitute the equivalent of a full course. A mark of at least 50 in a full course/term course is a credit/half credit; a mark of under 50 is a failure. A course attempt refers to a course registration not formally cancelled with the Registrar by the dates specified for dropping courses.

In addition to marks from the numerical scale 0-100, the designations INC, AEG, CR, NMR, and DNW may be used from time to time. These designations are defined on page 17. Courses recorded as AEG or CR will count as credits; but will not affect cumulative averages; those recorded as NMR, DNW or INC will count as zero in cumulative averages.

A student who has passed fewer than five courses, at least five courses but fewer than ten, at least ten but fewer than sixteen, sixteen or more, is considered a first, second, third, or fourth year student respectively.

The Faculty operates under a course credit system and the following regulations govern the practice of the Faculty with regard to standings and promotions.

1) Examining Body
The Faculty constitutes the examining body for all examinations. 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) Part-time/Full-time Terms
A part-time student is one registered for either one or two course attempts per term. In each term except the graduating term, a full-time term must include at least two mathematics courses, until the calendar Math requirements are satisfied for the programme in which a student is registered. The Pass B.Math. degree can be completed entirely by part-time study. The General B. Math. degree requires two full-time terms of study; the Honours B. Math. degree requires four full-time terms.
3) Academic Decisions
Progress from one academic year to another depends on both an overall cumulative average (O.C.A.) and a mathematics cumulative average (M.C.A.) as well as on courses passed and failed. At the end of each academic year a student will be given one of the following decisions.

a) May proceed clear.
In a Pass or General programme the O.C.A. $\geq 50\%$ and the M.C.A. $\geq 55\%$. In the Honours programme, the O.C.A. $\geq 60\%$ and the M.C.A. $\geq 65\%$.

b) May proceed clear - must improve averages to remain in the Honours programme.
The student's averages satisfy the requirements for the Pass or General programme but not the Honours programme.

c) May proceed in the regular programme only.
The student in the Co-operative programme had at least one average $< 55\%$ or had an unsatisfactory work term report.

d) May proceed on probation - must improve cumulative averages.
Both averages are at least $45\%$ but either
1) $45\% \leq \text{O.C.A.} < 50\%$ or
2) $45\% \leq \text{M.C.A.} < 55\%$.
The student will not normally be allowed to continue in the Honours programme.

e) Withdrawal required from Mathematics - may reapply in one year.
The first year student's averages are both at least $40\%$ but one is less than $45\%$.

f) Withdrawal required from the Faculty of Mathematics.
A student who falls in one of the following categories will normally be required to withdraw from the Faculty of Mathematics.
1) A first year student whose averages are not both $> 40\%$ or an upper year student whose averages are not both $> 45\%$.
2) A student who is already "on probation" and who fails to achieve an academic decision of "may proceed clear" in the student's next academic year.
3) A student who fails to complete the requirements for a Pass degree at the end of four academic years, or equivalent.
4) A student who is judged unlikely to profit from further study in the Faculty of Mathematics.

Note
A student who has been required to withdraw from the Faculty of Mathematics may reapply for admission after a three year period but must produce evidence of being able to profit from further study in the Faculty.

4) Failed Courses
a) 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 is a charge of $5.00 per course appealed, to be refunded if the mark is raised.
b) Failed non-compulsory courses need not be repeated but may be replaced by other non-compulsory courses.

5) Repeated Courses
A passed course may be repeated at most once for the purpose of raising cumulative averages. Both marks will show on the record and both will be counted in the averages. However, a course will not be counted more than once towards the total number of courses required for a degree.

6) External Courses
Permission to take courses from other universities for credit towards a B.Math. degree must be obtained in writing from the Standings and Promotions Committee through the Assistant Registrar, Mathematics. Permission will normally be given only for non-mathematics courses.

7) Illness or Incapacity
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, at the earliest possible opportunity.

8) Cancelling Course Registrations
No course registration can be dropped later than one month prior to the end of lectures in the term/year of the course unless the student voluntarily withdraws from the Faculty.

9) Voluntary Withdrawal
A student may withdraw from the Faculty of Mathematics up to and including the last day of lectures of the term/year without being held responsible for that term/year's courses.

10) Qualifications for Graduation
After completing no more than five academic years, or equivalent, a student must apply for the award of a degree by filling out an "Intent to Graduate" form. If, at the end of five academic years, or equivalent, the requirements for more than one degree have been fulfilled, the student will be awarded the highest degree (Pass, General, or Honours B.Math.).
Academic Programmes

General Remarks
In addition to the Pass, General and Honours programmes in which regular students enrol there are special co-operative programmes (Teaching Option, Chartered Accountancy and Business Administration Options) which are available in both General and Honours versions; for details see pp. 150, 151. Furthermore, double and joint honours programmes with other Faculties are possible; for details see pp. 148.

A first year student will be registered in one of the above-mentioned programmes but is not thereby irrevocably committed; in subsequent years it is quite possible to move from one programme to another provided that the prerequisites of the new programme are met.

The first year programme is such that the student can transfer to other Faculties in the second year if he has chosen his electives judiciously.

In the first two years students are not associated with any department but at the beginning of the third year Honours students must select the department in which they intend to do their work; Pass and General students may associate themselves with a department—a procedure that allows them to turn to the departmental undergraduate officer for advice but does not subject them to departmental regulations.

The five departments that constitute the Faculty are Applied Mathematics, Combinatorics and Optimization, Computer Science, Pure Mathematics and Statistics. The departments offer only Honours programmes.

All programmes have certain compulsory courses (core courses) that are available in both General and Honours versions; credit in an Honours course may be used to satisfy a requirement in the corresponding General or Pass course but credits in a Pass or General course may not be used to satisfy an Honours course requirement.

Occasionally, a student who has done well in the Pass or General version of a course (e.g. M220a/b) wishes to get credit in the corresponding Honours course (M230a/b); the procedure then is that the student asks the Standings and Promotions committee for permission to write the Honours examination; if permission is granted both marks will be used in computing the student's cumulative average.

Students receiving grades of 80% or higher in all four half courses M124a/b, 120a/b will be notified that they may go into the second year of an Honours programme provided that their work in other courses is satisfactory.

Students interested in the following areas are encouraged to take any or all of the courses listed:


Combinatorics and Optimization  Stat 220/221, C&O 239a/b, 352a/b, 353a, PMath 380a/b, C&O 417a/b, 438a/b, 451a/b – through – 460a/b.

Pure Mathematics  PMath 230, 363/362/361, C&O 351a/b, PMath 367, PMath 441, 430, C&O 446a/b.


The General Programme must be completed within five academic years or equivalent.

Three Year Pass Programme
Required courses: M124a/b; 120a/b; CS 116/117 or two of CS 140 or CS 150, CS 180, CS 240.

Typical Programme:

<table>
<thead>
<tr>
<th>Year</th>
<th>Mathematics</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

The Pass programme must be completed within four academic years or equivalent.

Four Year General Programme
Required* courses: M124a/b; 120a/b; two of CS 140, CS 150, CS 180, CS 240; M220a/b; M221a/b; M321; M322b; one of M322a, CS 370, CS 371, CS 472, CS 474.
These requirements do not apply to the Co-op Chartered Accountancy and Business Administration Options: for details see page 150.

Typical Programme:

<table>
<thead>
<tr>
<th>Year</th>
<th>Mathematics</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Students coming in from Grade 13 with a mathematics average less than 75% are strongly advised to take M124a/b, 120a/b.

Courses designated Math may be taken as non-mathematics electives; they will not count as mathematics credits.

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 and also in the corresponding mathematics course; a list of such courses is available at pre-registration and may also be obtained from the undergraduate advisers.

The General Programme must be completed within five academic years or equivalent.
Four Year Honours Programmes

Required (core)* courses:
M134a/b, M130a/b; two of CS 140, CS 150, CS 180, CS 240;
M231a/b, Stat 230/231, M230a/b, M331; M332b: one of
M332a, CS 370, CS 371, CS 472, CS 474.

*These requirements do not apply to the Chartered Accountancy and Business Administration Options: for details see page 150.

Typical Programme:

<table>
<thead>
<tr>
<th>Year</th>
<th>Mathematics</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

The Honours Programme must be completed within five academic years or equivalent.

Applied Mathematics
Core requirements and at least four credits from departmental third and fourth year courses; at least one credit must be at the 400 level. AM 260, AM 270 are recommended courses.

Recommended courses for Honours Applied Mathematics with Physics Option:
Physics 121*/122* or 162*/163*; 252*/253*, 255*, 355*, 358*/359*, 435, 441 and Chemistry 121*/122*.

Combinatorics and Optimization
Core requirements and an additional six full (twelve half) credits in third and fourth year Mathematics including at least three full fourth year credits. Courses taken must include at least one full (two half) departmental three-hundred level courses: C&O 351a/b; 352a/b; 353a; and at least two full (four half) departmental four-hundred level courses: C&O 417a/b; 418a/b; 446a/b; 451a/b – through 460a/b; at least one full (two half) courses from other departments in the Faculty at the three-hundred or four-hundred level. Recommended courses from other departments include: CS 370, 371 (or CS 472, 474); CS 330, 331; CS 360; PMath 361, 362, or 363; PMath 367; PMath 380a/b; PMath 441; PMath 430.

Computer Science
Core requirements; CS 140, CS 150, CS 180, CS 240; eight term courses at the CS 300 or CS 400 level; six term courses in Mathematics at the 300 or 400 level.
Department courses at the 300 or 400 level fall in three general areas: Numerical Analysis, Software and Theory of Computing.
At least three term courses must be selected from one area and at least three from the other areas combined.

Pure Mathematics
Core requirements including PMath 341, 351, 352; also PMath 367 and four 400 level mathematics courses, at least two of which must be in Pure Mathematics. Not all of PMath 341, 351, 352, 367 need be taken in third year.

Statistics
Core requirements and Stat 340/341, 350/351, 450, 451, 452, 454.

Actuarial Science
Core requirements and Stat 273, 284, 374, 384, 473, 483; two half courses from Stat 373, 383, 476, 480, 474, 486.

Double Honours Programmes within the Faculty of Mathematics
A student who has satisfied the requirements for any two of the above seven honours programmes may elect to have both areas named on the degree.

Joint Honours Programmes with Other Faculties

Mathematics and Economics
Mathematics and Geography
Mathematics and German
Mathematics and Philosophy
Mathematics and Psychology
Mathematics and Russian
Mathematics and Sociology
Students may take these programmes in either faculty in Years 1 and 2. In Year 3 they must register in a department of the Faculty of Mathematics. The faculty and departmental requirements for an Honours programme must be satisfied. However, the number of required credits in Mathematics is reduced from 15 to 12. These programmes must be approved by both departments involved. Requirements in the minor subjects are as follows:

**Economics**
101*/102*, 201*/202*, 231*, 311*, 312*; seven additional one-term courses in Economics.

**French**
190 Group B; seven additional full courses in French with three at the second-year level, two at the third-year level, and two at the fourth-year level.

**Geography**
481*, 490; Environmental Studies 200*; one of Geography 203*, 232*, 320; one of Geography 101*, 110*, 125R*, 126R*, 127*.
or Environmental Studies 195*.

**German**
101*/102*, 111*/112*, 113*/114*.
121*/122*, or 151*/152*: two full courses in German in each of Years 2, 3, and 4.

**Philosophy**
280/1, 282/3, 340, 358/9; three additional full courses in Philosophy, one of which is in a value area.

**Psychology**
101/2, 499; five additional full courses in Psychology chosen in consultation with the Psychology Department to fulfill their research requirements.

**Russian**
101*/102*: two full courses in Russian in each of Years 2, 3, and 4.

**Sociology**
101*, 321*/322*, 425*/426*, 480*/481*.
499; seven additional one-term courses in Sociology.

**Joint Honours Programmes with other Faculties**

**Joint Honours with a Minor in Mathematics**

**Economics and Mathematics**

**French and Mathematics**

**Geography and Mathematics**

**Man-Environment Studies and Mathematics**

**Philosophy and Mathematics**

**Psychology and Mathematics**

**Russian and Mathematics**

**Sociology and Mathematics**

Students may take these programmes in either faculty during Year 1 and 2. At the beginning of Year 3 they must register in the appropriate department in Arts or Environmental Studies, and have their programmes approved by that department. Requirements for a Minor in Mathematics are:

Mathematics 124a/b, 120a/b, 220a/b, 221a/b, at least three additional credits (six one-term courses) in Mathematics at the 100 level or above. Students wishing to specialize in one area of mathematics should consult the undergraduate officer of the appropriate department in the Faculty of Mathematics for advice in selecting their mathematics courses.

**Co-Operative Mathematics Programmes**

For general information on the Co-operative Programmes please read Chapter 5 of this calendar. It should be noted that students enrolled in the Chartered Accountancy Option are required to write one formal work report in their first work term. Experience in writing this work report provides the student with a firm grounding in communication skills which form an integral part of a practicing chartered accountant's responsibilities. For students in the Teaching Option, which has three work terms, three work reports are expected. All students should carefully read the Handbook for Students in Co-operative Mathematics Programmes, as provided by the Department of Co-ordination.

The academic requirements in the co-operative programmes in actuarial science, computer science, optimization, and statistics, are identical with those outlined under the corresponding regular programme. In this section we outline the requirements for certain special options.

**Applied Mathematics - Engineering Options**

**Year 1**
Math 134a/b, 130a/b; CS 140/150
Physics 121/122, two electives

**Year 2**
Math 231a/b, Math 230a/b; Stat. 230/231:
A.M. 260/270
1 course each term from options A, B, or C
1 non-Math elective (could be from A, B, or C)

**Year 3**
Math 332a/b, A.M. 330/340
2 full courses from A.M. 362, 372, 382, 395, 365, 371, 361
1 course each term from options A, B, or C
1 non-Math elective (could be from A, B, or C)

**Year 4**
3 full 400 level math courses
1 course each term from options A, B, or C
1 non-Math elective (could be from A, B, or C)
1 additional course, either Math or from A, B, or C

**Option A**
ME 19, 20; CE 303, 304; ME 257 and/or ME 525
One or more of CE 518, 522, 526, or ME 626

**Option B**
SD 252; SD 351 and/or SD 353; SD 382 and/or 352
One or more of SD 421, 451, 463
One or more of SD 452, 454, 456.
### Business Administration Option

<table>
<thead>
<tr>
<th>Honours Programme</th>
<th>General Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td></td>
</tr>
<tr>
<td>Mathematics 130a/b; 134a/b</td>
<td>Mathematics 120a/b; 124a/b</td>
</tr>
<tr>
<td>Comp. Sci. 140; 180</td>
<td>Comp. Sci. 140; 180</td>
</tr>
<tr>
<td>Economics 101; 102; 191; 192</td>
<td>Economics 101; 102; 191; 192</td>
</tr>
<tr>
<td>Business 111; 121</td>
<td>Business 111; 121</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 2</strong></td>
<td></td>
</tr>
<tr>
<td>Mathematics 230a/b; 231a/b</td>
<td>Mathematics 220a/b; 221a/b</td>
</tr>
<tr>
<td>Statistics 230; 231</td>
<td>Statistics 220; 221</td>
</tr>
<tr>
<td>Two of CS 150, Stat. 270, C&amp;O 239b</td>
<td>Business 212; 222</td>
</tr>
<tr>
<td>Business 212; 222</td>
<td>One elective credit</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 3</strong></td>
<td></td>
</tr>
<tr>
<td>Comp. Sci. 330; 331†</td>
<td>Three math credits</td>
</tr>
<tr>
<td>Statistics 331; (332 or 330)†</td>
<td>(honours required courses are recommended)</td>
</tr>
<tr>
<td>C&amp;O: two of 352a/b; 353a; 456α†</td>
<td>Business 388; 398</td>
</tr>
<tr>
<td>Business 388; 398</td>
<td>One elective credit</td>
</tr>
<tr>
<td>One math credit††</td>
<td>One elective credit</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
<td></td>
</tr>
<tr>
<td>Three math credits††</td>
<td>Three math credits††</td>
</tr>
<tr>
<td>Business 481; 491</td>
<td>Business 481; 491</td>
</tr>
<tr>
<td>Two elective credits</td>
<td>One elective credit</td>
</tr>
</tbody>
</table>

### Notes

1) † These three credits constitute the core requirements for this option. One of these credits may be delayed to Year 4 and certain substitutions can be made with special permission.

2) †† Recommended courses are:

   - Comb. & Opt.: 431αb; 452αb; 453α; 455αb
   - Comp. Sci.: 240; 370; 371; 484
   - Statistics: 340; 430; 440; 442
   - (Actuarial Science: Stat. 373; 383; 374; 384; 475; 485; 476; 480)

3) At least six 300 and 400 level full courses (or equivalent) must be included in the honours programme with at least two of them at the 400 level.

### Mathematics Academic Programmes

### 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 of graduation. This programme is offered in co-operation with the Institute of Chartered Accountants of Ontario. This option involves a single stream co-operative programme: students go on their first work term in January.

<table>
<thead>
<tr>
<th>Honours Programme</th>
<th>General Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td></td>
</tr>
<tr>
<td>Mathematics 230a/b; 231a/b</td>
<td>Mathematics 220a/b; 221a/b</td>
</tr>
<tr>
<td>Statistics 230; 231</td>
<td>Statistics 220; 221</td>
</tr>
<tr>
<td>Two of CS 150, Stat. 270, C&amp;O 239b</td>
<td>Business 212; 222</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 2</strong></td>
<td></td>
</tr>
<tr>
<td>Comp. Sci. 330; 331†</td>
<td>Three math credits</td>
</tr>
<tr>
<td>Statistics 331; (332 or 330)†</td>
<td>(honours required courses are recommended)</td>
</tr>
<tr>
<td>C&amp;O: two of 352a/b; 353a; 456α†</td>
<td>Economics 391; 392</td>
</tr>
<tr>
<td>One math credit††</td>
<td>One elective credit</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 3</strong></td>
<td></td>
</tr>
<tr>
<td>Three math credits††</td>
<td>Three math credits††</td>
</tr>
<tr>
<td>Economics 393; 394; 491</td>
<td>Economics 393; 394; 491</td>
</tr>
<tr>
<td>Business 363</td>
<td>Business 363</td>
</tr>
<tr>
<td>One elective credit</td>
<td>One elective credit</td>
</tr>
</tbody>
</table>

### Notes

1) † These three credits constitute the core requirements for this option. One of these credits may be delayed to Year 4 and certain substitutions can be made with special permission.

2) †† Recommended courses are:

   - Comb. & Opt.: 431αb; 452αb; 453α; 455αb
   - Comp. Sci.: 240; 370; 371; 484
   - Statistics: 340; 430; 440; 442
   - (Actuarial Science: Stat. 373; 383; 374; 384; 475; 485; 476; 480)

3) At least six 300 and 400 level full courses (or equivalent) must be included in the honours programme with at least two of them at the 400 level.
Teaching Option

The Co-operative Mathematics Teaching Option is a uniquely integrated programme involving the Faculty of Mathematics and Althouse College of Education of the University of Western Ontario. This programme combines academic work, experience in secondary schools, and professional training, with the graduate fully qualified as a secondary school mathematics teacher.

Students interested in the programme will enrol in the Regular programme in Year 1, and are admitted to the Co-operative programme in Year 2 on the basis of good academic work and success in an interview process.

Students enrolled in the Co-operative Mathematics Teaching Option must, in addition to required Faculty courses, include the following:

- C&O 300a/b, 446a/b, Mthel 206a,
- Psych 241, 243, Phil 311, 312, Soc 207g;
- and one further full course or equivalent in Computer Science.

Honours candidates must include at least three 400 level full courses (or equivalent) in their programme.

There are various recommended courses which are of special interest to persons interested in a career in teaching. A selection of these may be made in consultation with the academic adviser as the student progresses.

Work term arrangements in this option differ from other co-operative programmes because of the nature of the programme. Details concerning this and the Althouse College components are outlined in a separate brochure available upon request.

Honours Statistics – Economics Option

Year 1
Mathematics 134a/b: 130a/b; CS 140; CS 180 or 150.
Economics 101*, 102*.
Two electives (four half courses)

Year 2
Mathematics 230a/b; 231a/b; Stat 230/231.
Two of AM 260, Stat 273, C&O 239a/b, CS 240.
Economics 201*, 202*, 231*, 311*.

Year 3
Mathematics 331; 332b; Stat 350/351.
One of Mathematics 332a, CS 370, CS 371, CS 472, 474.
Two of CS 370, 371, C&O 352a/b.
Four half courses in Economics, including 301*, 302*, 321*.

Year 4
At least four of Stat 340, 341, 450, 451, 452, 454.
At least two additional half courses in Mathematics (CS 330, 331 and 446 are recommended).
Economics 401*, 402*, 411*, 413*.
Faculty of Science

Optometry Clinic
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 1975 over 2000 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 recent M.Sc. programme in Earth Sciences offers specialization in the area of Environmental Geology while the recent 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 Programme commenced in September of 1967. Further information appears on page 182.

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 5 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. Students contemplating post-graduate study should direct their correspondence to the chairman of the department in which they propose 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 Year 5
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 1 Programmes

The following specifically labelled Year 1 programmes are offered: Co-operative Applied Chemistry, Co-operative Applied Physics and Regular Science. The Year 1 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 2. Year 1 Regular Science also provides the background of the pre-professional year necessary to apply for admission to Year 2 Optometry (the first year of the professional programme). Students planning to enter the Co-operative Earth Sciences programme in Year 2 should also take Year 1 Regular Science.

Admission as an Adult Student

It is recommended that applicants obtain standing in Ontario Year 5 (Grade 13) Mathematics and Science courses or their equivalent in order to have the proper background for first year University courses in these areas. To discuss admissibility and appropriate qualifying work, applicants are advised to contact the Assistant Registrar, Faculty of Science.

Advanced Standing

Students applying to Co-operative programmes in the Faculty of Science will not normally be admitted above the Year 2 Term B level.

Students within the University desiring to transfer into the Faculty of Science will be given admission credits for relevant courses based on the grades obtained and the number of transfer credits permitted. See page 24. Transfer Credits.
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.

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 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 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 Standing Committee and subsequently the Faculty Council. After the results have been considered by these bodies, they will be issued to individual students by the Registrar. Appeals against 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 examination 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 necessary 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 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% 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 182 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/her standing to at least the minimum overall level noted or else 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/her 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 Standings Committee may decide that each student must transfer to the General programme (either option). An Honours student in Conditional Standing may be required by such a student’s major Department to repeat certain courses which have been done poorly or the individual may elect to do so himself in order to improve 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>0.0-0.99</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>Passing</td>
<td></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 for the first time unless the student’s performance has been very poor; for such a poor first-time performance, or any time such a level is achieved twice, Failure, required to withdraw will be necessary. If a regular (full-time) student, even in good standing, fails more than two full-year courses or their equivalent in a given year such student may be transferred to the General programme or else may be asked to withdraw if the Department feels unsatisfactory progress is being made 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

1) 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.

2) In cases where more than one course or course-sequence contains the same or similar course content, credit will only be given in one.

c) Programme selection:

Full-time students. All first year students must take a minimum of 5 lecture courses. Students with a Year 5 high school average of 70% or better may be permitted to take 6 lecture courses. In subsequent years course loads are as designated under the appropriate programmes. Permission may be granted to take one additional lecture course per year if a student has a cumulative average of 70% or better. An additional course once completed will normally count as a course passed or failed as well as in calculation of the cumulative average.

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 lecture course minimum except in exceptional circumstances.
d) **Co-operative Programmes:** Students in Co-operative programmes will be evaluated by the rules shown modified where necessary to suit their special needs. In particular:

1. **Evaluation in Year 1** will be made at the end of term 1B 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.

2. **Upper year assessment** 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.

3. **A student is expected to follow the work-term sequence from the point of entry, subject to the minimum requirements for graduation within the individual programmes.**

   - The minimum number of related work terms required is normally four.
   - The minimum number of satisfactory work reports is normally four.

**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 course 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 of 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. Credits will normally be transferred without a cumulative average.

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 course-credits) regardless of the number of transfer credits they present.

b) Upgrading of B.Sc. Degree
A student who has graduated with a 3-year General degree from this University only, may successfully complete the requirements of the 4-year degree with an official major field designation and exchange the old diploma for a new one. Normally a student 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 Standards Committee.

c) Future Regulations
Normally, students will be given advanced 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 and drop courses only with the permission of the instructor and the appropriate undergraduate officer and upon completing the appropriate change form. (See (e)).

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 weeks 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 or five required in Year 1 of 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.

Terminology
In descriptions of programmes to follow, the word “course” may refer to a lecture course, a laboratory course, or a lecture-laboratory course which includes both lecture and laboratory.

A lecture, or lecture-laboratory course which extends for one full academic year is given one “course-credit”. A one-term course, as designated by the asterisk symbol *, after the course number, is given 0.5 of a “course-credit”.

Laboratory courses as designated by the letter L following the course number are generally one-term courses, and carry 0.25 of a “course-credit” for a 3 hr/week or alternate week laboratory and 0.50 of a course credit for a 6 hr/week laboratory.

First Year Programmes (Regular and Co-operative)
The normal minimum course load for a full-time student in Year 1 Science is 5.0 lecture courses, exclusive of laboratory credits. At least two of these courses must be Faculty of Science courses and one should be an Arts elective (preferably English or Psychology). Only students whose secondary school Year 5 average was 70% or better may select 6 lecture-courses if they wish (recommended for students intending to take an Honours Physics programme).

Courses should be chosen either with a specific Year 2 goal in mind or to cover many Year 2 programmes. The recommended Year 1 selections for various Year 2 Honours or General Science-Major programmes follow; in most cases the number of required courses is only two or three 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.

Note 1
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.

Students desiring the geophysics option of the Honours Physics programme are advised to include Earth Sciences 130 and Chemistry 121*-122* in Year 1.

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 (111*-112* recommended), Chemistry (121* and 122*), Earth Sciences 130 and Mathematics 130.

Students wishing the elective programme with Electrical Engineering are advised to select Systems Design 183 (Fall term) and Mathematics 122a* (Winter term).

Note 2
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 at least two terms in a row may elect these courses. Science 100, a one-term introductory geology course, is available in the Fall term. Students completing term 1B in the spring must elect both Chemistry 121*-122* and Physics 121*-122*. Chemistry 112* and Physics 112* are not offered in the Spring term.

Note 3
All Co-operative Applied Physics and Earth Sciences students take Year 1 as two terms in a row (see page 160).

Note 4
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 Year 5 or its equivalent – for these students Chemistry 111*-112* is recommended rather than 121*-122*. Physics 121*-122*, 121L*-122L* or 162*-163*, 162L*-163L* may be taken instead of Physics 111*-112*, 111L*-112L*.

Note 5
Earth Science majors planning to enter the co-operative programme and desiring elective courses in Biology should take Biology 131 during their first year.

By the end of Year 2, students must have completed Physics 111*-112*, General Physics (or an equivalent physics course), Mathematics 130, Calculus, and an introductory course in computer programming (for example Mathematics 122a, 132a or General Engineering 121*).

Note 6
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.

A brief discussion of the above courses and some other courses available for selection is given below. See Course Descriptions, Chapter 14 of this Calendar for more details.
### Year 1 Science Programme Selections Leading to Year 2 Honours or Major Programmes

#### Regular Programmes

<table>
<thead>
<tr>
<th>Major Field of Study</th>
<th>Required Courses in Year 1</th>
<th>Recommended Electives in Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biology</strong></td>
<td>Biology 132, Chemistry 121*-122* and 121L*-122L*</td>
<td>Biology 131 or 132, Earth Sciences 130 or 195* or a Computer Science course</td>
</tr>
<tr>
<td><strong>Biology and Chemistry</strong></td>
<td>Biology 132, Mathematics 130, Chemistry 121*-122* and 121L*-122L*</td>
<td><strong>Chemistry</strong> (Environmental Studies Option)</td>
</tr>
<tr>
<td><strong>Chemistry</strong></td>
<td>Chemistry 121*-122* and 121L*-122L*, Mathematics 130, a full-year Physics course</td>
<td><strong>Chemistry (Mathematics Option)</strong></td>
</tr>
<tr>
<td><strong>Chemistry (Physics Option)</strong></td>
<td>Chemistry 121*-122* and 121L*-122L*, Mathematics 130, Physics 121*-122* and 121L*-122L* or 162*-163* and 162L*-163L*</td>
<td><strong>Chemistry (Physics Option)</strong></td>
</tr>
<tr>
<td><strong>Earth Sciences (see Note 5)</strong></td>
<td>Earth Sciences 130, Chemistry 121*-122* and 121L*-122L*</td>
<td><strong>Earth Sciences and Geography</strong></td>
</tr>
<tr>
<td><strong>Optometry (see Note 4 and page for further details)</strong></td>
<td>Mathematics 130, Biology 132, Physics 111*-112* and 111L*-112L*, Psychology 101*</td>
<td><strong>Optometry (see Note 4 and page for further details)</strong></td>
</tr>
<tr>
<td><strong>Physics (see Note 1)</strong></td>
<td>Mathematics 130, Physics 121*-122* and 121L*-122L* or 162*-163* and 162L*-163L*</td>
<td><strong>Physics (see Note 1)</strong></td>
</tr>
</tbody>
</table>

#### Co-operative Programmes

<table>
<thead>
<tr>
<th>Major Field of Study</th>
<th>Required Courses in Year 1</th>
<th>Recommended Electives in Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applied Chemistry</strong> (See Note 2)</td>
<td>Chemistry 121*-122* and 121L*-122L*, Mathematics 130, a full-year Physics course</td>
<td><strong>Applied Physics</strong> (See Note 1 and 3)</td>
</tr>
<tr>
<td><strong>Co-operative Earth Sciences</strong> (See Notes 3 and 5)</td>
<td>Earth Sciences 130, Chemistry 121*-122* and 121L*-122L*</td>
<td><strong>Co-operative Earth Sciences</strong> (See Notes 3 and 5)</td>
</tr>
</tbody>
</table>
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* are suggested. Science 160* (Computational Methods in Science) is a Science Faculty course, while Math 122A* (Introduction to Computing) and Math 132B* (Introduction to Computer Science) are offered by the Faculty of Mathematics. Only students who are above average in Mathematics (i.e. approximately 70% or better in at least two Year 5 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 111*-112*, 121*-122*, 162*-163* and only one of Chemistry 111*-112* or 121*-122*.

Biology

Biology 130
Introduction to Biology. This course is the same as Biology 131 without the laboratory component. (For non-Biology Majors only).

Biology 131
Introduction to Biology (2 lectures, 3 hours laboratory on alternate weeks). 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 Year 5 Biology was taken in secondary school.

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 Year 5 Biology was taken in secondary school.

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 Geograpy or other specific high school background for this course. Students with potential interest in Geology, Geochemistry, or Geophysics should select this course.

Chemistry 121*-122*
Chemical Structure 121* and Chemical Reaction 122* (with the associated laboratories, 121L*-122L*) are the normal selection for those wishing to major in Chemistry, or those electing a first year Chemistry course.

Chemistry 110*-111*
For students without Ontario Year 5 Chemistry (or its equivalent) the General Chemistry courses 111* and 112*, (with their laboratories 111L* and 112L*) are recommended.

All these courses involve 3 lectures and 3 hours laboratory per week.

Physics

Any of the course sequences, 111*-112*, 121*-122* or 162*-163* constitute sufficient preparation for higher year courses in physics. Science students must take the appropriate laboratory course if 121*-122* or 162*-163* is chosen. This laboratory course accompanying 111*-112* is optional.

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 secondary school Year 5 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 111*-112* 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 111L*-112L* is recommended for 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 Year 5 Physics as prerequisites to take 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. Information
regarding approved specialized fields can be obtained from the Ontario University of Education.

**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 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 for 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

**Year 1**  
(For a complete discussion of Year 1, see page 160)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 231*</td>
<td>Concepts of Ecology</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Biology 234</td>
<td>Plant Biology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 235</td>
<td>Fundamentals of Microbiology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 237*</td>
<td>Invertebrate Zoology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 238*</td>
<td>Vertebrate Zoology</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 239*</td>
<td>Cytogenetics</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 266*</td>
<td>Organic Chemistry 1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 267*</td>
<td>Organic Chemistry 2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 267L*</td>
<td>Organic Chemistry Laboratory</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 267L*</td>
<td>Organic Chemistry Laboratory</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics 253A</td>
<td>Elementary Statistics for Biologist</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

One non-Biology elective (half-course) as specified

One non-Biology elective (half-course) as specified

**Year 3†, ‡**  
At least two full courses from

- Biology 331*  
- Biology 332*  
- Biology 333*  
- Biology 334*  
- Biology 335  
- Biology 338*  
- Cell Physiology
- Vertebrate Physiology
- Histology & Cytology
- Plant Physiology
- Population Ecology
- Biochemistry 1
- Biochemistry 1 Laboratory
- Biochemistry 2
- Biochemistry 2 Laboratory

Plus at least two full courses from

- Biology 341*  
- Biology 342  
- Biology 343*  
- Biology 345*  
- Biology 346*  
- Chemistry 332*  
- Chemistry 332L*  
- Chemistry 333*  
- Chemistry 333L*  

One Elective (1 full-course or equivalent) as specified

†Students may select only two of the three Zoology courses offered (i.e. Biology 331*, 332*, 333*). Those wishing to take the third course may do so as part of their fourth year programme or as an elective.

‡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 $100. All students must fulfill this field course requirement to obtain their B.Sc. Honours degree in this programme.

**Year 4**  
5 courses, or which at least 3 are Biology 400-level courses. This year is designed to be the specialist year. The course selection should reflect this and must form an integrated group around a particular area of interest. (Chemistry 432*-433* is recommended.)

### Note Regarding Electives

A listing of Science and other electives is found on page 188. 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

#### Year 1
Normal Year 1 Science (see page 160) in which Chemistry 121*-121L*, 122*-122L*, Biology 132, Mathematics 130 are required; first year Physics is recommended.

#### Year 2
<table>
<thead>
<tr>
<th>Courses</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 231*</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Biology 234</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 235</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 237*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 238*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 239*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 212*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 220*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 220L*</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 221*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 221L*</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 264*</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 264L*</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Elective</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Year 3
Two full Biology courses from

<table>
<thead>
<tr>
<th>Courses</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 331*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 332*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 333*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 334*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 335</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 336*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 341*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 342</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 343*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 345*</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Biology 346*</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 332*-333*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 335*-357*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 364*</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Chemistry 365*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chem 356L*-357L*</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 364L*</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Year 4
Biology
Any three 400-level full courses offered in Biology as specified
or
Any two 400-level full courses offered in Biology and Chemistry 492

<table>
<thead>
<tr>
<th>Courses</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 312*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 316*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 419*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 432*-433*</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chem 432L*-433L*</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### Note
Students may select only two of the three Zoology courses offered (i.e. Biology 331*, 332*, 333*). Those wishing to take the third course may do so as part of their fourth year programme or as an elective.
Honours Chemistry  
This programme fulfills the academic requirements for professional membership in the Chemical Institute of Canada

**Year 1**
Normal Year 1 Science (see page 160) including Chemistry 121*, 121L*, 122*, 122L*, Mathematics 130 and a full-year Physics course.

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Fall Term</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 10*</td>
<td>Structure and Bonding</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 212*</td>
<td>Introductory Analytical Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 220*</td>
<td>Analytical Chemistry Laboratory 1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 220L*</td>
<td>Physical Chemistry 1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics 215</td>
<td>Differential Equations</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>One elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Winter Term | | | |
| Chemistry 10* | Analytical Chemistry of Multi-Component Systems | 2 | 0 |
| Chemistry 221* | Analytical Chemistry Laboratory 2 | 0 | 3 |
| Chemistry 221L* | Physical Chemistry 2 | 2 | 1 |
| Chemistry 255* | Organic Chemistry 1 | 2 | 1 |
| Chemistry 264* | Organic Chemistry Laboratory 1 | 0 | 3 |
| Physics 243* | Electricity and Magnetism | 3 | 0 |
| Physics 243L* | Electricity and Magnetism Laboratory | 0 | 3 |
| One elective | | | |

| Year 3 | Fall Term | | |
|--------|-----------| | |
| Chemistry 10* | Transition Metal Chemistry | 2 | 0 |
| Chemistry 312* | Inorganic Chemistry Laboratory 1 | 0 | 3 |
| Chemistry 314L* | Physical Chemistry 3 | 2 | 1 |
| Chemistry 355* | Physical Chemistry Laboratory 1 | 0 | 3 |
| Chemistry 355L* | Organic Chemistry 2 | 2 | 1 |
| Chemistry 364* | Organic Chemistry Laboratory 2 | 0 | 6 |
| Two electives† | | | |

| Winter Term | | | |
| Chemistry 10* | Main Group Chemistry | 2 | 0 |
| Chemistry 313* | Inorganic Chemistry Laboratory 2 | 0 | 6 |
| Chemistry 315L* | Physical Chemistry 4 | 2 | 0 |
| Chemistry 338* | Physical Chemistry Laboratory 2 | 0 | 6 |
| Chemistry 358L* | Organic Chemistry 3 | 2 | 0 |
| Two electives† | | | |

| Year 4 | | | |
| Chemistry 10* | Advanced Laboratory | 0 | 9 |
| Chemistry 492 | | | |
| Eight one-term electives† | | | |

†In Years 3 and 4, in addition to the required core courses, a total of 6 one-term Chemistry courses must be selected from the Chemistry elective courses listed on page 166. At least four of these must be at the 400-level.
Chemistry Electives

Note  
Elective courses will be given subject to sufficient demand as determined at preregistration.

1) Available at least once every academic year

**Fall Term**  

**Winter Term**  

**Spring Term**  
Chemistry 333* (in 1977 only, 332*-332L*)

2) Available only once every two years

**Fall Term**  
(even years beginning Fall 1976) Chemistry 342*

**Fall Term**  
(odd years beginning Fall 1977) Chemistry 351*, 440*

**Winter Term**  
(odd years beginning Winter 1977) Chemistry 409*, 458*

**Winter Term**  
(even years beginning Winter 1978) Chemistry 359*, 362*, 417*

---

Co-operative Applied Chemistry (Honours)

Information about the Co-op work terms and the Co-ordination Department can be found in Chapter 5. 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. This procedure will allow both streams to take Year 4 together over the regular academic year (Fall-Winter) when a wider range of courses are offered, and to graduate at the same time in May. The required courses in the two Co-op streams are exactly the same as for the "regular" Honours Chemistry program. However, the order in which some of these courses are taken is slightly different for the Second Group which starts its 2A term in the winter. The difference allows this group to take most of their year 3 electives in their 3B Winter term, when a wider selection of courses is available.

This programme fulfills the academic requirements for professional membership in the Chemical Institute of Canada.

**Year 1**

Normal Year 1 Science (see page 160) including Chemistry 121*-121L*, 122*-122L*, Mathematics 130 and a full-year Physics course.
### First Group: Commencing with the Fall 1975 intake into year one††

*For course details see Hons. Chem. (page 165)*

<table>
<thead>
<tr>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 2A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*, 212*, 220*, 220L*, 254*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Term</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 3A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*, 313*, 314L*, 358*, 355L*, 364*, 364L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two Electives†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Term</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 3B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*, 312*, 315L*, 355*, 358L*, 365*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two Electives†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Term</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*, 492</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eight Electives†</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Second Group: Commencing with the Fall 1975 intake into year one††

<table>
<thead>
<tr>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 2A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*, 220*, 220L*, 254*, 264*, 264L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Term</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 3A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One Elective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Term</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 3B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*, 313*, 315L*, 358*, 358L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three Electives†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Term</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*, 492</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eight Electives†</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

†In Years 3 and 4, in addition to the required courses, a total of six one-term Chemistry courses must be taken; at least four of these must be at the 400-level. For students in the Co-operative Applied Chemistry programme, it is strongly recommended that five one-term courses be selected from: Chemistry 311*, 320*-320L*, 353*, 354*, 363*, 416*, 420* or 421, 453* or 457*, 454*, 455*, 456*.

‡‡Students who entered Year 1 in 1973 or 1974 should consult with the undergraduate officer concerning details of their programmes. Students who entered in 1972 will be in Year 4 in 1976/77. Year 4 has not changed.

Other electives may be chosen from the Chemistry Electives list on page 166.
Honours Chemistry (Environmental Studies Option)

This programme is structured to provide the student with a sound knowledge of the discipline of chemistry together with knowledge of environmental problems, approaches to their solution, environmental law and resource management. This programme fulfills the academic requirements for professional membership in the Chemical Institute of Canada.

Year 1

<table>
<thead>
<tr>
<th>Fall Term</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 212*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 220*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 220L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 251*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Env Studies 195*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man-Env 357*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planning 156*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter Term</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 221*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 221L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 255*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 264*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 264L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 243*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 243L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Env Studies 200*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth Sciences 221*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Year 2

<table>
<thead>
<tr>
<th>Fall Term</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 312*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 314L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 355*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 355L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 364*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 364L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 243</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man-Env 356*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Env Studies 358*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geography 356*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Fall Term</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 312*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 314L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 355*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 355L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 364*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 364L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics 243</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man-Env 356*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Env Studies 358*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geography 356*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Winter Term

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 10*</td>
<td>Main Group Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 313*</td>
<td>Inorganic Chemistry Laboratory 2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 358*</td>
<td>Physical Chemistry 4</td>
<td>2</td>
</tr>
<tr>
<td>Chemistry 358L*</td>
<td>Physical Chemistry Laboratory 2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 365*</td>
<td>Organic Chemistry 3</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics 243</td>
<td>Statistics for the Sciences</td>
<td>2</td>
</tr>
<tr>
<td>Man-Env 320*</td>
<td>Environmental Economics</td>
<td>3</td>
</tr>
<tr>
<td>Man-Env 331*</td>
<td>Environmental Issues in a Global Perspective</td>
<td>3</td>
</tr>
</tbody>
</table>

### Year 4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 492</td>
<td>Advanced Laboratory</td>
<td>0</td>
</tr>
<tr>
<td>Env Studies 400</td>
<td>Environmental Law</td>
<td>3</td>
</tr>
<tr>
<td>Four one-term</td>
<td>(Recommended courses include: Chemistry 311*, 320*-320L*, 332*-332L*, 419*, 420*, 455*)</td>
<td></td>
</tr>
<tr>
<td>Chemistry courses</td>
<td>Two one-term (or equivalent) courses from†</td>
<td></td>
</tr>
<tr>
<td>Man-Env 410</td>
<td>Environmental Management</td>
<td>2</td>
</tr>
<tr>
<td>Geography 411*</td>
<td>Resource Studies</td>
<td>3</td>
</tr>
<tr>
<td>Geography 414*</td>
<td>Resources Management Workshop</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 421*</td>
<td>Geochemistry 2</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 641*</td>
<td>Isotope Geochemistry</td>
<td>3</td>
</tr>
</tbody>
</table>

†The courses indicated as options need not be taken in the order listed. For example a 300-level course could be taken in second year. Course options not elected in a previous year may be selected with the consent of the undergraduate officer in a subsequent year. The student should be careful, however, to select courses that are prerequisites as early in the programme as feasible, thus ensuring maximum flexibility in the course selection of upper years. The choice of Biology 131 or 132 in Year 1 would permit choice of certain Year 2 Biology courses.

### Honours Chemistry

**Mathematics Option**

This programme fulfills the academic requirements for professional membership in the Chemical Institute of Canada.

**Year 1**

As for Honours Chemistry (see page 160). A first year course in Algebra is also required and at least one term of Computer Science is recommended.

### Year 2

#### Fall Term

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 10*</td>
<td>Structure and Bonding</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 212*</td>
<td>Introductory Analytical Chemistry</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 220*</td>
<td>Analytical Chemistry Laboratory 1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry 254*</td>
<td>Physical Chemistry 1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Mathematics 215</td>
<td>Differential Equations</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Math 314A*</td>
<td>Introduction to Scientific Computation</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Math 217, 219, 229, 237
### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 221*</td>
<td>Analytical Chemistry of Multi-Component Systems</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemistry 221L*</td>
<td>Analytical Chemistry Laboratory 2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chemistry 255*</td>
<td>Physical Chemistry 2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemistry 764*</td>
<td>Organic Chemistry 1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemistry 264L*</td>
<td>Organic Chemistry Laboratory 1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Physics 243*</td>
<td>Electricity and Magnetism</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physics 243L*</td>
<td>Electricity and Magnetism Laboratory</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Math 217, 219, 229, 237</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

*Mathematics 314* may replace Mathematics 215 in the Core

### Year 3

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 312*</td>
<td>Transition Metal Chemistry</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemistry 314L*</td>
<td>Inorganic Chemistry Laboratory 1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chemistry 355*</td>
<td>Physical Chemistry 3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemistry 355L*</td>
<td>Physical Chemistry Laboratory 1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chemistry 364*</td>
<td>Organic Chemistry 2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemistry 364L*</td>
<td>Organic Chemistry Laboratory 2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mathematics 312a*, 329, 362a*, plus</td>
<td></td>
<td></td>
<td></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>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 313*</td>
<td>Main Group Chemistry</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemistry 315L*</td>
<td>Inorganic Chemistry Laboratory 2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chemistry 358*</td>
<td>Physical Chemistry 4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chemistry 358L*</td>
<td>Physical Chemistry Laboratory 2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chemistry 365*</td>
<td>Organic Chemistry 3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Mathematics 312b*, 329, 362b*, plus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One elective</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Year 4

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 10*</td>
<td>Advanced Laboratory</td>
<td>0</td>
<td>Four one-term Chemistry courses of which two must be at the 400-level. Four one-term (or equivalent) Mathematics courses at the 300- or 400-level.</td>
</tr>
</tbody>
</table>
Honours Chemistry (Physics Option)

This programme fulfills the academic requirements for professional membership in the Chemical Institute of Canada

Year 1
As for Honours Chemistry (see page 160) but the first year Physics course selected should be 121*-121L*, 122*-122L* or 162*-162L*, 163*-163L*. A full-year course in Algebra and at least one term of Computer Science is recommended.

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Fall Term</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chemistry 10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemistry 212*</td>
<td>Structure and Bonding</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chemistry 220*</td>
<td>Introductory Analytical Chemistry</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chemistry 220L*</td>
<td>Analytical Chemistry Laboratory 1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Chemistry 254*</td>
<td>Physical Chemistry 1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Mathematics 22*</td>
<td>Calculus 2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physics 222* or 252*</td>
<td>Electricity and Magnetism 1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Phys 222L* or 252L*</td>
<td>Electricity and Magnetism Laboratory 1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Winter Term</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemistry 10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemistry 221*</td>
<td>Analytical Chemistry of Multi-Components Systems</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chemistry 221L*</td>
<td>Analytical Chemistry Laboratory 2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Chemistry 255*</td>
<td>Physical Chemistry 2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chemistry 264*</td>
<td>Organic Chemistry 1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chemistry 264L*</td>
<td>Organic Chemistry Laboratory 1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Mathematics 215</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Physics 223* or 253*</td>
<td>Electricity and Magnetism 2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Phys 223L* or 253L*</td>
<td>Electricity and Magnetism Laboratory 2</td>
<td>0</td>
</tr>
</tbody>
</table>

Year 3

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Fall Term</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chemistry 10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chemistry 312*</td>
<td>Transition Metal Chemistry</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chemistry 314L*</td>
<td>Inorganic Chemistry Laboratory 1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Chemistry 355*</td>
<td>Physical Chemistry 3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chemistry 355L*</td>
<td>Physical Chemistry Laboratory 1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Chemistry 364*</td>
<td>Organic Chemistry 2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chemistry 364L*</td>
<td>Organic Chemistry Laboratory 2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Physics 324*</td>
<td>Atomic and Nuclear Physics 1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>One Elective†</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 10*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 313*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 315L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 358*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 358L*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemistry 365*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 325*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One Elective

### Year 4

<table>
<thead>
<tr>
<th>Chemistry 10*</th>
<th>Advanced Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem 492</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Two one-term Chemistry courses which must be at the 400-level. Four one-term Physics courses at the 300- or 400 level. Two one-term electives.</td>
</tr>
</tbody>
</table>

† Year 3 electives may be chosen from: Physics 352*-353* plus 352L*-353L*, 362*-363*, 364*-365*, Mathematics 219, 312b*, 314a*.

### Honours Earth Sciences (Geology Option)

Completion of this programme requires a total of 23 1/2 course-credits (including Year one). Of these, at least 19 must be from courses in the Faculties of Science and Mathematics, including all required courses, and 2 must be from courses in the Faculty of Arts. In addition, attendance on two third year field trips is required. (see Undergraduate Course Descriptions, Ch. 14).

A list of recommended Science and Mathematics electives is given on page 173.

### Year 1

(For a complete discussion of Year 1, see page 160)

<table>
<thead>
<tr>
<th>Course</th>
<th>Lectures</th>
<th>Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 221*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth Sciences 231*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth Sciences 232*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth Sciences 235*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth Sciences 236*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth Sciences 260*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Year 2

Three course-credits, normally two from courses in Science and/or Mathematics and one from Arts.

### Note

By the end of Year 2, students must have completed Physics 111*-112*, General Physics (or an equivalent physics course), Mathematics 130, Calculus, and an introductory course in computer programming (for example Mathematics 122a*, 132a*, or General Engineering 121*)

Arts elective: as specified.
### Year 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</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>

**Electives**

*Two course-credits, normally one from courses in Science or Mathematics and one from Arts.*

### Year 4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 436</td>
<td>Thesis</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 427*</td>
<td>Crustal Evolution</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

*Seven half-courses from:*

- Earth Sciences 421* | Geochemistry 2                           | 3     | 2    |
- Earth Sciences 432* | Precambrian Geology                      | 2     | 2    |
- Earth Sciences 433* | Sedimentology 2                          | 2     | 3    |
- Earth Sciences 434* | Biostratigraphy                          | 2     | 2    |
- Earth Sciences 435* | Advanced Structural Geology              | 3     | 2    |
- Earth Sciences 438* | Engineering Geology                      | 2     | 1    |
- Earth Sciences 439* | Groundwater Geology                      | 3     | 0    |
- Earth Sciences 440* | Quaternary Geology                       | 2     | 3    |
- Earth Sciences 456* | Mathematical Geology 2                  | 3     | 0    |
- Earth Sciences 461* | Applied Geophysics                       | 3     | 0    |
- Earth Sciences 470* | Metallic Mineral Deposits                | 3     | 2    |

**Electives**

*One course-credit, not from Earth Sciences*

Recommended Mathematics and Science electives:

- Earth Sciences 355*, Mathematical Geology (Taken in Yr. 3);
- Chemistry 218*, Development of Chemical Bonding and Structure;
- Chemistry 219*, Chemistry of non-Transition Metals;
- Chemistry 356*-357*, General Physical Chemistry;
- Biology 131, Introduction to Biology;
- Biology 333, Invertebrate Zoology;
- Physics 259*-259L*, Crystallography and X-ray Diffraction;
- Physics 250*, The Solar System;
- Physics 251*, The Stellar System;
- Physics 368*, Geophysics 1;
- Physics 369, Geophysics 2;
- Mathematics 236, Elementary Differential Equations;
- Mathematics 31, Differential Equations;
- Mathematics 237, Advanced Calculus.

**Note**

*The Department of Earth Sciences is prepared to work out honours programs with students who wish to use their electives to specialize in a particular discipline: e.g., Mathematics, Biology, Chemistry, Physics.*
### Honours Earth Sciences and Geography

#### Year 1

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</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 Structure</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 121L*</td>
<td>Chemical Structure Laboratory</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Chemistry 122*</td>
<td>Chemical Reaction</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 122L*</td>
<td>Chemical Reaction Laboratory</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

*One of:*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<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>Env Studies 195*</td>
<td>Introduction to Environmental Problems</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Electives**

*Two course-credits*

#### Year 2

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 221*</td>
<td>Geochemistry I</td>
<td>2</td>
<td>3</td>
</tr>
<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 260*</td>
<td>Introductory Structural Geology</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Env 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>

**Electives**

*Three half course-credits including one of:*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geography 203*</td>
<td>Some Basic Topics of Cultural and Regional Geography</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Geography 320</td>
<td>World Regional Geography</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Year 3

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</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 I</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 370*</td>
<td>Geology of non-renewable Primary Resources</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Geography 381*</td>
<td>Special Topics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geography electives:</td>
<td>One course-credit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Elective:**

*One course-credit*

#### Year 4

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lect.</th>
<th>Lab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 436</td>
<td>Honours Thesis</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences electives:</td>
<td>Three course-credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geography electives:</td>
<td>One course-credit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective:</td>
<td>One course-credit</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Co-operative Earth Sciences (Honours)

Earth Science Majors (for a complete discussion of Year 1, see page 160)

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.

General features and conditions of the Co-operative plan at the University of Waterloo are given in Chapter 5.

F - Fall  W - Winter  S - Spring  Wk Tm - Work Term

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
</tr>
<tr>
<td>2A</td>
<td>Wk Tm 1</td>
<td>2B</td>
<td>Wk Tm 2</td>
<td>3A</td>
</tr>
<tr>
<td></td>
<td>3B</td>
<td>Wk Tm 4</td>
<td>Wk Tm 5</td>
<td>4A</td>
</tr>
</tbody>
</table>

The normal progress of a student entering Co-operative Earth Sciences in his second academic year in the Fall of 1975 is shown in the table above. Completion of this course requires a total of 23.5 course-credits (including year one). Of these at least 19 must be from courses in the Faculties of Science and Mathematics, including all required courses, and 2 must be from courses in the Faculty of Arts. In addition, attendance is required on two third year field trips (see Undergraduate Course Descriptions, Ch. 14). A list of recommended Science and Mathematics electives is given on page 173.

Year 2A

Earth Sciences 231*  Mineralogy  2  3
Earth Sciences 236*  Principles of Paleontology  2  2
Earth Sciences 235*  Stratigraphy  2  2
Electives: Three half course-credits, normally two from courses in Science and/or Mathematics and one from Arts.

Year 2B

Earth Sciences 221*  Geochemistry  2  3
Earth Sciences 232*  Petrography  2  3
Earth Sciences 260*  Introductory Structural Geology  2  2
Electives Three half course-credits, normally two from courses in Science and/or Mathematics and one from Arts.

Note

By the end of Year 2, students must have completed Physics 111*-112*, General Physics (or an equivalent physics course), Mathematics 130, Calculus, and a course involving computer programming (for example, Mathematics 122a*, 132a*, or General Engineering 121*).
### Science Academic Programmes

#### Year 3A

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 332*</td>
<td>Metamorphic Petrology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 333*</td>
<td>Sedimentology 1</td>
<td>3</td>
</tr>
<tr>
<td>Earth Sciences 345*</td>
<td>Historical Geology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 370*</td>
<td>Geology of non-renewable Primary Resources</td>
<td>2</td>
</tr>
</tbody>
</table>

Electives: Two half course-credits, normally one from Science or Mathematics and one from Arts.

#### Year 3B

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Sciences 331*</td>
<td>Igneous Petrology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 336*</td>
<td>Paleontology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 342*</td>
<td>Geomorphology</td>
<td>2</td>
</tr>
<tr>
<td>Earth Sciences 360*</td>
<td>Introduction to Applied Geophysics</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives: Two half course-credits, normally one from Science or Mathematics and one from Arts.

#### Year 4A, 4B

Identical to regular programme in Honours Earth Sciences.

### Honours Physics

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 on the pages following the core programme which is listed below. *Detailed descriptions of the courses start in Chapter 14.*

#### Year 1

*(For a complete discussion of Year 1, see page 160.)*

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Course</th>
<th>Course Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 252*-253*</td>
<td>Electricity and Magnetism 1 and 2</td>
<td>1.00</td>
</tr>
<tr>
<td>Phys 252L*-253L*</td>
<td>Electricity and Magnetism Labs</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 256*</td>
<td>Optics (first term)</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 256L*</td>
<td>Optics Laboratory</td>
<td>.25</td>
</tr>
<tr>
<td>Physics 255*</td>
<td>Quantum Physics (second term)</td>
<td>.50</td>
</tr>
<tr>
<td>Mathematics 237</td>
<td>Advanced Calculus</td>
<td>1.00</td>
</tr>
<tr>
<td>Mathematics 31*</td>
<td>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.

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Course</th>
<th>Course Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 360A*</td>
<td>Intermediate Laboratory</td>
<td>.25</td>
</tr>
<tr>
<td>Physics 360B*</td>
<td>Intermediate Laboratory</td>
<td>.25</td>
</tr>
<tr>
<td>Physics 362*-363*</td>
<td>Classical Mechanics 1 and 2</td>
<td>1.00</td>
</tr>
<tr>
<td>Physics 365*</td>
<td>Mathematical Physics 2</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 354*</td>
<td>Atomic and Molecular Physics</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 358*</td>
<td>Thermodynamics</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 359*</td>
<td>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.

<table>
<thead>
<tr>
<th>Year 4</th>
<th>Core</th>
<th>Course Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 434A*</td>
<td>Introductory Quantum Mechanics</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 441</td>
<td>Electromagnetic Theory</td>
<td>1.00</td>
</tr>
<tr>
<td>Physics 355*</td>
<td>Nuclear and Particle Physics (if not taken in Year 3)</td>
<td>.50</td>
</tr>
<tr>
<td>Physics 433</td>
<td>Experimental Research Project</td>
<td>1.00</td>
</tr>
<tr>
<td>or Physics 437*</td>
<td>Theoretical Physics Project</td>
<td>.50</td>
</tr>
</tbody>
</table>

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 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*.

Core plus: *Year 3*  
Physics 352*-353*, 352L*-353L*, 364*, 371A*, 371B*

Core plus: *Year 4*  
Physics 432*, 433*, 435*, 464*, 465*  
Two of: Physics 442*, 443*, 445*, 452*, 453*

**Ex 2 Honours Physics**  
(epecially suitable as preparation for secondary school teaching)

Core plus: *Year 2*  
Physics 265*, 250*-251*, Mathematics 240a*

Core plus: *Year 3*  

Core plus: *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 223A  
Three of: Chemistry 254*, 255*, 266*, 267*,  
Biology 245*, 246*

Core plus: *Year 3*  
380*, 381*  
One of: Biology 341*, 343*, 239*, Chemistry 356*, 357*,  
332*, 333*, 353*

Core plus: *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*

Core plus: Year 3  
Physics 352*, 352L*, 353*, 353L*  
Two of: Mathematics 223A, 334, 340

Core plus: 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 218*-219*, 254*-255*, Mathematics 240a* or 240b*.

Core plus: Year 3  
Elective*

Core plus: Year 4  
2.00 credits from Physics 434B*, 435*,  
Chemistry 350*, 355*, 358*, 312*, 311*, Elective*

Ex 6 Honours Physics  
(with Astrophysics)

Core plus: Year 2  
Physics 250*, 251*, 270*, Mathematics 240a*-240b*.

Core plus: Year 3  
Physics 364*; two of: 350*, 351*, 352*-352L*, 353*,  
353L*, 449*, 450*, 451*, Arts Electives totalling  
1.00 credit.

Core plus: Year 4  
Physics 434B*,  
Three of: Physics 350*, 351*, 449*, 450*, 451* plus 2.00  
credits from Physics 431*, 433, 435*, 436, 437*, 443*,  
464*, 465*, Electives

Ex 7 Honours Physics  
– Business Administration Option

See comments regarding the Business Administration  
Option on page 190.

Core plus: Year 1 Special Requirements  
Economics 101*-102*, Mathematics 112A* or 122A*

Core plus: Year 2  
Economics 201*-202*, 191*-192*

Ex 8 Honours Physics  
(with Geophysics)

Core plus: Year 3  
Business (WLU) 212*-222*, 255*-275*,  
Management Sciences 406*

Core plus: 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 9 Honours Physics  
(with Electrical Engineering)

Core plus: Year 1 Special Requirements  
Systems Design 183 (Fall term), and Mathematics 122a*.  
(Winter term)

Core plus: Year 2  
Physics 259*, 259L*, Electrical Engineering 221, 241

Core plus: Year 3  
Physics 352*, 353*, 352L*, 353L*, Electrical Engineering  
316 and one or two of Electrical Engineering 324, 380, 261

Note  
It may be possible to replace Physics 360a*-360b* by an  
Electrical Engineering course if two of the Electrical  
Engineering courses chosen have labs associated with  
them.

Core plus: Year 4  
Physics 433, 435*, 453*, Electrical Engineering 428, 429,  
435, 436
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 2
Physics 259*, 259L*, Mathematics 229, elective*

Core plus: Year 3
Physics 355*, 364*, Mathematics Elective, elective*

Core plus: Year 4

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, 433a*, 453b*, 464*, 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 student's course work and interests where possible. Many work term experiences, especially in the upper year, 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 an individual to apply a 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 14.

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.
Further information about the Co-operative work terms and the Co-ordination Department can be found starting in Chapter 5.

### Year 1
(For a complete discussion of Year 1, see page 160)

<table>
<thead>
<tr>
<th>Year 2A</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>physics 252*</td>
</tr>
<tr>
<td></td>
<td>physics 252L*</td>
</tr>
<tr>
<td></td>
<td>physics 256*</td>
</tr>
<tr>
<td></td>
<td>physics 256L*</td>
</tr>
<tr>
<td></td>
<td>mathematics 237a*</td>
</tr>
<tr>
<td></td>
<td>mathematics 31*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2B</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>physics 253*</td>
</tr>
<tr>
<td></td>
<td>physics 253L*</td>
</tr>
<tr>
<td></td>
<td>physics 255*</td>
</tr>
<tr>
<td></td>
<td>mathematics 237b*</td>
</tr>
</tbody>
</table>

### Note
Physics 265 is recommended.

<table>
<thead>
<tr>
<th>Year 3A</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>physics 354*</td>
</tr>
<tr>
<td></td>
<td>physics 358*</td>
</tr>
<tr>
<td></td>
<td>physics 360A*</td>
</tr>
<tr>
<td></td>
<td>physics 362*</td>
</tr>
<tr>
<td></td>
<td>One of: Physics 371A*, 352L* (Laboratory)</td>
</tr>
</tbody>
</table>

### Note
Physics 364* is recommended.

<table>
<thead>
<tr>
<th>Year 3B</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core</td>
<td>physics 360B*</td>
</tr>
<tr>
<td></td>
<td>physics 359*</td>
</tr>
<tr>
<td></td>
<td>physics 363*</td>
</tr>
<tr>
<td></td>
<td>physics 365*</td>
</tr>
<tr>
<td></td>
<td>One of: Physics 371A*, 371B*, 353L* (Laboratory)</td>
</tr>
</tbody>
</table>

### Note
Students desiring Physics 444* must elect Physics 355*.
### Year 4A-4B

<table>
<thead>
<tr>
<th>Core</th>
<th>Physics 434A*</th>
<th>Introductory Quantum Mechanics</th>
<th>.50</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physics 441</td>
<td>Electromagnetic Theory</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Physics 355*</td>
<td>Nuclear and Particle Physics (if not taken in Year 3)</td>
<td>.50</td>
</tr>
</tbody>
</table>

**Note**: Physics 434B* is strongly recommended for students intending to do graduate work.

### Options

Some suggested programmes are given below. In choosing his electives the student should make sure that his programme contains a minimum of 24 course credits.

<table>
<thead>
<tr>
<th>Ex 1 Co-op Applied Physics (Solid State)</th>
<th>Ex 3 Co-op Applied Physics (with Chemistry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core plus: <strong>Year 2A</strong></td>
<td>Core plus: <strong>Year 2A</strong></td>
</tr>
<tr>
<td>Physics 270*, Mathematics 240b*</td>
<td>Chemistry 254*, 212*</td>
</tr>
<tr>
<td>Core plus: <strong>Year 2B</strong></td>
<td>Core plus: <strong>Year 2B</strong></td>
</tr>
<tr>
<td>Physics 259*, 259L*, 271*, Chemistry 311* or Mathematics 240a*</td>
<td>Chemistry 264*, Physics 259*, 259L*, Arts Elective*</td>
</tr>
<tr>
<td>Core plus: <strong>Year 3A</strong></td>
<td>Core plus: <strong>Year 3A</strong></td>
</tr>
<tr>
<td>Core plus: <strong>Year 3B</strong></td>
<td>Core plus: <strong>Year 3B</strong></td>
</tr>
<tr>
<td>Core plus: <strong>Year 4A</strong></td>
<td>Core plus: <strong>Year 4A</strong></td>
</tr>
<tr>
<td>Physics 433, 435*, 452*, 464*</td>
<td>Physics 433, 435*, 436A*, Chemistry 332* or 353* or 455*</td>
</tr>
<tr>
<td>Core plus: <strong>Year 4B</strong></td>
<td>Core plus: <strong>Year 4B</strong></td>
</tr>
<tr>
<td>Physics 433, 434B*, 442*, 453*, 465*</td>
<td>Physics 433, 434B*, Chemistry 332* or 333*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ex 2 Co-op Applied Physics (Biophysics)</th>
<th>Ex 4 Co-op Applied Physics (with Computing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core plus: <strong>Year 2A</strong></td>
<td>Core plus: <strong>Year 2A</strong></td>
</tr>
<tr>
<td>1.00 credit from Chemistry 254*, 266*, Biology 245*, 203*, 341*, 239*, Physics 380*</td>
<td>Mathematics 219a*, 240b*</td>
</tr>
<tr>
<td>Core plus: <strong>Year 2B</strong></td>
<td>Core plus: <strong>Year 2B</strong></td>
</tr>
<tr>
<td>1.00 credit from: Chemistry 255*, 267*, 332*, 353*, Physics 265*</td>
<td>Mathematics 219b*, 240a*, Physics 259*, 259L*</td>
</tr>
<tr>
<td>Core plus: <strong>Year 3A</strong></td>
<td>Core plus: <strong>Year 3A</strong></td>
</tr>
<tr>
<td>Core plus: <strong>Year 3B</strong></td>
<td>Core plus: <strong>Year 3B</strong></td>
</tr>
<tr>
<td>Core plus: <strong>Year 4A and 4B</strong></td>
<td>Core plus: <strong>Year 4A</strong></td>
</tr>
<tr>
<td></td>
<td>Core plus: <strong>Year 4B</strong></td>
</tr>
<tr>
<td></td>
<td>Mathematics 334b*, Physics 453*, 465*</td>
</tr>
</tbody>
</table>
Ex 5 Co-op Applied Physics
– Business Administration Option
See comments regarding Business Administration Option on page 190.

Core plus: Year 1 Special Requirements
Economics 101*-102*, Mathematics 122A* or 112A*

Core plus: Year 2
Economics 201*-202*, 191*-192*

Core plus: Year 3
Business (WLU) 212*-222*, 255*-275*, Management Sciences 406*

Core plus: Year 4
Economics 393*-394*, Business (WLU) 385*-395*, 388*-398*, Management Science 407*
(Physics 360A* and 360B* are not normally taken with this Option).

Ex 6 Co-op Applied Physics
(with Electrical Engineering)

Core plus: Year 1 Special Requirements
Systems Design 183 (Fall term), and Mathematics 122a* (Winter term).

Core plus: Year 2A
Electrical Engineering 221

Core plus: Year 2B
Physical 259*, 259L*, Electrical Engineering 316

Core plus: Year 3A
Physics 352*, 352L*

Core plus: Year 3B
Physics 353*, 353L*, Electrical Engineering 241 and one or two of Electrical Engineering 324, 380

Note
It may be possible to replace Physics 360A*-360B* by an Electrical Engineering course if two of the Electrical Engineering courses chosen have labs associated with them.

Core plus: Year 4A and 4B

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 optometry 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 students with sufficient general and specialized knowledge in Science so that they may follow a career in research and teaching if so desired. 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 Year 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 Assistant Registrar, Faculty of Science. Specific admissions requirements and regulations for Examinations and Standings may be found on page 155. The Optometry programme requires the same academic standard as do the Honours programmes in the Faculty. All other inquiries relating to the course should be sent to the Undergraduate Officer of the School of Optometry at the University.

Students who enroll at the University of Waterloo and intend to proceed in Optometry should register in Year 1 Regular Science and should receive counselling regarding the prerequisites for continuing in Optometry in their second year. All University of Waterloo students interested in applying for Optometry should preregister for the first professional year (Year 2 Optometry) during the spring preregistration period. At that time an interview with the admission committee will be arranged for the student. All applicants should note that enrolment in the first professional year is limited and that neither acceptance to nor successful completion of the pre-professional programme guarantees admission to the first professional year. Applicants are selected on a competitive basis considering scholarship, interest, motivation, general qualifications for the profession and recommendations. While admissions of well-qualified applicants are made from all provinces, prospective students are advised that some preferential consideration must be given to Ontario residents. The admissions committee cannot at this time accept applications from those on student visas and priority is granted in admissions to Canadian citizens. Applications are not normally accepted from persons over age 30.
Students who have met the University’s requirements for admission to the pre-professional year and who have in addition completed satisfactorily at another University a programme equivalent to the pre-professional year as given at the University of Waterloo may apply for direct admission to the first professional year (Year 2) of the Optometry programme. The general guidelines for admission stated in the preceding paragraphs should be noted. Applicants should also be aware that preferential consideration in admissions to the first professional year is given to students completing their pre-professional requirements at the University of Waterloo.

Students applying from other universities should request an application form no earlier than January. Completed applications for the School of Optometry will not be accepted after May 1. The academic transcripts, letters of reference and other material required in the admissions procedure must be received no later than June 15. It is expected that decisions of the admissions committee will be made by July 15.

Students granted direct admission to the first professional year who have taken courses equivalent to those required in the upper years of the programme may apply for exemptions from these courses after registration in September. Details of the policy on exemptions may be obtained by writing to the Admissions Officer.

Admission to Advanced Standing
Applications are not ordinarily accepted to a year more advanced than the first professional year. However, graduates from certain Commonwealth Universities who are licensed to practice optometry in their country of origin may in certain instances be admitted to a more advanced level in a programme leading to the O.D. degree. For more information write: The Admissions Officer, School of Optometry.

Note
Interviews with the Admissions Officer of the School are required in the case of applicants in certain categories before any application can be processed. These categories include:
1) Applicants over age 30.
2) Applicants with undergraduate or graduate training who have not completed prerequisites for the first professional year and who are considering a “make-up” year.
3) Applicants considering a “make-up” year to repeat courses for the purpose of raising grades.
4) Applicants who are presently engaged in another vocation such as teaching, engineering, research, etc., and who may find it necessary to terminate employment before the admissions decision had been made.

Appointments for interviews can be made by phone or letter to the Admissions Officer of the School of Optometry.

Note
As is 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 160) with Mathematics 130, Physics 111*-112* and 111L*-112L* or 121*-122* and 121L*-122L* or 162*-163* and 162L*-163L*, Psychology 101* and Biology 132 required. Recommended electives are Chemistry 121*-122* and 121L*-122L*, and Psychology 102*.

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* and 111L*-112L* is recommended rather than Chemistry 121*-122* and 121L*-122L*.

Note 2
Non Science students intending to apply for Optometry should ensure they complete the laboratory work in their chosen Science courses.
### Year 2
#### Fall Term
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 201</td>
<td>Anatomy, Histology and Embryology (first term)</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 268*</td>
<td>Introductory Organic Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 268L*</td>
<td>Introductory Organic Chemistry Laboratory</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 200*</td>
<td>History and Orientation</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 206*</td>
<td>Geometrical Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 224*</td>
<td>Anatomy of the Eye and Associated Structures</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>

#### Winter Term
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 201</td>
<td>Anatomy, Histology and Embryology (second term)</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 211*</td>
<td>Physiological Optics</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 234*</td>
<td>Anatomy of the Eye and Associated Structures</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Physics 246*</td>
<td>Physical Optics</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Physics 246L*</td>
<td>Optics Laboratory</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 237*</td>
<td>Introductory Biochemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chemistry 237L*</td>
<td>Introductory Biochemistry Laboratory</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note**: The curriculum which follows for Years 3, 4 and 5 may not apply for the class entering Year 2 in September, 1976.

### Year 3
#### Fall Term
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinic</th>
</tr>
</thead>
<tbody>
<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>1</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 306*</td>
<td>Optometrical Optics</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Psychology elective*</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Winter Term
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinic</th>
</tr>
</thead>
<tbody>
<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>1</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 316*</td>
<td>Optometrical Optics</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Psychology 206*</td>
<td>Perceptual Processes</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Year 4
#### Fall Term
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 401*</td>
<td>Physiological Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 402*</td>
<td>Clinical Optometry</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 404*</td>
<td>Physiology of Visual Systems</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 405*</td>
<td>Ocular Pathology</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 406*</td>
<td>Optometrical Optics</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 407*</td>
<td>Optometric Specialties: Contact Lenses</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 408*</td>
<td>Optometry Clinic</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Optometry 409*</td>
<td>Light and Illumination</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Winter Term
<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Lectures</th>
<th>Labs</th>
<th>Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 411*</td>
<td>Physiological Optics</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 412*</td>
<td>Clinical Optometry</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 414*</td>
<td>Physiology of Visual Systems</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 415*</td>
<td>Ocular Pathology</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 418*</td>
<td>Optometry Clinic</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Optometry 427*</td>
<td>Optometric Specialties: Aniseikonia and Low Vision Aids</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
### Summer

**Optometry 428 Summer Clinic**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(total 120 hours)</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

*Subject to the availability of programmes students in good standing are required to participate in vision care projects involving up to 400 hours during the period between their fourth and fifth years.*

---

### Year 5

#### Fall Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 500*</td>
<td>Optometrical Jurisprudence and Praxis</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 501*</td>
<td>Physiological Optics</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 502*</td>
<td>Advanced Clinical Optometry</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 504*</td>
<td>Ocular Pharmacology</td>
<td>4</td>
</tr>
<tr>
<td>Optometry 508*</td>
<td>Optometry Clinic</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 509*</td>
<td>Community Health Optometry</td>
<td>4</td>
</tr>
<tr>
<td>Psychology 357*</td>
<td>Psychopathology</td>
<td>3</td>
</tr>
</tbody>
</table>

---

#### Winter Term

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optometry 510*</td>
<td>Optometrical Jurisprudence and Praxis</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 511*</td>
<td>Physiological Optics</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 512*</td>
<td>Advanced Clinical Optometry</td>
<td>3</td>
</tr>
<tr>
<td>Optometry 513*</td>
<td>Optometric Communication</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 514*</td>
<td>Genetics for Optometrists</td>
<td>2</td>
</tr>
<tr>
<td>Optometry 518*</td>
<td>Optometry Clinic</td>
<td>0</td>
</tr>
<tr>
<td>Optometry 519*</td>
<td>Community Health Optometry</td>
<td>4</td>
</tr>
</tbody>
</table>

**Note**

*Students with a particular interest in and aptitude for research in physiological optics may substitute Optometry 505*-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 or 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 to 24 course-credits total of which at least 14 should be Science Faculty course-credits. 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.

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 158)

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 160)

Year 2
3 course-credits from Biology 231*, 234, 235, 237*, 238*, 239*, Chemistry 266*-267* and 267L*
2 other course-credits (Math 253A* is recommended).

Year 3
Chemistry 332*-333* and 332L*-333L*
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 160)

Year 2 (see notes 1, 2 and 3)
3 Chemistry lecture course-credits at least 2 of which must be chosen from Chemistry 212*, 220*, 221*, 264*, 254*, 255*.
1 other Science course-credit chosen from Physics, Biology or Earth Sciences.
Elective course-credits to give a total of at least 6 course credits in the Year.

Year 3 (see notes 1, 2 and 3)
3 Chemistry course-credits at least 2 of which are at the 300-level or higher.
1 other Science course-credit chosen from Physics, Biology or Earth Sciences.
2 Elective course-credits

Year 4 (see notes 1, 2 and 3)
4 Science course-credits of which at least 2 must be at the Chemistry 300- or 400-level.
1 Elective course-credit

Note 1
Before graduation a student must obtain at least one lecture course-credit in each of the following areas of Chemistry: Analytical, Inorganic, Organic, Physical.

Note 2
Before graduation a student must obtain at least 0.5 laboratory course-credits in each of the four areas of Note 1. Wherever possible, the laboratory chosen should accompany the appropriate lecture-course.
All students in Chemistry Programmes are also required to register in Chemistry 10 in each term of their programme beyond Year 1.

Honours Science (Earth Sciences major)
In total at least 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* and 121L*–122L*, Physics 111*–112* or equivalent, Mathematics 130 and 122a* or equivalent must be among these choices). A suggested year by year breakdown is as follows:

(For Year 1, see page 160)

Year 2
Earth Sciences 221*, 231*, 232*, 235*, 236*, 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* and 121L*–122L* or 162*–163* and 162L*–163L*, Mathematics 130.

Physics 252*–253*, 252L*–253L*, Physics 256*, 256L*, Physics 255* (or 324*–325* in third year), Mathematics 31*, 237

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 and one-half course-credits 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 (especially 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.

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. Students may transfer from one of these options to the other; for transfer from the three- or the four-year programme, the student must have the necessary course selection and standing required for a major field.

General Science – Three-year Programme
The three-year programme B.Sc. requires the successful completion of 15 course-credits at least 14 of which must be lecture course-credits. Normal progress is 5 lecture course-credits per year. At least half of the 15 course-credits must be in Science and normally no more than 7 are allowed from the same subject area (i.e. no more than 7 Biology course-credits or 7 Mathematics course-credits or 7 English courses, etc.). Also, at least 6 of the 15 courses must be at the 200-level or higher.

If students wish to specialize in a particular subject area in Science they are 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/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 lecture courses, two of which must be in Science. 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 160).

**Year 2**
5 course-credits of which 2 or 3 should normally be in Science.

**Year 3**
5 course-credits of which 2 or 3 should normally be in Science.

**Note**
Selections should be made so that at the end of Year 3 the total programme will include 15 course-credits (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 course-credits must be 200 or higher level.

Some possible electives (other than Year 1 courses described on page 161).

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 course will be allowed (e.g. credit for one of Chemistry 220*-221*, 226*-227*; one of Physics 111*-112*, 121*-122*, 162*-163*; etc.). In addition, where Departmental course listings clearly indicate an elective is 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 prerequisites listed before attempting upper year courses: these are listed in the Departmental descriptions. More courses are offered under the Science listing this year 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)**

- Chemistry 218*-219*, 226*-227*, 266*-267*, 316*-317*, 332*-333*, 356*-357*, 366*-367*, 395* but not 237* or 268*
- Physics 222*-223* and 222L*-223L*, 226*-227* and 226L*-227L*, 250*-251*, 301*-302*, 324*-325*, 325*, 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 prerequisites 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 course-credits for the B.Sc. An official major field (from Biology, Chemistry, Earth Sciences and Physics) must be selected; at least 8 course-credits from this major field must be completed as specified and normally not more than 10 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 course-credits presented must be in Science. 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 of 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* and 121L*-122L* (see page 160).

Year 2
Two course-credits from: Biology 231*, 234, 235, 237*, 238*, 239*
Chemistry 266*-267* and 267L*
Two other course-credits

Year 3
Two or three course-credits† from Biology 331*, 332*, 333*, 334*, 335, 338*, 341*, 342, 343*, 345*, 346*.
Three or two non-Biology electives (Chemistry 332*–333* and 332L*–333L* recommended).

Year 4
Five courses at least two† of which are 400-level Biology courses or from the above list of 300-level Biology Courses.

†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.

Chemistry Major
Year 1
Including Chemistry 121*-122* and 121L*-122L* and Mathematics 130 and a full-year Physics course.

Year 2††
Chemistry 226*-227* and 226L*-227L*, 266*-267*, 267L*, 218*, 219*.
1 Elective course-credit.†

Year 3††
2 Elective course-credits.†

Year 4††
Five elective course-credits to complete the requirements for the degree.†
†Electives can be freely chosen provided that before graduation at least two Chemistry course-credits are obtained at the 300- or 400-level, in addition to the required courses listed above.

††All students in Chemistry Programmes must also register in Chemistry 10* in each term of their programme beyond Year 1.

Earth Science Major
Year 1
Including Earth Sciences 130 and Chemistry 121*-122* and 121L*-122L* (see page 160).

Year 2
Two Electives

Note
Students should note that Physics 111*-112* 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 Earth Sciences 355*, 456* and 461* given in the third and fourth years.

Year 3
Two or three course-credits from:
One or two course-credits from:
Arts elective: One course-credit.
Science

General Science Programme

Year 4
Two or three course-credits from:
Three or two course-credits from non-Earth Sciences courses.

Physics Major
Year 1
Including Physics 121*-122* or 162*-163* and Mathematics 130 (see page 160).

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 one non-Physics Science courses
Arts or Mathematics Electives

Business Administration Option
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 economic 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 their choice.

Specific Requirements Over and Above the Major Requirements

Year 1
Economics 101*-102*; Mathematics 122A* or 112A* and Mathematics 130 if not in major programme selected.

Year 2
Mechanical Engineering 001* or Civil Engineering 221*, Mathematics 31*, Economics 201*-202*, 191*-192*

Year 3
Business (WLU) 212*-222*, 255*-275*, Management Sciences 406*

Year 4
Economics 393*-394*, Business (WLU) 385*-395*, 388*-398*, Management Sciences 407*

General Science and Business
The following four-year General Science 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 at least 20 course-credits 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 Wilfred 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 their 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 111*-112* General Physics
Chemistry 121*-122*, 121L*-122L* Chemical Structure; Chemical Reaction
Earth Sciences 130 Introductory Geology
Mathematics 130 Calculus
Economics 101*-102* Introduction to Microeconomics and Macroeconomics

Note
Physics 121*-122* or 162*-163* are acceptable alternatives to Physics 111*-112*.

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*, 267L* Organic Chemistry 1 and 2 and Laboratory
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 250* 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 255*-275* (WLU)
Basic Statistics; Decision Analysis
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) Operational Behaviour
School of Architecture

Professor, Director

Assistant Professor, Associate Director and Undergraduate Officer
O. Dutt, B.A. (Punjab), B.Sc. (Hon.) (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., (on Sabbatical Leave 1975-76)
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)
P. Irgens, M.Arch. (Technical University of Norway, Trondheim)
K. Kuras, M.Arch. (Technical University of Warsaw)
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

Assistant Professors (Part-time)
J. Belisle, B.Arch (McGill), M.Arch., M.L.A. (California)

Visiting Critics
A. Brown, B.Arch. (Toronto)
E. Gustavs, B.Arch., M.Arch. (Toronto)

Special Lecturers
W. G. Dailey, B.Arch. (Liverpool)
D. K. Lansdowne

Faculty members holding cross and/or joint appointments as shown.
1 Architecture and English

Course Descriptions

Undergraduate Course Descriptions

Courses for Bachelor of Environmental Studies
(Pre-Professional Architecture)

For Recommended Programme, see page 116.
For Elective Course Requirements, see page 200.

Systems and Measures

Courses in this theme area give preparation leading to the application of mathematics, statistics and computer science as tools for analyzing quantitative and behavioural problems as prerequisites for ensuing studies: to 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 fittings, 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

112* & 113* Computer Science
Introduction to Programming
This course is essentially the same as Math 132, with emphasis on solving architectural problems.

The 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

163* Statics
Basic concepts, forces, moments, system of forces, resolution of forces, transformation of couples; resultant of force systems; centre of gravity of a system of forces and of composite bodies; equilibrium, free body diagrams; shears, moments, bar forces in simple trusses; friction; moment of inertia.
Prerequisite: Arch 102* or Math 130*
4 hours lectures/labs per week, Winter term
212* Computer Science Simulation
Simulation programming is 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. is introduced.
Prerequisite: none
3 hours per week, Fall term

213* Computer Generated Design 1
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

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; 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 lectures/labs per week, Fall term

263* Theory of Structures 1
Historic review of building structures; live and dead loading, wind, snow, earthquake, reactions, stability, 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, influence lines, introduction to arches and cables.
Prerequisite: Arch, 262*
4 hours lecture/lab per week, Spring term

265* Structural Morphogenesis
Prerequisite: Architecture students should have completed first year; other students require consent of instructor
3 hours per week lecture/lab. Spring term

313* Computer Generated Design 2
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. Course is project oriented.
Prerequisite: Arch 213*
4 hours per week, Fall or Winter term

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 methods.
Prerequisite: Arch 263*
4 hours per week lecture/lab, Fall term

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 lecture/lab, Winter term

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.

021* Introduction to the Art of Urban Design
To engender in the student a critical awareness of the environment and to encourage the recollection and recording, by freehand sketches, of personal visual impressions of "place" in both the man-made and natural environment.
Prerequisite: Consent of instructor

ES 111* Introduction to the Study of the Future
See Environmental Studies course descriptions, page 261.

ES 195 Introduction to Environmental Problems
See Environmental Studies course descriptions, page 261.

ES 200 Field Ecology
See Environmental Studies course descriptions, page 261.

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: ES 195*
2 hours per week, Spring term

224* An Introduction to Landscape Design
An introduction to the design of landscape with emphasis upon the architectural attributes of plant and land forms.
Prerequisite: Arch 192 and 193
3 hours (1 hour lecture, 2 hours studio), Fall, Winter and Spring terms
ES 252* Media Tools for Environmental Studies
See Environmental Studies course descriptions, page 261.

ES 253* Media Tools for Environmental Studies – Advanced Level
See Environmental Studies course descriptions, page 261.

ES 358* Environmental Pollution and its Control
See Environmental Studies course descriptions, page 262.

ES 380*/381* Environmental Studies Workshop
See Environmental Studies course descriptions, page 262.

ES 400 Environmental Law
See Environmental Studies course descriptions, page 262.

ES 411* Alternative Future Environments 1
See Environmental Studies course descriptions, page 262.

ES 412* Alternative Future Environments 2
See Environmental Studies course descriptions, page 262.

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.

091* An Introduction to Studies in Architecture
Created for those who wish to study architectural first principles. Objectives include participant exposure and visual communicative techniques including free-hand drawing etc. related to explorations in general design.
Prerequisite: None

095* An Introduction to Visual Design
Intensive studio participation involving seminars and lectures develops problem solving abilities through the introduction of man-made and natural structural models. Knowledge integration, the genesis of form is applied in the search for new ideas and methods.
Prerequisite: None

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: Architecture students only
8 hours per week lectures and workshop, Full term
1 course credit

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 students 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, (1 1/2 course credits)

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
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/her ability to consciously and deliberately make use of his/her own creative potential; 3) engendering an awareness of the capacity to use himself/herself and the people he/she works with to produce better solutions to the problems identified by the group.
Prerequisite: Consent of instructors
One 40 hour week, Winter term

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 areas, of appropriate complexity to the particular term.
Prerequisite: Approval of (in house) U.G.A.C.
3 hours per week, Fall and Winter terms

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 lectures/workshops, Fall Term
1 1/2 course credits

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 lectures/workshops, Spring Term
1 1/2 course credits

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 a specific architectural problem area, of appropriate complexity to the particular term.
Prerequisite: Approval of (in house) U.G.A.C.
3 hours per week, Fall and Winter terms

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 lectures/workshops, Winter term
2 course credits

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 lectures/workshop, Fall term
2 course credits

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.

022* Architecture & Its Social Context
A critical view of the social forces that shape buildings. Examples, both historical and contemporary, from differing cultures, will be used; Medieval architecture, Masai villages, Scandinavian buildings, Shaker architecture, the organization of architects offices, clients aspirations. If deemed useful, there will be a small design project.
Prerequisite: Consent of instructor

045* Finnish, British and North-American Architecture
Landscape, history, tradition, materials, and personalities in Finnish architecture and city planning. The development of modern architecture in Britain from 1930 until the present. Introduction to the major forces and forms of North American architecture.
Prerequisite: None
Course Descriptions
Architecture

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: Consent of instructor
4 hours per week lecture/lab, Fall term

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 lecture/lab, Winter term

244* History of Gardens of Europe and Western Asia
To study the garden as a work of art reconciling man with his world. Gardens of Europe and Western Asia are studied as responses to the stress and aspirations of an age to the climate and landscape of the land in which they were created.
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

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: second year standing
3 hours per week lecture/lab, Winter/Spring terms

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 lecture/lab, Fall term

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 lecture/lab, Spring term

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 lecture/lab

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

Courses for Bachelor of Architecture
(For Recommended Programme, see page 116)
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/her 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/her 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 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/she aspires to become a practising professional.
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, Fall term

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; sub-contractors; labour relations, estimating and cost control.
Prerequisite: B.E.S. standing
3 hours per week, Winter term

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, bolted and welded: criteria for choosing steel systems; introduction to plastic design.
Prerequisite: B.E.S. standing
4 hours per week, Fall term

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 sawn and laminated timber members.
Prerequisite: Arch. 462*
4 hours per week, Winter term

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, geometrics and materials; and vertical transportation systems.
Prerequisite: Arch. 372*
4 hours per week, Fall term

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 a specific architectural problem area, of appropriate complexity to the particular term.
Prerequisite: Approval of (in house) U.G.A.C.
3 hours per week, Fall and Winter terms

492, 493 Design Studio
The intent of these courses 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.
Prerequisite: B.E.S. or its equivalent
21 hours per week in both 492 and 493, Fall and Winter terms (2 course credits each)

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, Winter term

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, Spring term

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; synclastics 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
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 a specific architectural problem area, of appropriate complexity to the particular term.
Prerequisite: Approval of (in house) U.G.A.C.
3 hours per week, Winter and Spring 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 both in 592 and 593, Winter and Spring terms, (3 course credits each)

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 inter-disciplinary 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/her 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/her 10th academic term.

(FE)
Free Elective Courses selected by the student without restrictions as long as the course is approved by Senate.

Note
Department approval is mandatory for both TE and FE.
Course Descriptions
Arts

Arts Undergraduate Course Descriptions

Several courses formerly offered under the designation "Arts" are now offered under "Interdisciplinary Social Science". See course descriptions in the Social Development Studies 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.

105* Introduction to the Science 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*.

3 hours per week Fall and Winter

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.

3 hours per week

190*/191* Introductory Chinese
A course designed to impart a knowledge of the basic structure and grammar of modern Chinese. Emphasis will be divided equally between reading and conversation. The student will be expected to master a minimum of 500 characters. Limited to students with no prior knowledge of Chinese.

Prerequisite: Permission of instructor; in addition, Arts 190* is a prerequisite for Arts 191*.
192*/193* Introductory Chinese
Similar course to Arts 190*/191* but for speakers of any Chinese dialect except Mandarin. The course emphasizes standard pronunciation practice and analysis of Chinese literary forms.
Prerequisite: Permission of instructor; in addition, Arts 192* is a prerequisite for Arts 193*.

Note
Students may not receive credit for both Arts 190*/191* and Arts 192*/193*.

200G* Issues in Mass Communication 1
An introductory and interdisciplinary approach to those factors in mass media behavior that contribute to good communication or to distortion, including the historical, psychological, legal, sociological, semantic, etc. Emphasis will be on the domestic scene.
3 hours per week Fall term

201G* Issues in Mass Communication 2
The emphasis of this course will be on the mass media role in National and international affairs and a study of those factors in mass media performance, which contribute to better international understanding and conflict resolution. Topics will include propaganda, economic and political factors, government information systems, press freedom, language and stereotypes.
3 lectures. Fall term

205G* Peace and Conflict Studies 1
An examination of the phenomenon of human conflict. Special attention is given to influential theories of the roots of conflict (e.g., Marx and Freud), the question of the inevitability of conflict, the diverse forms of conflict and the moral implications of various types of conflict.
3 hours per week Fall term

206G* Peace and Conflict Studies 2
This course explores various means of conflict resolution on both global and domestic levels. Included are critical assessments of coercion, law, behavior control and nonviolence as models of resolution.
(Prerequisite: Arts 205G encouraged but not required.) 3 hours per week Winter term

211*/212* Computing Techniques in Language and Literature
An introduction to non-mathematical 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. Arts 212* will stress data management, I/O, SORTing, and the use of programme utilities.
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 everwidening rift between environmental 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. 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 Rollo May; and, current developments symbolized by Manson and contemporary films. Communities of love and the tensions between love and justice.
3 lectures. Fall term

219G* Dissent
A study of individuals who emerge in every society to challenge the prevailing consensus as advanced 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.

220R* Chinese Thought and Culture 1
An examination of traditional culture, institutions and the modern development of China as the context for the examination of contemporary Chinese society.
Prerequisite: none. Fall term

221R* Chinese Thought and Culture 2
An investigation of the dynamics of the new China: education, medicine, the arts, the position of women, foreign policy, the Cultural Revolution, rural and urban organization, the role of the army, the role of the Chinese Communist Party, and the philosophy of Mao Tse Tung.
Prereq: Arts 220R* or consent of instructor. Winter

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

271G*/272G* Introduction to Peace Research 1 and 2
This course will focus on the current basic issues including personality and aggression, international tension, cause 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

290*/291* Intermediate Chinese
This course is designed to extend the knowledge of the structure and grammar of Mandarin Chinese beyond the base provided by Arts 190*/191*.
Prereq: Arts 190*/191*; Arts 290* is a Prereq. for Arts 291*

292*/293* Intermediate Chinese
Description same as Arts 290*/291*.
A continuation of Arts 192*/193*.
Prereq: Arts 192*/193*; Arts 292* is a Prereq. for Arts 293*

Note
Students may not receive credit for both Arts 290*/291* and Arts 292*/293*

301G*/302G* Seminar in 20th Century Values
Not offered 1976/77.

320R*/321R* Special Topics in Chinese Thought and Culture
An indepth study of courses arising out of Arts 220R*/221R*

391*/392* Classic Chinese
A course based on selected readings from seminal works in the pre-modern literary, historical and philosophical tradition of China.
Prerequisite: Arts 190*/191* 290*/291* or permission of instructor

393/394 Classical Chinese
Course description same as Arts 391*/392*, but for speakers of any Chinese dialect.
Prerequisite: Arts 192*/193*, 292*/293*, or permission of instructor
Department of Biology

Professor, Chairman of Department
J. K. Morton, B.Sc., Ph.D. (Durham), F.L.S.

Associate Professor, Associate Chairman of the Department
A. G. Kempton, M.S.A. (Toronto), Ph.D. (Michigan State)

Professor, Graduate Officer
A. D. Harrison, M.Sc., Ph.D. (Cape Town)

Assistant Professor, Graduate Officer
S. M. Smith, M.Sc. (McMaster), Ph.D. (Manitoba)

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

Assistant Professor, Undergraduate Officer
W. R. Hawthorn, M.Sc. (McMaster), Ph.D. (Western)

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)
G. Power, B.Sc. (Durham), Ph.D. (McGill) (on leave of absence)

Associate Professors
C. R. Barnes, B.Sc. (Birmingham), Ph.D. (Ottawa)
A. M. Charles, M.Sc., Ph.D. (Manitoba)
E. B. Dambroff, M.Forestry, Ph.D. (Georgia)

H. C. Duthie, B.Sc., Ph.D. (Wales)
W. E. Inness, M.S.A. (Toronto), Ph.D. (Michigan State)
J. Kruvel, M.Sc. (Waterloo), Ph.D. (Western)
P. E. 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)
J. J. Dodson, B.Sc. (Waterloo), Ph.D. (McGill)
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)
C. I. Mayfield, B.Sc., Ph.D. (Liverpool)
J. C. Semple, B.Sc. (Tufts), M.A., Ph.D. (Washington University, St. Louis)
J. B. Theberge, B.Sc.A (Guelph), M.Sc. (Toronto), Ph.D. (U.B.C.)

Adjunct Faculty
I. R. Ball, B.Sc. (Liverpool), Ph.D. (Waterloo), Royal Ontario Museum.

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

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 $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 the structure and function of animals, survey of the animal kingdom, cell structure, embryology, human biology and general ecological concepts.
2 lect, 3 hrs lab, Winter term (Primarily for students of Kinesiology. Available also to students in Faculties other than Science)

130 Introduction to Biology
This course is the same as Biology 131 without the laboratory component.
(For non-Biology majors only)
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 lect, 3 hrs lab, on alternate weeks
(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 lect, 3 hr lab
(For Science students intending to major in Biol. 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.
Prereq: Biol. 132 or equiv., 2 lect., 3 hr lab
(For Optometry Students only)

203* Human Physiology
An integrated study of basic physiological processes with particular emphasis placed on the cardiovascular and respiratory systems. Other topics which will be discussed include digestion, excretion and endocrinology.
Prereq: Biol. 110* or 131 or 132. 2 lect., 3 hr. lab, Fall term
(Primarily for students in Kinesiology. Available to other students except those whose major field is Biology)

204* Human Physiology
A detailed study of physiological processes associated with nerve and muscle function, and consideration of the integrative role of the central nervous system.
Prereq: Biol. 110* or 131 or 132. 2 lect., 3 hr. lab, Winter term
(Primarily for students in Kinesiology. Available to other students except those whose major field is Biology)

231* Concepts of Ecology
An introduction to the study of the relationships of plants and animals to their environment. The nature of ecosystems, ecological energetics, biogeochemical cycling, community ecology, introduction to population biology.
Prereq: Biol. 131 or 132. 3 lect., plus field trips as required
Fall term

234 Plant Biology
A survey of the major groups of plants, and the fungi, including their evolution, morphology, ecology and importance to man.
Prereq: Biol. 131 or 132. 2 lect., 3 hr. lab

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.
Prereq: Biol. 131 or 132. 2 lect., 3 hr. lab (Only for students in Biol. Honours Programmes and 4-year Biol. majors)

237* Introductory Invertebrate Zoology
A study of the functional anatomy of selected invertebrate types with special emphasis on the various grades of organization and development in the different phyla.
Prereq: Biol. 131 or 132. 2 lect., 3 hr. lab, Fall term

238* Introductory Vertebrate Zoology
Comparative functional anatomy and development of selected vertebrate types, with special emphasis on the broad aspects of evolution within this group.
Prereq: Biol. 131 or 132. 2 lect., 3 hr. lab, Winter term

239 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.
Prereq: Biol. 131 or 132. 2 lect., 3 hr. lab, Winter term

245* General Microbiology 1
History and scope of microbiology. Study of the characteristics of bacteria and other microorganisms.
2 lect., 3 hr. lab, Fall term (Available to students excluded from Biol. 235)

246* General Microbiology 2
Relationships of microorganisms to man and his environment.
Prereq: Biol. 245* 2 lect., 3 hr. lab, Winter term (Available to students excluded from Biol. 235)

301 Human Physiology
The physiology of the major organ systems of the body. The topics discussed include circulation, respiration, digestion and nutrition, metabolism, muscle, nervous system, special senses, and the endocrine system.
Prereq: Biol. 131 or 132. 2 lect., 3 hr. lab (For Optometry students only)

331* Vertebrate Zoology
Major topics in vertebrate zoology as exemplified by both living and fossil members of the subphylum Craniiata.
Prereq: Biol. 238*. 2 lect., 3 hr. lab., Winter term

332* Arthropod Zoology
A survey of the phylum Arthropoda, including the insects, with emphasis on their classification, interrelationships and ways of life.
Prereq: Biol. 237*. 2 lect., 3 hr. lab, Winter term
333* Invertebrate Zoology
A survey of the major invertebrate phyla other than the arthropods, with emphasis on their functional anatomy, classification and ways of life.
Prereq: Biol. 237*. 2 lect., 3 hr. lab., Fall term

334* The Flowering Plants
A study of floral morphology in relation to classification and evolution. An introduction to taxonomy and nomenclature. History of taxonomy. Systems of classification. Mechanisms of pollination and dispersal. (Students entering this course are required to make a plant collection during the long vacation prior to the course.)
2 lect., 3 hr. lab., Fall term

335 Microbial Form And Function
Prereq: Biol. 235 or permission of instructor
3 lect., 3 hr. lab.

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.
Prereq: Biol. 234. 2 lect., 3 hr. lab., 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.
Prereq: Biol. 131 or 132. 2 lect., 3 hr. lab., Fall term (Available only to students 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.
Prereq: Biol. 238*. 2 lect., 3 hr. lab (Available only to students taking Chem. 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.
Prereq: Biol. 131 or 132. 2 lect., 3 hr. lab., 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.
Prereq: Biol. 234. 2 lect., 3 hr. lab., Winter term (Available only to students taking Chem. 332*-333*)

346* Population Ecology
The ecology of populations. Topics include: demographic parameters and their estimation; population growth and regulation; competitive and predator-prey interactions; population genetics and evolution; applied population biology.
Prereq: Biol. 231* and Math 253A* or equiv.
2 lect. and 1 tut. per week, Fall term

431 Quantitative and Experimental Ecology
A consideration of various procedures employed to study populations, population interactions, and community relationships such as diversity and stability. Topics include: the analysis of model properties, evolutionary aspects of ecology, structural descriptions of vegetation, systems ecology.
Prereq: Biol. 346* (For 1976-77 only, the prereq. will be Biol. 236). 2 lect. and 3 hr. field lab or tutorial

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.
Prereq: Biol. 235. 2 lect., 3 hr. lab.

343* 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.)
2 lect., 3 hr lab.

434 Genetics
A survey of genetics with emphasis on bacterial and bacteriophage genetics and the molecular basis of gene action.
2 lect., 3 hr lab.

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.
Prereq: Biol. 235, Chem. 332*-333* or 337
2 lect., 3 hr lab
437* Biosystematics
A study of evolutionary process in living organisms.
Prereq: Biol. 230*. 3 hr. lecture-seminar. Fall term

441 Plant Physiology
A detailed study of the physical and chemical processes that govern plant growth and function.
Prereq: Biol. 345* 2 lect., 3 hr. lab.

442 Comparative Animal Physiology
A comparative study of physiological processes in the animal kingdom with emphasis on endocrine physiology.
Prereq: Biol. 342 2 lect., 3 hr. lab.

443 Applied Microbiology
Properties of pathogenic microorganisms and special groups related to food and fermentation microbiology.
Prereq: Biol. 335 2 lect., 3 hr. lab.

444* Evolution
Prereq: Biol. 131 or 132. 3 hr. lecture-seminar. Winter term

445* Mycology
A seminar course covering fungal systematics, dispersal mechanisms, plant pathology, medical mycology. Fungi as food and in food processing; as producers of poisons and hallucinogens; in industry; in biological control. Fungi as predators; as coprophiles; as symbionts with algae, higher plants and animals.
Prereq: Biol. 234. 2 lect., 3 hr. lab., Fall term

446* Phycology
A study of selected topics in the biology of algae.
Prereq: Biol. 234. 2 lect., 3 hr. lab., 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 Prereq. 3 lect., Fall 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.
Prereq: Biol. 343* is strongly recommended as preparation for this course. 2 lect., 3 hr. lab

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.
Prereq: Biol. 235. 2 lect., 3 hr. lab.

450 Limnology and Oceanography
A survey course covering the important physical, chemical and biological aspects of fresh and marine waters and including such topics as circulation of nutrients, eutrophication, aquatic food chains and productivity.
Prereq: Biol. 346* and 333* (For 1976-77 only the prereq. will be Biol. 236 and 333). 3 lect.

499 Seniors Honours Project
The aim of this course is to provide able undergraduate students the opportunity to pursue original research, under the close supervision of a member of the Biology department. The results of this study will be presented in thesis form and 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 undergraduate officers in Biology. Normally, only students attaining at least a 70% average in the major field(s) will be accepted into this course.
Canadian Studies

Professor, Chairman of the Canadian Studies Group

Assistant Professor, Director of the Programme
S. E. McMulIin, B.A., M.A. (Carleton), Ph.D. (Dalhousie)

Members of the Canadian Studies Group

Professors
H. MacKinnon, B.A. (Montreal), Ph.L. S.T.L. (Gregorian), M.A. (Toronto), D.Phil. (Oxford)
W. U. Ober, B.A. (Washington and Lee), Ph.D. (Indiana)

Associate Professors
J. R. Dugan, B.A., M.A. (Toronto), Ph.D. (Yale)
R. R. Kerton, B.Com. (Toronto), M.A. (Carleton), Ph.D. (Duke)
G. R. McBoyle, B.Sc., Ph.D. (Aberdeen)
S. M. Weaver, B.A., M.A., Ph.D. (Toronto)
K. Westhues, B.A. (Conception), M.A., Ph.D. (Vanderbilt)

Participating Faculty (1975-76)

Professors
R. R. Krueger, B.A., M.A. (Western), Ph.D. (Indiana)
J. M. Wilson, B.A. M.A. (Toronto)

Associate Professors
R. D. Lambert, B.A., M.A. (McMaster), Ph.D. (Michigan)
W. R. Needham, B.Com. (Carleton), M.A., Ph.D. (Queen’s)

Assistant Professors
D. J. Horton, B.A. (Waterloo Lu.), M.A. (Waterloo), Ph.D. (McGill)
S. E. McMulIin, B.A., M.A. (Carleton), Ph.D. (Dalhousie)
P. Socken, B.A. (Toronto), M.A. (Iowa), Ph.D. (Toronto)

Lecturer
C. Crockford, B.Ed. (Alberta), M.A. (British Columbia)

The Programme

Year 1 (recommended):

A) 2 courses
English 101
History 123

B) 2 courses
Economics 101*/102*
Geography 101*/102*
Political Science 101*/102*
Sociology 120R*/121R*

C) 1 course
A course given in French such as 101*/102*, 131*/132*, or 151*/152*. (A course in French language is strongly recommended. In rare circumstances, however, a student unable to fulfil this recommendation may be allowed to substitute a third course from the group B social sciences list above).

Degree Programme

After completing their first year, students may apply for a degree programme which includes Canadian Studies. There are three options: a minor, a general programme, and honours.

Honour Programme

Students may choose straight or double honours in History, Economics, Political Science, Geography, Sociology, French, English or Anthropology. 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.

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 General Arts Degree (Canadian Studies)

A student takes fifteen courses with at least five of them in his major. The student would also take six courses in Canadian Studies (or seven if the French course is taken in year one). Students would take Canadian Studies 201*/202* and 300 as part of the Canadian Studies package.

A Minor in Canadian Studies

The Minor consists of five courses, two of which would be Canadian Studies 201*/202* and Canadian Studies 300, with the other three being selected from three different disciplines but all from designated Canadian Studies courses. A French language course is strongly recommended.
The core course for each year of the programme is an inter-disciplinary 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.

Core Courses

201* Canadian Studies
An interdisciplinary course offered both through lectures and discussion groups devoted to the Canadian social and physical environments. The course works from the assumption that regional identities are varied and complex in Canada, and that an understanding of this complexity is essential in the process of dealing with Canadian problems.

202* Canadian Studies
Also an interdisciplinary approach to the study of the cultural environment in Canada. Canadian culture is examined within a regional context.

300 Canadian Studies
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* or permission of the instructors

400 Canadian Studies
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

Anthropology
218* A Survey of North American Archaeology
226* A survey of Great Lakes Archaeology
231* North American Indian Hunting and Gathering Societies
232* North American Indian Pastoral and Horticultural Societies
233* Eskimo Cultures
240* Canadian Indian-White Relations 1830-1950
241* The Contemporary Canadian Indian Scene
310* Indians of the Canadian Subarctic

318* Great Lakes Archaeology – Paleo Indian and Archaic
326* Great Lakes Archaeology
333* Community Studies and Planning Change
499 Honours Essay

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
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
415* Major Canadian Writers
495 Senior Honours Essay (Canadian Literature option)

French
190 French Language, or French 151*/152* if students have not passed the equivalent of Year 5 French
131* Basic French
132* Basic French
191* French Language
192* French Language
205* Spoken French
206* Spoken French
250* Intensive Language Training
271* Poetry and Song in Québec
272* Introduction to French-Canadian Novel
273* Aspects of Québec
300 Advanced Instruction in Written French
375* Contemporary French-Canadian Novel
376* The "essai" in French Canada
401* Advanced Language Study
402* Advanced Language Study
471* French-Canadian Poetry
472* Contemporary Québec Theatre
501* Problems of French Language
502* Problems of French Language
Course Descriptions

Canadian Studies

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
123 Major Themes in Canadian History
224* Canadian History Since 1867
263 Canadian History
266 The History of Selected Racial and Regional Minorities
267* Canadian Non-Indigenous Minorities 1
268* Canadian Non-Indigenous Minorities 2
275* Comparative Studies in Canadian Regionalism to 1850
276* Comparative Studies in Canadian Regionalism after 1850
380 Canada 1867-1967
382 Canadian Intellectual History
383 History of French Canada in 1867
384 Canada in Crisis
386* Ontario History to Confederation
387* Ontario History Since Confederation
388* History of Canada/American Relations
389 Canada in World Affairs: The Twentieth Century
390 History of North American Indians
420 Senior Seminar in Nineteenth-Century Canadian History
421 Senior Seminar in Ontario History
423 Senior Seminar in Modern Quebec
425 Senior Seminar in Canadian Cultural History
450 Marxism and Canadian History

Political Science
102* Introduction to Politics 2
232* Policy Making in Canada
260* Canadian Government and Politics
291* The Canadian Legal Process
292* Aspects of Canadian Law
293* Political Journalism
331* Public Administration 1
332* Public Administration 2
341* Provincial Politics
343* Urban Politics 1
373* Political Parties
374* Interest Group Politics
377* Political Socialization
431* Canadian Public Policy 1
432* Canadian Public Policy 2
434* Canadian Foreign Policy
442* Politics in Ontario
443* Politics in Western Canada
444* Politics in Quebec
445* Politics in the Atlantic Provinces
451* Comparative Parliamentary Systems
461* Problems in Canadian Politics 1
462* Problems in Canadian Politics 2
473* Voting Behaviour
478* Research Seminar in Political Socialization

Sociology
101* Introduction to Sociology
120R Fundamentals of Sociology
205* Sociological Analysis of Social Problems
215* Sociology of Sex Roles
216* An Introduction to the Sociology of Marriage and the Family
250* Crime and Society
251* Ethnic and Racial Relations
262* Canadian Population
300* Canadian Social Institutions
301* Urban Sociology
303* Crisis in Social Structure and Character
304* Crisis Management
315* Social Stratification
321* Research Methods 1
323* Project in Sociological Research
327R Canadian Ethnic and Cultural Minorities
372* Medical Sociology
398* Seminar in Nationalism and Ideology in Canada and Quebec
499 Honours Essay

Principal Canadian Content Courses Offered by Other Arts Departments

Fine Arts
316* Canadian Art
317* Canadian Art

Inter-Disciplinary Social Science
18S221R* 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
264P* Religion in Canada 1
265P* Religion in Canada 2

Social Work
Soc Wk 120R* Introduction to Social Work
Soc Wk 121R* Social Problems
Department of Chemical Engineering

Professor, Chairman of Department
K. F. O'Driscoll, B.Ch.E. (Pratt Inst.), M.A., Ph.D. (Princeton)

Professor, Associate Chairman (Graduate Studies)
E. Rhodes, B.Sc., Tech., M.Sc., Ph.D. (Manchester)

Professor, Associate Chairman (Undergraduate Studies)

Professors
T. L. Batke, B.A.Sc., Ph.D. (Toronto)
J. J. Byerley, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (U.B.C.)
T. Z. Fahidy, B.Sc., M.Sc., (Queen's), Ph.D. (Illinois), P.Eng.
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), P.Eng.
D. C. T. Pei, B.Eng. (McGill), M.Sc. (Queen's), Ph.D. (McGill)
P. L. Silveston, B.S., M.S. (M.I.T.), Dr. Ing. (Munich), P.Eng.
D. R. Spink, B.S. (Mich.), M.S. (Rochester), Ph.D. (Iowa State)
G. A. Turner, B.Sc., (London), Ph.D. (Manchester)
B. M. E. van der Hoff, Ing. (Amsterdam), Ir. (Delft)

Professor Emeritus
A. H. Heatley, B.Sc., M.A., Ph.D. (Toronto)

Associate Professors
L. E. Bodnar, B.A., M.A. (Sask.), Ph.D. (McMaster)
C. M. Burns, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (Polytechnic Inst., Brooklyn)
K. Enns, B.A.Sc., LL.B., M.A.Sc., Ph.D. (Toronto)
J. D. Ford, B.Eng. (McGill), M.A.Sc., (Queen's), Ph.D. (Minn.), P.Eng.
C. E. Gall, B.A.Sc. (Toronto), M.Sc., (Queen's), Ph.D. (Minn.), P.Eng.
I. F. Macdonald, B.Eng. (N.S.T.C.), Ph.D. (Wisconsin)
G. L. Rempel, B.Sc., Ph.D. (U.B.C.)
C. W. Robinson, B.A.Sc. (U.B.C.), Ph.D. (U.C. Berkeley)
J. R. Wynnyckyj, B.Eng. (McGill), M.A.Sc., Ph.D. (Toronto)

Assistant Professors
J. M. Scharer, B.Sc., Ph.D. (Pennsylvania)

Faculty members having cross-appointments as shown

Course Descriptions

Chemical Engineering

Undergraduate Course Descriptions

100 Introductory Engineering Concepts 1
An introduction to the basic methods and principles used by engineers in the analysis and design of physical processes: units, dimensions, and measurements; mass balances; behaviour of fluids. Laboratory on visual communication is included.
3 h lect., one h tut., 6 h 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; Laboratory experiments illustrate the physical principles discussed.
3 h lect., 1 h tut., 3 h lab., Winter, Spring terms

102 Chemistry for Engineers
Chemical principles with applications in engineering. Stoichiometric calculations, properties of gases, properties of liquids and solutions; gas phase chemical equilibrium, ionic equilibrium in aqueous solution, oxidation-reduction reactions, chemical kinetics.
3 h lect., 1 tut., Fall term

211 Transport Processes 1 (Fluid Mechanics)
Fundamentals 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 particulate systems.
3 h lect., 2 h lab., Spring, Fall terms

220 Applied Mathematics 1
Statistical frequency distributions, tests of significance, correlations, curve fitting, sampling theory, applications: errors. design of experiments.
3 h lect., Fall, Winter terms

211 Transport Processes 1 (Fluid Mechanics)
Fundamentals 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 particulate systems.
3 h lect., 2 h lab., Spring, Fall terms

220 Applied Mathematics 1
Statistical frequency distributions, tests of significance, correlations, curve fitting, sampling theory, applications: errors. design of experiments.
3 h lect., Fall, Winter terms

Physical Chemistry 1
Introduction to physical chemistry. Ideal and real gases, the kinetics theory of gases, first law of thermodynamics, thermochemistry, heats of reaction, second law, chemical equilibria in simple systems, phase equilibria in simple systems, third law.
3 h lect., 1 h tut., Fall, Winter terms
231 Physical Chemistry 2
Thermodynamics of systems of variable composition, properties of solutions, ideal solutions, colligative properties of solutions, phase equilibria in complex systems; non-ideal solutions, chemical kinetics; empirical laws and mechanisms; theory of kinetics.
Prerequisite: Ch.E. 230, 3 h lect., 1 h tut., Spring, Fall terms

232 Inorganic Chemistry 1
Wave mechanics, atomic structure and the periodic table, chemical bonding, structural chemistry of elements and compounds, introductory transition metal chemistry, some thermodynamic aspects of inorganic chemistry.
3 h lect., Fall, Winter terms

233 Physical Chemistry Laboratory
Experiments on viscosity of gases and liquids, chemical kinetics, adsorption, homogeneous and heterogeneous catalysis, thermochemistry, phase equilibria, diffusion, determination of molecular weight of polymers, training in technical report writing.
3 h lab., 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 221, 3 h lect., 1 h tut., Winter, Spring terms

313 Transport Processes 3 (Mass Transfer)
Mass transfer by diffusion and convection applications to both stage-wise and continuous separation processes such as distillation, extraction, absorption and others; analogies between momentum, energy and mass transport.
Prerequisite: Ch.E. 312, 3 h lect., 2 h tut., Fall, Winter terms

315 Chemical Engineering Laboratory
Experimental application of physical and chemical principles using pilot scale equipments, experiments illustrating major unit operations (distillation, absorption, extraction, drying, humidification).
Prerequisite: Ch.E. 312, 6 h lab., Fall, Winter terms

320 Applied Mathematics 2
Gamma-, beta-, and error-functions; sine-, cosine-, exponential - and elliptic-integrals, linear differential equations; Wronskian, Green function; initial and boundary value problems; Bessel functions; Fourier series, integrals and transforms; orthogonal functions; Laplace transforms; applications.
Prerequisite: Ch.E. 220, 3 h lect., Winter, Spring terms

330 Chemical Engineering Thermodynamics
Thermodynamics of flow processes, vapour power plants, internal combustion engines, liquefaction of gases, refrigeration and evaporation, chemical equilibria in chemical reactions, thermal pollution, the energy crisis, efficient energy utilization and thermodynamics.
Prerequisite: Ch.E. 231, 3 h lect., Winter, Spring terms

331 Chemical Reaction Engineering
Homogeneous reactors: batch, CSTR, tubular flow systems, ideal models; residence time distributions in ideal reactors, temperature effects, steady states, semi-batch systems, nonideal behaviour, heterogeneous catalysis: mass transfer effects; catalytic rate equations, fixed and fluidized bed reactors.
Prerequisite: Ch.E. 231, 3 h lect., Fall, Winter terms

332 Inorganic Chemistry 2
Introductory electrochemistry: electrolysis, electrolytic conductance and transport, reversible electrode processes, irreversible electrode processes and electrode kinetics, electrochemical measurements and their analytical applications, chemistry of corrosion.
Prerequisite: Ch.E. 232, 3 h lect., Winter, Spring terms

334 Instrumental Methods of Chemical Analysis
An introduction to modern analysis including optical, electrochemical, radiochemical, chromatographic and spectroscopic methods.
3 h lab., Winter, Spring terms

420 Process Dynamics and Control 1
Block and signal flow diagrams, proportional-integral-derivative controllers, frequency response techniques, analytical and graphical stability criteria. Introduction to modern control theory.
Prerequisites: Math 31, Ch.E. 312, 3 h lect., 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 of products, study of criteria for the appraisal of capital expenditures, critical path method, linear programming.
3 h lect., Spring, Fall terms

482 Technical Seminar and Process Design
Technical seminars will be presented and criticized. Subject material will be from recent literature or industrial experience. Lectures on the sizing and costing of equipment, problems on the design of process components.
3 h lect., Spring, Fall terms
501 The Chemical Engineer as an Entrepreneur
How an individual engineer may develop a new small business to supply goods or services to Canadian chemical industries, while performing his/her own technical and management functions; technical, economic, legal and financial aspects.
3 h lect., Winter term

510 Prediction of Physico-chemical Properties
Methods of estimating physico-chemical properties of gases, and liquids in cases where experimental values are absent. Prediction is usually based on correlations of a form suggested in part by theory, with empirical constants based on experimental data.
3 h lect., Spring, Fall terms

515 Two-Phase Flow Operations
Introductory theory to one-dimensional two-phase flow: conventions, definitions, homogeneous theory, separated flow (Lockhart-Martineielli), particulate characterization and behaviour; applications: two-phase flow in pipes, boiling and evaporation, sedimentation, filtration.
3 h lect., Winter term

517 Performance of Separation Processes
Introduction, patterns of change and computational approaches, group methods, limiting flows and stage requirements, capacity and efficiency of contacting devices, energy requirements, selection, optimal design and operation, mass transfer with chemical reaction.
3 h lect., Winter term

520 Chemical Engineering Analysis
Application of advanced mathematical techniques to the analysis of chemical engineering processes.
Prerequisite: Permission of instructor
3 h lect., Fall, Winter terms

521 Process Dynamics and Control 2
Analog computation, time domain analysis, control of complex chemical systems.
Prerequisite: Ch.E. 420, 3 h lect., 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 h lab., 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 h lect., 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 h lect., 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 h lab., 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 h lect., Spring, Fall terms

551 Metallurgical Chemistry
Ionic equilibria, thermodynamics and kinetics of reactions in solution, bonding, stability and stereochemistry of coordination compounds and mechanisms of their reaction, introductory hydrometallurgy, corrosion and homogeneous catalysis.
3 h lect., Winter term

553 Principles of High Temperature Extractive Metallurgy
Principles of important Canadian metallurgical processes, kinetics of roasting and reduction industrial roasting, blast and electric furnace reduction; nature of melts and slags, slag metal reactions; converting, refining and fused salt electrolysis.
3 h lect., Winter term

560 Introduction to Biochemical Engineering
Aspects of microbiology and biochemistry, of interest to the biological process industries and to environmental pollution, classification and growth characteristics of microorganisms, physico-chemical properties of biological compounds, metabolism and biochemical kinetics.
3 h lect., some lab., Spring, Fall terms

561 Fermentation Operations
Engineering principles 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 h lect., some lab., Winter term
563 Food Processing
Formulation, processing, preservation and quality evaluation of natural and textured foods, food components and additives: mixing, extrusion, sterilization, separation, purification and concentration operations.
Prerequisite: Ch.E. 560 or permission of instructor
3 h lect., some lab., 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 aspects.
3 h lect., Spring, Fall terms

571 Physico-chemical Methods in Water Pollution Control
Treatment of waste water from metals processing industries; waste characterization; toxicity; recycle; treatment by electro-oxidation/reduction, ion exchange, solvent extraction, absorption, electrodialysis, reverse osmosis etc; economics, regulations, moral, legal, social and political implications.
3 h lect., Winter term

580 Research-Design Project 1
An individually supervised research and/or design project on any Chemical Engineering subject chosen by the student-professor group.
3 h lab., Spring, Fall terms

581 Research-Design Project 2
Continuation of Ch.E. 580.
Equivalent to two one-term courses.
12 h lab., Winter term

583 Process System Design
The undergraduate curriculum is brought together to accomplish by team effort the basic objective of the process engineer: the design of an integrated process.
4 h lab., 2 h tut., Winter term

585 Technical Elective Project
An individually supervised research or design project, based on one of the technical elective courses taken in the 4A term.
6 h lab., Winter term

007, 280, 281, 380, 381, 480, 481, – General
Awareness Seminar
Informal discussions on the Chemical Engineering Programmes.
Non-credit
Course Descriptions

Chemistry

Department of Chemistry

Professor, Chairman of Department
W. A. E. McBryde, M.A. (Toronto), Ph.D. (Virginia), F.C.I.C.

Professor, Dean of the Faculty of Science

Associate Professor, Associate Dean of the Faculty of Science
D. A. Brisbin, B.Sc. (Alberta), Ph.D. (Toronto)

Professor, Acting Director of the Guelph-Waterloo Centre for Graduate Work in Chemistry
A. J. Carty, B.Sc., Ph.D. (Nottingham)

Professors
J. Cizek, R.N.Dr. (Charles University, Prague), C.Sc. (Czechoslovak Academy of Sciences, Prague)
B. O. Fraser-Reid, M.Sc. (Queen's), Ph.D. (Alberta)
D. E. Irish, B.Sc. (Western), M.Sc. (McMaster), Ph.D. (Chicago), F.C.I.C.
F. W. Karasek, B.S. (Elmhurst), Ph.D. (Oregon State), F.C.I.C.
H. G. McLeod, M.A., Ph.D. (Toronto)
J. B. Moffat, B.A., Ph.D. (Toronto), F.C.I.C.
J. Paldus, R.N.Dr. (Charles University, Prague), C.Sc. (Czechoslovak Academy of Sciences, Prague)
L. W. Reeves, B.Sc., Ph.D., D.Sc. (Bristol), F.C.I.C.
G. Socrates, Dottore in Chimica (Geneva), Lib. Doc.
H. D. Sharma, M.Sc., (Delhi), Ph.D. (California)
J. G. Smith, B.A., M.A., Ph.D. (Toronto)
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. McCourt, B.Sc., Ph.D. (British Columbia)
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. Chich, 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
M. Barwell, B.Sc. (Brock), M.Sc. (Waterloo)
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), B.Sc. (Waterloo)

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 13.

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
The course covers the material considered essential preparation for first year chemistry courses. Included are formulae, nomenclature, stoichiometry, and an introduction to thermochemistry, solution chemistry, chemical equilibria, acids, bases and oxidation reduction reactions, kinetics and bonding.
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

10* General Chemistry Seminar
A 1 hour/week seminar course required for all Chemistry students in all years beyond Year 1.
1 h. zero credit, Fall, Winter and Spring

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 lec., 3 h. lab., alternate weeks, Fall, Winter terms (Normally for students in Year 2 Engineering)
36* Organic Chemistry 2
An introduction to the important classes of hetero-cyclic compounds and natural products.
Prereq: Chem. 26*, 3 lect., Fall and Spring terms
(Normally for students in Year 2 Engineering)

111* General Chemistry 1*
Structure and properties of matter, formulae, nomenclature, stoichiometry, atomic and molecular structure.
Prereq: Grade 12 Chem., 3 lect., Fall term
Science students must take Chem. 111L* with this course

111L* General Chemistry 1 Laboratory
Selected experiments for students taking Chemistry 111*. 3 h. lab., 0.25 course credit, Fall term

112* General Chemistry 2
Chemistry 111* continued to include chemical equilibria and rates of reaction and oxidation reduction reactions.
Prereq: Chem. 111*, 3 lect., Winter term
Science students must take Chem. 121L* with this course

112L* General Chemistry 2 Laboratory
Selected experiments for students taking Chemistry 112*. 3 h. lab., 0.25 course credit, Winter term

121* Chemical Structure
Stoichiometry and structure; periodic atomic properties and their chemical implications; descriptive chemistry of selected compounds; special interest topics.
Prereq: Yr. 5 Chem., Math (Functions and Relations; and Calculus) 3 lect., Fall term
Science students must take Chem. 121L* with this course

121L* Chemical Structure Laboratory
Selected experiments for students taking Chemistry 121*. 3 h. lab., 0.25 course credit, Fall term

122* Chemical Reaction
Ionic equilibria in aqueous solutions; oxidation-reduction; reaction kinetics and mechanisms in aqueous solutions; special interest topics.
Prereq: Chem. 121*, 3 lect., Winter and Spring terms
Science students must take Chem 122L* with this course

122L* Chemical Reaction Laboratory
Selected experiments for students taking Chemistry 122*. 3 h. lab., 0.25 course credit, Winter and Spring terms

212* Structure and Bonding
Ionic and valence bond models; molecular orbital theory; bond lengths and bond energies; hydrogen bond and other weak interactions; properties, structures and stereochemistries of typical inorganic compounds; acid-base behaviour; nomenclature. (Primarily for Honours students majoring in Chemistry).
Prereq: Chem 121*, 2 lect., Fall term

218* Development of Chemical Bonding and Structure
Prereq: Chem 121*, 2 lect., 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.
Prereq: Chem 218*, 2 lect., 1 tutorial, Winter term

220* Introductory Analytical Chemistry
The principles underlying quantitative measurements. (Primarily for Honours students majoring in Chemistry.)
Prereq: Chem 121*-122*, 2 lect., Fall and Winter terms

220L* Analytical Chemistry Laboratory 1
Selected experiments for students taking Chemistry 220*. 6 hrs., 0.5 course credit, Fall and Winter

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 students majoring in Chemistry.)
Prereq: Chem 220*, 2 lect., Fall, Winter and Spring terms

221L* Analytical Chemistry Laboratory 2
Selected experiments for students taking Chemistry 221*. 3 hrs., 0.25 course credit, 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.

Prereq: A first year Chemistry course, and a knowledge of Calculus. 2 lect. per week, 2 terms (full-year course)
Full-year course for Correspondence students only.

226* Chemical Analysis 1
A variety of classical and modern analytical methods.

Prereq: Chem 121*-122*, 2 lect., Fall term

226L* Chemical Analysis 1 Laboratory
Basic techniques of analytical methods.
3 hrs., 0.25 course credit, Fall term

227* Chemical Analysis 2
The evolution of some modern analytical methods.

Prereq: Chem 226* or 220*, 2 lect., Winter term

227L* Chemical Analysis 2 Laboratory
The application of analytical methods to contemporary problems in Chemistry and other Sciences.
6 hrs., 0.5 course credit, Winter term

237* Introductory Biochemistry
The basic chemistry of amino acids, peptides, proteins, carbohydrates and lipids including some aspects of metabolism.

Prereq: Chem 268*, 3 lect., Winter term
(For Optometry students only.)

237L* Introductory Biochemistry Laboratory
Selected Experiments for students taking Chemistry 237*
3 hrs., 0.25 course credit, Winter term

254* Physical Chemistry 1
Kinetic theory of gases and elementary transport properties. Thermodynamics of ideal systems. Rate of chemical reactions and applications to the elucidation of reaction mechanisms.

Prereq: Chem. 121*-122*, Math 130
2 lect., 1 tutorial, Fall and Winter terms
(Primarily for Honours students majoring in Chemistry)

255* Physical Chemistry 2
Introductory quantum mechanics. Phase equilibria, phase rule, and the properties of liquids and solutions.

Prereq: Chem 254*, Math 31*
2 lect, 1 tutorial, Fall, Winter and Spring terms
(Primarily for Honours students majoring in Chemistry)

264* Organic Chemistry 1
Preparation and reactions of typical organic functional groups examined from the basis of the reaction mechanisms. Introduction to spectroscopic correlations of these functional groups. Stereochemistry of organic molecules. (Primarily for Honours students majoring in Chemistry.)

Prereq: Chem. 121*-122*, 2 lect., 1 tutorial, Winter and Spring terms (but will be offered Fall 1976)

264L* Organic Chemistry Laboratory 1
Selected experiments for students taking Chemistry 264*.
3 hrs., 0.25 course credit, Winter and Spring terms (but will be offered Fall 1976)

266* Organic Chemistry 1
The properties, preparation, reaction and basic structural theory of the common classes of aliphatic compounds. Introduction of electrophilic and nucleophilic reaction mechanisms.

Prereq: Chem. 121* and 122*, 2 lect., 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.

Prereq: Chem 266*, 2 lect., Winter term

267L* Organic Chemistry Laboratory
Selected experiments for students taking Chemistry 267*
3 hrs., 0.25 course credit, Winter Term

(For students needing a full year of Organic Chemistry as a prerequisite to medicine, the sequence 266*-267* and 267L* should be selected; for Honours students majoring in Chemistry, 264*-364* plus the appropriate laboratory courses 264L*-364L* should be selected.)

268* Introductory Organic Chemistry
The basic chemistry of the important classes of aliphatic and aromatic compounds including aspects of stereochemistry and reaction mechanisms.

Prereq: Ont. Year 5 Chem.; (Yr. 1 Chem. desirable), 3 lect., Fall term (For Optometry students only.)

268L* Introductory Organic Chemistry Laboratory
Selected experiments for students taking Chemistry 268*.
3 hrs., 0.25 course credit, Fall term

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.
311* Radiochemistry
Prereq: Chem. 121* or equiv., 2 lect., Winter term

312* Transition Element Chemistry
The transition elements and their compounds. Stereochemistry of complex ions; ligand field and molecular orbital theories of metal-ligand bonding; electronic spectra and magnetochemistry of complexes; reaction mechanisms. 
Prereq: Chem. 212*, 2 lect., Fall, Spring terms

313* The Chemistry of the Main Group Elements
A systematic approach to the synthesis, properties, reactions and structures of main group element compounds. Trends in chemical behaviour, bonding and stereochemistry. Electron deficient compounds, the rare gases, chemistry of phosphorus, nitrogen and sulphur will be dealt with in detail. 
Prereq: Chem. 212*, 2 hrs., Winter term

314L* Inorganic Chemistry Laboratory 1
An introduction to practical inorganic chemistry. 
3 hrs., 0.25 course credit, Fall, Winter and Spring terms

315L* Inorganic Chemistry Laboratory 2
Advanced experiments in inorganic chemistry. 
Prereq: Chem. 314L* 
6 hrs., 0.5 course credit, Fall, Winter terms

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. 
Prereq: Chem. 218* or 212* 2 lect., Fall term

316L* Inorganic Chemistry Laboratory
Selected experiments for students taking Chemistry 316*. 
3 hrs., 0.25 course credit, Fall 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. 
Prereq: Chem. 221* or 227*, 2 lect., Winter term

320L* Chemical Instrumentation Laboratory
Selected experiments for students taking Chemistry 320*. 
3 hrs., 0.25 course credit, Winter term

332* Biochemistry 1
Prereq: Chem. 264* or 267*, 2 lect., Fall, and Winter terms (but will be offered Spring 1977)

332L* Biochemistry 1 Laboratory
Qualitative and quantitative measurements of biochemically important materials for students taking Chemistry 332*. 
3 hrs., 0.25 course credit, Fall and Winter terms (but will be offered Spring 1977)

333* Biochemistry 2
Introduction to the chemistry and metabolism of carbohydrates and lipids. 
Prereq: Chem. 332*, 2 lect., Fall and Winter terms

333L* Biochemistry 2 Laboratory
A continuation of Chemistry 332L* for students taking Chemistry 333*. 
3 hrs., 0.25 course credit, Fall and Winter terms

342* Quantum Chemistry
The postulates of quantum mechanics; review of quantum mechanics of hydrogen-like systems; angular momentum and simple coupling schemes; atomic spectroscopy; a discussion of multi-electron atoms as time permits. 
Prereq: Chem. 255*, 2 lect., Fall term even years only, beginning Fall 1976

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. 
Prereq: Chem. 212* or 218* or equiv., 2 lect., for two terms (full-year course). Full-year course for Correspondence students only equivalent to 311*-312*

350* Spectroscopy and Molecular Structure
Introduction to concepts and applications of microwave, Raman, IR, electronic and resonance spectroscopy with respect to molecular parameters. 
Prereq: Chem. 255*, 2 lect., Fall term

351* Statistical Thermodynamics
Not offered 1976-77. Will be offered Fall 1977.
Course Descriptions
Chemistry

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.
Prereq: Chem. 255*. 2 lect., 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.
Prereq: Chem. 255*, 2 lect., Winter term

355* Physical Chemistry 3
Elementary statistical mechanics. Introduction to the physical chemistry of surfaces and simple macromolecules.
Prereq: Chem. 255* and Math. 31*, 2 lect., Fall and Spring terms (Primarily for Honours Students majoring in Chemistry)

355L* Physical Chemistry Laboratory 1
Selected experiments for students taking Chemistry 355*. 3 hrs., 0.25 course credit, Fall, Winter, Spring terms

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.
Prereq: Chem. 122* and Math 130, 2 lect., Fall term

356L* General Physical Chemistry Laboratory 1
Selected experiments for students taking Chemistry 356*. 3 hours, 0.25 course credit, Fall term
(A special section in Winter term will be available for Honours Biology and Chemistry students only).

357* General Physical Chemistry
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 photochemical phenomena. Chemical kinetics.
Prereq: Chem. 356*, 2 lect., Winter term

357L* General Physical Chemistry Laboratory 2
Selected experiments for students taking Chemistry 357*. 3 hrs., 0.25 course credit, Winter term

358* Physical Chemistry 4
Some theories of rates of chemical reactions. Basic electrochemistry and transport properties of ionic solutions. Application of quantum mechanics to atomic spectroscopy.
Prereq: Chem. 355*, 2 lect., Fall, Winter terms
(Primarily for Honours Students majoring in Chemistry.)

358L* Physical Chemistry Laboratory 2
Selected experiments for students taking Chemistry 358*. 6 hrs., 0.5 course credit, Winter term

359* Application of Chemical Thermodynamics.

360* Organic Chemistry 3
Stereochemistry of organic compounds; conformational isomers, geometrical (cis-trans) isomers, optical isomers and diastereomers. Introductory carbohydrate chemistry.
Prereq: Chem. 261*, 2 lect., Fall term. For correspondence students only.

361* Organic Chemistry 4
Acidity and basicity of organic compounds. Formation and reaction of enolate anions with emphasis on their synthetic utility. Cycloaddition reactions.
Prereq: Chem. 360* or 261* or 364*, 2 lect., Winter term. For correspondence students only.

362* Theoretical Organic Chemistry

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.
Prereq: Chem. 364* or 267*, 2 lect., Winter term

364* Organic Chemistry 2
The treatment of organic chemistry in Chemistry 264* is continued and extended to aromatic compounds. (Primarily for Honours students majoring in Chemistry.)
Prereq: Chem. 264* 2 lect., 1 tutorial, Fall and Winter terms (but will be offered Spring 1977)

364L* Organic Chemistry Laboratory 2
Selected experiments for students taking Chemistry 364*. 6 hrs, 0.5 course credit, Fall and Winter terms (but will be offered Spring 1977)

365* Organic Chemistry 3
Stereochemistry and conformational analysis of organic molecules. Acidity and basicity. Formation and reactions of enolate anions with emphasis on their synthetic utility.
Prereq: Chem. 364* or 267*, 2 lect., Fall, Winter and Spring terms
366* Structural and Synthetic Organic Chemistry  
Stereochemistry of organic molecules; synthesis of selected organic compounds examined in detail with emphasis on cyclo-addition reactions and condensation reactions.  
*Prereq: Chem. 267* or 364*, 2 lect., Fall term

366L* Organic Chemistry Laboratory  
Selected experiments for students taking Chemistry 366*.  
3 hrs., 0.25 course credit, Fall term

367* Selected Topics in Organic Chemistry  
Some of the following topics will be discussed: natural products, photochemistry, organometallic compounds, carbohydrates.  
*Prereq: Chem. 365* or 366*, 2 lect., 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 lect., Winter term

409* Solid State Chemistry  
Packing in solids; metals, alloys and molecular crystals; ionic and covalent solids; chemical factors affecting crystal structures; properties of metals, semiconductors and molecular crystals.  
*Prereq: Chem. 212*, 2 lect., Winter term odd years only beginning 1977

411* Organometallic Chemistry  
*Prereq: Chem. 312*, 2 lect., Fall 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, hydroformylation. Synthesis and purification of metals.  
*Prereq: Chem. 312*, 2 lect., Fall term

417* Synthesis and Structure of Inorganic Compounds.  

419* Biological Aspects of Inorganic Chemistry  
Metalloproteins and other metal-containing biological molecules in hydrolytic enzymes; radio reactions; nitrogen fixation and oxygen transport; the role of alkali and alkaline earth metal cations.  
*Prereq: Chem. 312* or 316*, 2 lect., Winter term

420* Analytical Chemistry  
Selected topics in modern analysis of inorganic materials such as rocks, ores, ceramics, metals and alloys; Atomic flame spectroscopic methods, analytical X-ray techniques, methods for ultra-nure materials. trace and micro determinations.  
*Prereq: Chem 221* or 227*, 2 lect., 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.  
*Prereq: Chem 221* or 227*, 2 lect., Winter term

432* Biochemistry 3  
Kinetics, stereospecificity, structure and function of enzymes, bio-energetics, oxidative phosphorylation.  
*Prereq: Chem. 333*, 2 lect., Fall term

432L* Biochemistry 3 Laboratory  
Selected experiments for Honours Biology and Chemistry students taking Chemistry 432*.  
3 hrs., 0.25 course credit, Fall term

433* Biochemistry 4  
Chemistry and biosynthesis of porphyrins. Metabolism of amino acids, purines and pyrimidines. Roles of vitamins in biological transformations. Respiration, muscular contraction.  
*Prereq: Chem 432*, 2 lect., Winter term

433L* Biochemistry 4 Laboratory  
Selected experiments for Honours Biology and Chemistry students taking Chemistry 433*.  
3 hrs., 0.25 course credit, Winter term

434* Applied Biochemistry  
Chemistry and function of antibiotics; blood coagulation and related topics. Immuno-chemistry. Nutritional aspects of food.  
*Prereq: Chem. 333*, 2 lect., Winter term
440* Group Theory
Not offered 1976-77. Will be offered Fall 1977.

453* Polymer Properties and Polymerization
Polymerization reactions; control of polymer structure and properties.
Prereq: Chem. 353* or equiv., 2 lect., 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.
Prereq: Chem. 225*, 2 lect., 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.
Prereq: Chem. 225* or 356*, 2 lect., 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.
Prereq: Chem. 255*, 2 lect., Winter term

457* Experimental Aspects of Polymer Science
Selected experiments to describe properties of polymers and polymerization processes.
Prereq: Chem 353* or equiv., 1 lect., 3 hrs. lab., Winter term

458* Quantum Chemistry
The application of quantum mechanics to chemistry with emphasis on the investigation, correlation, and elucidation of chemical bonds and reactions.
Prereq: Chem. 358*. 2 lect., Winter term odd years only beginning Winter 1977

464* Spectroscopy in Organic Chemistry
Elucidation and identification of organic structures by contemporary spectroscopic techniques.
Prereq: Chem. 364*. 350*, 2 lect., Fall term

465* Special Topics in Organic Chemistry
Topics will be selected from photochemistry, organometallics, synthesis, heterocyclics, natural products, molecular rearrangements. (May be taken in third and fourth years as 465A* and 465B* provided topics are different).
Prereq. or corequisite: Chem. 365*, 2 lect., Winter term

492 Advanced Laboratory
9 hours laboratory
Fall and Winter terms (a full-year course)
Department of Civil Engineering

Professor, Chairman of the Department

Professor, Acting Chairman 1975-1976

Professor, Dean of Engineering
W. A. McLoughlin, B.Eng. (Saskatchewan), M.S., Ph.D. (Purdue), P.Eng.

Professor, Associate Dean of Engineering
H. H. E. Leipholz, Dipl. Eng., Dr.-Ing., Docent Habil (Stuttgart)

Associate Professor, Associate Chairman, Graduate Studies

Professor, Associate Chairman, Undergraduate Studies
J. Roorda, B.A.Sc. (Waterloo), Ph.D. (London), P.Eng.

Professors
S. T. Ariaratnam, B.Sc. (Eng.) (Ceylon), M.Sc. (London), Ph.D. (Cambridge)
M. Z. Cohn, C.Sc. (Bucharest), P.Eng.
R. Green, B.Sc. (Eng.) (London), M.Sc. (Queen's), M.Sc. (Waterloo), Ph.D. (Waterloo), P.Eng.
B. G. Hutchinson, B.E. (Sydney), M.Sc. (Queen's), Ph.D. (Waterloo), P.Eng.
J. T. Pindera, Dr. of Tech. Sciences (Warsaw), Docent Habil (Cracow), P.Eng.
T. Prasad, B.Sc., M.Sc. (Banaras Hindu Univ.), Ph.D. (Cambridge)
A. N. Sherbourne, B.Sc. (Manchester), M.S. (Lehigh), M.A., Ph.D. (Cambridge), P.Eng.
T. E. Unny, B.E. (Madras), M.Tech. (Kharagpur), Dr. Ing. (Dresden), P.Eng.

Associate Professors
R. W. Cockfield, B.Sc., M.Sc. (Queen's), Ph.D. (Waterloo), P.Eng.
G. J. Farquhar, B.A.Sc. (Waterloo), Ph.D. (Wisconsin), P.Eng.
O. L. White, B.Sc. (Melbourne), M.A.Sc. (Toronto), Ph.D. (Illinois), P.Eng.
S. Yagar, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (California), P.Eng.

Assistant Professors
N. Kouwen, B.A.Sc., Ph.D. (Waterloo), P.Eng.
J. F. Sykes, B.A.Sc., M.A.Sc., Ph.D. (Waterloo)
J. C. Thompson, B.A.Sc. (Toronto), M.S., Ph.D. (Illinois), P.Eng.

Adjunct Professors
D. C. Aird, M.B.A.
M. Batty, B.A. (Manchester)
J. J. Munk, B.Sc. (Sir George Williams), B.Eng. (McGill), LL.B. (Osgoode Hall), P.Eng.
T. McClurkin, Chartered Accountant
P. Novak, B.Sc. (London), Ph.D. (Prague), D.Sc. (Prague)
P. Allen
O. Stradal, C.E., D.Sc. (Prague)

Adjunct Lecturer
J. B. Kerr, M.A.Sc., (Waterloo)

Faculty members holding cross appointments as shown

Civil Engineering and Earth Sciences
Undergraduate Course Descriptions

110 Urban Transport Problems and Prospects
Overview of urban development and role played by transport. Dimensions of current issues such as congestion, travel equity, pollution and energy consumption. Transport demands and relation to land use. Transport planning options; transport technology, general development options.
Not intended for civil engineering students at any level
Not recommended for first year students

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 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. Newton's Second Law, energy and momentum, impulsive motions; systems of particles, plane motion of rigid bodies: equations of motion.

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 Solids 2
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.

222 Differential Equations

224 Probability and Statistics
A course in aspects of probability and statistics. Sample spaces, calculus of events, probability, conditional probability, independence, Chebychev's inequality, random sampling, parameter and interval estimation, hypothesis testing, regression, analysis of variance.

265 Structure and Properties of Materials
Topics include: crystalline and non-crystalline arrangements, bonding forces, structural defects, phase equilibria, non-equilibrium transformations, heat treatment, deformation resistance: elasticity, anelasticity, plasticity, creep, fracture, fatigue, 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 $60.

292 Socio-Economic Aspects of Civil Engineering
An overview of the man-environment interaction. Economic concepts of human welfare and resource allocation. engineering economic decisions, breakeven and minimum cost analysis, engineering methods and scheduling of resource allocation, interest, evaluation of alternatives.

298, 299 Seminar
The engineer in society. Principles, methods and practice of Civil Engineering. Informal lectures.

300 Civil Engineering Project 2
Detailed design of 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. Emphasis is placed on the integration of knowledge acquired in other 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.

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 introduction to 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: $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, clarification, filtration, disinfection, removal of dissolved materials, waste water characteristics; primary, secondary and tertiary treatment, sludge handling industrial wastes.

381 Hydraulics
An introductory course in hydraulics. Open channel flow, hydrometeorological 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
The basic features of the behaviour and design of structural concrete. Properties of concrete, reinforcing steel, flexural behaviour, shear, bond, combined axial and bending loads singly and doubly reinforced flexural sections. Design of continuous beams; yield line analysis for slabs.

415 Structural Design 2
A continuation of CE413 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.

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
Introduction to law and the Common Law legal systems; contracts, effect of mistakes on contracts, interpretation of contracts, breach of contracts, legal remedies; technical specifications; sale of goods; the Law of Agency; the Tort of Negligence, professional negligence; restrictive trade practices; Patent Law.

493 Engineering in the Canadian North
Introduction to the technical, ecological and sociological problems associated with construction in the Canadian North. Transportation, water supply, foundations, structures, etc. Engineering and Feasibility studies for railways, pipelines, natural resource explorations, vehicle development and marine anchorages.

498, 499 Seminar
The engineer in society. Principles, methods and practice of Civil Engineering. Informal lectures.

500 Special Project
An independent piece of engineering work, design or research, under the direction of a faculty member.

501 Approximate Analysis of Structures

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.

506 Project Management

508 Structural Dynamics and Stability

518 Plates and Shells
Elementary methods of analysis and design of plates and shells. Types, uses, typical materials and methods of construction; membrane theory for shells, elementary bending theory for plates and shells, derivation and solution of governing equations; 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.

522 Engineering Analysis

524 Probability, Statistics and Decision Theory
An extension of CE224: objective, subjective and axiomatic probabilities; classical inference; Bayesian decision theory, terminal and pre-posterior analysis; game theory, bargaining models; decisions under uncertainty; multiple regression analysis, introduction to stochastic processes.

525 Introduction to Finite Element Methods
The concept and theoretical basis of the finite element method are presented as a logical extension to solid body stress analysis of the matrix methods applied to structural frames. Students will analyze representative two-and three-dimensional problems using available programmes.

526 Continuum Mechanics
Mathematical preliminaries: Co-ordinate transformations, cartesian tensors, tensor fields, integral theorems; Analysis of stress, strain and rate of deformation. Fundamental laws: Conservation of mass, momentum, moment of momentum and energy. Constitutive equations: Application to specific continua.

534 Model Analysis of Engineering Structures

536 Model-Aided Design of Engineering Structures

540 Highway Design
The design of urban roads and streets. Driver characteristics, intersection capacity, alignment, cross sections, pavements, parking, signing, lighting, trade-offs in design of urban roads.
Course Descriptions
Civil Engineering

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 practice of transportation planning using case studies to illustrate current practice. Airport and air terminal planning; urban rapid transit, demand scheduled bus systems. Students will be required to complete a planning and design problem in one area.

551 Engineering Terrain Analysis
Introduction to engineering terrain analysis. Use of geologic and pedologic information and air photo interpretation techniques, prediction of engineering properties of soils, planning of engineering soil surveys; permafrost and muskeg; 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: CE454

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 waste-water estimates, water supply and distribution systems, urban hydrology, wastewater collection, hydraulics of treatment works.

584 Technological Forecasting and Long-range Planning
Needs for advanced forecasting and long-range planning in various physical, technological and social systems. Evaluation of different forecasting models and applications. Data requirements. Example economic, demographic, environmental and other problems.

586 Hydrology
A course in hydrology, following CE381. 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 the student 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

Associate Professor and Chairman of the Department
J. R. Dugan

Classics Faculty

Professors
P. Keresztes, M.A. (Toronto), Ph.D. (Graz)
D. C. Mackenzie, B.A., M.A., Ph.D. (Princeton)

Associate Professor
P. Forsyth, A.B. (Mount Holyoke), M.A., Ph.D. (Toronto)

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)

Spanish Faculty

Professor
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.Lit et Phil. Universitas Complutensis (Madrid)
B. Thalman, B.A. (DePauw), M.A., Ph.D. (Ohio State)

Lecturers
S. Harrison, B.A. (Oxford), M.A. (Toronto)
G. Renart, B.A. (Instituto Miguel Rua), M.A. (Toronto)

Italian Faculty

Assistant Professor
E. Evans, B.A. (Calcutta), D.Paed. (Bruges)

Sessional Lecturers
A. Gualtieri, B.A. (Toronto), M.A. (Colorado)
V. F. Golini, B.A. (McMaster), M.A. (Colorado)

French Faculty

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. BinamC, L. en Phil. Rom., Agrégé (Brussels)
J. R. Dugan, B.A., M.A. (Toronto), Ph.D. (Yale)
J. LaFrance, B.Paed., M.A., Ph.D. (Laval)
C. Racine, B.A. (Joliette), Lic. en Péd., Lic. ès Lettres, D.E.S. (Montreal), 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)
P. Socken, B.A. (Toronto), M.A. (Iowa), Ph.D. (Toronto)

Sessional Lecturers
H. S. Fournier, B.A. (Toronto), M.A. (Western), Ph.D. (Western)
M. Hennig, B.A. (Western), M.A. (Waterloo)

Co-ordinators
M. I. Evert-Phillips, B.A. en Péd. (Quebec), Gradunu du conservatoire d'art dramatique de l'Université de Montréal, B.A.-U.Q.A.M. (Montreal), M.A. (Waterloo)
N. Vassiliadis, B.A.-Lic. ès Lettres. M.A.

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 a particular class will meet.
2) In choosing courses each year, students should always bear in mind the requirements of the profession they intend to enter after graduation. The members of the department are at all times willing to advise students.
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 programmes – 8 courses (except French and Political Science – 7 courses)
   c) Single honours programme – 10 courses

Undergraduate Course Descriptions

Classics

Classical Civilization (Courses in Translation)

101* Colossos – The Major Figures of Ancient Greece
An introductory study of the achievement of ancient Greece through some of its most prominent figures. These seminal figures have been selected as representatives, for good or bad, of the Greek experience. Each year two of the following will be featured:
Theseus: The Minoan-Mycenaean Age of Bronze; Pericles and the Rise of Democracy; Socrates, Man and Martyr; Alexander the Great and the Age of Expansion.

Fall term
102* Colossos - The Major Figures of Ancient Rome
An introductory study of the achievement of ancient Rome through some of its most prominent figures. Each year the Roman experience will be examined in two of the following topics:
Caesar, Cicero and the Collapse of the Republican Ideal; Augustus: The Empire Rises; Nero and the Corruption of Power; Hadrian and the Imperial Machine.
Winter term

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* Medieval Civilization
Not offered 1976-77.

256* Medieval Civilization
Not offered 1976-77.

265* Classical Verse in Translation 1
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 Translation 2
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.
Year course

321* Forms of Classical and Neo-Classical Satire
Not offered in 1976-77.

322* Pastoral and Mythological Aspects of Classical and Neo-Classical Poetry
Not offered in 1976-77.

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*)
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*)
Winter term

365* Problems in Greek History 1
Not offered in 1976-77.

366* Problems in Greek History 2
Not offered in 1976-77.

371* Christianity and the Roman Empire 1
Not offered in 1976-77.

372* Christianity and the Roman Empire 2
Not offered in 1976-77.

381* From Diocletian to Constantine
Not offered in 1976-77.

382* Constantine the Great
Not offered in 1976-77.

386* Classical Prose in Translation
Not offered in 1976-77.

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)
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 Ancient Greek
A course designed for students beginning the study of ancient Greek or who have not yet reached the level expected in Greek 200. 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
An introduction to Greek epic and philosophy, with readings from Plato (selections are usually chosen from the Apology, Crito, Republic, or Symposium) and from Homer (selections from either the Iliad or Odyssey).
Prereq: Year 5 Greek, Greek 100 or instructor's permission

Year course

265* The Birth of History
An introduction to Greek history and historiography, featuring selections from Herodotus.
Fall term

266* The Drama of Euripides
Not offered in 1976-77.

365* The Greeks at War
Not offered in 1976-77.

366* The Lyric Age
Not offered in 1976-77.

375* Aeschylus and Early Greek Tragedy
The beginnings of the art of tragic drama will be examined through the plays of Aeschylus. Normally the Agamemnon is read in Greek, while the other extant plays are studied in translation.
Winter term

376* Classical Drama
Not offered in 1976-77.

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
Not offered in 1976-77.

200 A Survey of Latin Literature
A general survey of Latin prose and poetry from its beginnings to the Fall of the Roman Empire. The literary achievement of Rome will be examined mainly through selections in Latin with occasional readings in translation.
Prereq: Year 5 Latin, Latin 100, or instructor's permission

Year course

251* Language Study
Composition, translation, basic grammar with intensive analysis of selected works.
Fall term

265* Letters
Selections from the letters of Cicero and Pliny.
Fall term

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

352* Language Study
Not offered in 1976-77.

365* History and Historiography
Not offered in 1976-77.

366* Cicero
Selected orations, Caesar, De Bello Civili.
Fall term

375* Lyric Poetry
Not offered in 1976-77.

376* Elegiac Poetry
Not offered in 1976-77.

395* Mediaeval Latin Literature
Not offered in 1976-77.
Course Descriptions
Classics and Romance Languages

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.

465* Philosophy
Not offered in 1976-77.

466* Horace the Satirist
Not offered in 1976-77.

475* Comedy
Plautus, "Rudens;" Terence, "Phormio.
Winter term

476* Historiography and Literary Criticism
Not offered in 1976-77.

485* Roman Life in the Empire 1
Not offered in 1976-77.

486* Roman Life in the Empire 2
Not offered in 1976-77.

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

Waterloo at Laval
There is an arrangement between the Department and the Université Laval, at Québec, whereby Waterloo students may study for a year or a term at Laval. Further particulars may be obtained from the Department.

First-year French Courses
Students should read the following carefully in order to enrol initially in the appropriate course. When in doubt, consult the Department.

Level 1: Courses for students who have not studied French before

101* Reading French
An elementary course, taught in English, designed to give the student a rapid and adequate reading knowledge of French. Basic elements of French sentence structure are explained, and reading passages from diverse academic disciplines are studied. This course will not give the student training in oral French.
3 h. lect., 1 h. lab., Prereq: Consent of department. Fall term; Summer session

102* Reading French
A continuation and completion of the work begun in French 101*
Prereq: Fr. 101* or consent of Department
Winter term; Summer session

Note
Successful completion of French 102* will satisfy the "reading knowledge of French" requirement of University of Waterloo Graduate programmes.

131* Basic French
An elementary course designed to give the student a solid beginning in oral expression in the French language, as well as an understanding of the basics of French sentence structure.
4 h. lect., 1 h. lab., Prereq: Consent of Department. Fall term; Spring term; Summer Session

132* Basic French
A continuation and completion of the work begun in French 131*.
Prereq: Fr. 131* or consent of Department
Winter term; Summer session
Note
Students completing French 132* with very high standing may petition the Department for admission into the General French or Honours French Degree programmes.

Level 2: Courses for students who have studied French before but have not completed high school Year 5 French

151* Intermediate French
A comprehensive approach to language study. Involves reading, writing and speaking French.
3 h. lect., 1 h. lab., Prereq: Fr. 132* or consent of Department. Fall term; Spring term; Summer session

152* Intermediate French
A continuation and completion of the work begun in French 151*.
Prereq: Fr. 151* or consent of Department
Winter term; Summer session

Note
Students completing French 152* with high standing may petition the Department for admission into the General French or Honours French Degree programmes.

Level 3: Courses for students who normally have completed high school Year 5 French, or who have otherwise acquired an equivalent command of French.

191 French Language and Literature
This intensive course taught in French, has two components:
a) French language: emphasis on oral expression, comprehension, reading and writing;
b) Lectures and discussion on a representative selection of French novels and short stories.
2 h. language study, 1 h. lab., 2 h. lect. and disc.
Prereq: Year 5 Fr., Fr. 152* or consent of Department
Year course: Fall and Winter terms

192 French Language
A very intensive French language course, taught in French. Emphasis will be placed exclusively on strengthening oral expression, comprehension of spoken French, reading and writing skills.
3 h. lect., 1 h. language techniques
Prereq: Year 5 Fr., Fr. 152* or consent of Department
Year course: Fall and Winter terms; Summer session

195* Oral French for Co-op Students (formerly French 105*)
Intensive oral and aural training in the classroom as well as in the language laboratory, exercises in comprehension and conversation.
2 h. lect., 2 h. lab., Prereq: Year 5 Fr. or equivalent. French 152*, or consent of Department.
Fall term; Winter term; Spring term

Note
Students with credit for the former French 105* may not enroll in this course.

196* Oral French for Co-op students (formerly French 106*)
A continuation and completion of work begun in French 195*.
2 h. lect., 2 h. lab. Prereq: Fr. 195*, Fr. 105* or consent of Department
Fall term; Winter term; Spring term

Note
Students with credit for the former French 106* may not enroll in this course.

†The French Language Placement Test is designed to assist the student to find the French language course level best suited to his/her needs. The Department reserves the right to refuse admission to any of its language courses on any level to a student who has, in the Department's view, attained a level of competence either inferior to or superior to the levels of competence outlined in each course description. In order to permit proper evaluation of performance in the French Language Placement Test, the Department reserves the right to delay as necessary the commencement of classroom instruction.
Second-year French Courses:

205* Spoken French
Intensive oral and aural training in the classroom. There will be particular emphasis on comprehension and conversation, with the class being divided into small groups for practice in speaking. These groups will be streamed according to the fluency of the students. 3 h. lect., 1 h. lab.,
Prereq: normally one of Fr. 152; 190, 191, 192, 106* or 196*, or consent of Department
Fall term; Winter term; Spring term

206* Spoken French
Continuation and completion of work begun in French 205*
Prereq: Fr. 205* or consent of Department
Winter term; Spring term

Note 1
Each classroom section of this course will be limited to a maximum enrolment of 12 students.

Note 2
A student may repeat the course, on successive levels of difficulty. He/she will, however, receive a maximum of 1 credit for the course regardless of the number of times it is taken.

Note 3
A student registered in the General French or Honours French Degree programmes may include this course as one of his/her non-French electives (regardless of the number of times he/she may repeat). He/she may not count this course as one of the French courses required to complete his/her degree.

250 French Language
Continued training in spoken and written French, with a concentration on more difficult problems of the language. 4 h. per week, including language lab.
Prereq: Fr. 190 or Fr. 106* or consent of Department
Year course: Fall and Winter terms

251* French Language
Fall term of French 250: see note below.

252* French Language
Winter term 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 Québec
Not offered in 1976-77.

272* Introduction to the French-Canadian Novel
The course will deal with about seven novels, including ones by Gabrielle Roy and Gérard Bessette. The themes of the “roman de la fidélité”, the “roman social” and the “roman intérieur” will be studied.
Taught in French; Winter term

273* Aspects of Québec
A presentation of traditional and contemporary Québec in the fields of the Arts, literature, music, politics and society.
Taught in French; Fall term

281* Introduction to the French Theatre
The study of a choice of plays representative of different periods and styles. Taught in French.
Prereq: Fr. 191, 192 or consent of Department
N.B. Not open to students who have taken French 200

282* From Villon to Prévert
An introduction to French poetry through the discussion of a representative selection of works. Taught in French.
Prereq: Fr 191, 192 or consent of Department
N.B. Not open to students who have taken French 200

291* French and French-Canadian Civilization
This course traces the cultural development of France and Québec 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.
3 hours in classroom; Fall term

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
This course completes the study of 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.
Course Admission Requirement: French 291* is recommended
3 hours in classroom; Winter term

Note
See note under French 291*. 
Advanced Level French Courses

Language Courses

300 French Language
Advanced grammar and composition, including translation; oral practice and corrective phonetics. 4 h., including language lab.
Prereq: Fr. 250 or consent of Department Year course

301* French Language
Fall term of French 300: see note below.

302* French Language
Winter term of French 300: see note below.

Note
These half-courses are available only to students in the Co-operative System or with the permission of the Department.

401* Advanced Language Study
Consult the Department for further details of this course.
Prereq: Fr. 300 or Fr. 350. Fall term

402* Advanced Language Study
Consult the Department for further details of this course.
Prereq: Fr. 401* or consent of Department Winter term

501* Problems of the French Language
Advanced training in stylistics and in problems of translation. Admission to the course by permission of the Department only.
Fall term

502* Problems of the French Language
Advanced training in stylistics and in problems of translation. Admission to the course by permission of the Department only.
Winter term

Literature Courses

Period Numbering System
409-419 Medieval Language or Literature
420-429 Renaissance Literature
330-339, 430-439 17th Century French Literature
340-349, 440-449 18th Century French Literature
350-359, 450-459 19th Century French Literature
360-369, 460-469 20th Century French Literature
370-379, 470-479 French Canadian Literature
(This area includes also 270-279)

Courses offered in the Literature Courses number sequences may vary from year to year, and course numbers will be adjusted accordingly. Although there are no firm Course Admission Requirements, it is recommended that the student have completed a literature course on the 200 level.

Note 1
The Department requires that students registered in the General French degree programme complete, before graduation, at least three full credits in French on the 300 or 400 levels. Of these, one half-credit must be taken in at least three of the areas listed above.*

Note 2
The Department requires that students registered in the Honours French degree programme complete, before graduation, at least six full credits in French on the 300 or 400 levels. Of these, one half-credit must be taken in at least six of the areas listed above.*

Note 3
The Department requires that students registered in a Joint Honours programme combining French with another subject complete before graduation, at least four credits in French on the 300 or 400 levels. Of these, one half-credit must be taken in at least five of the above areas.*

*The above requirements will apply only to students completing their second year in the Winter term of 1975, or later.

331* Le Grand Siecle
A study of those major authors of the seventeenth century who, by influence or by reaction, provide the foundations of many future literary works.
Taught in French: Fall term

341* Eighteenth Century Literature:
The Aesthetic Dimension
Not offered in 1976-77.

351* Romanticism
A study of the French novel from 1800-1850. Selected authors will include Chateaubriand, Constant, Balzac, Stendhal, Hugo and Mérimé. Taught in French.
3 h. in classroom; Fall term

352* Realism and Naturalism
A study of the French novel from 1850-1900. Authors studied will include Flaubert, Maupassant, Zola and Huysmans. Taught in French
3 h. per week in classroom; Winter term

361* Contemporary French Literature
A study of selected texts by authors such as Sartre, Camus, Ionesco, Robbe-Grillet, Vian. Taught in French.
Fall term.
362* Gide, Proust and their contemporaries
Not offered in 1976-77.

375* Contemporary French-Canadian Novel
A study of a limited number of texts by authors such as Gabrielle Roy; Anne Hébert; Jacques Godbout; André Langévin; Hubert Aquin; Gérard Bessette. Taught in French
Fall term

376* The "essai" in French Canada
Not offered in 1976-77.

409* Medieval French Language
An introduction to the early development of French. Fall term

411* French Prose of the Renaissance
Not offered in 1976-77.

412* French Poetry of the Renaissance
Readings in sixteenth century poetry: Marot, the Pléiade, the baroque poets, etc. Taught in French
Winter term

413* Classical French Tragedy
The rise and decline of classical French tragedy from Corneille to Voltaire. Taught in French
Winter term

414* "The Philosophes": French Prose Writers of the Eighteenth Century
Selected texts from Voltaire, Rousseau, Diderot, etc. Taught in French; Fall term

415* Comedy and "drame bourgeois" of the 18th Century
Not offered in 1976-77.

416* Movements and Themes in Nineteenth Century Poetry
Not offered in 1976-77.

461* French Literature between the Wars
A study of some of the most significant literary works of the period in their historical, social and intellectual setting. Taught in French.
Winter term

471* French-Canadian Poetry
Not offered in 1976-77.

472* Contemporary Quebec Theatre
A study of the themes, structures and evolution of Contemporary Québec theatre, based on the principal plays of authors such as: Gratien Gélinas; Marcel Dubé; Yves Thériault; François Loranger; Anne Hébert; Jacques Ferron; Jacques Langirand; Michel Tremblay. Taught in French
Winter term

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.

Italian

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.
3 lectures and laboratory

210J Intermediate Italian
Advanced study of grammar, conversation and an 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.
Prereq: Italian 110J or consent of instructor
3 lect. and language lab., Year course

310J 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

311J Italian Literature
Continued survey of Italian literature with selected readings in prose and poetry, including one novel. One semester devoted to the Divina Comedia: Inferno.
Prerequisite: Italian 210J
3 lectures

320J Classical Literature
Not offered in 1976-77.

391J* Italian Novel
Selected novels of the Post World War II period

392J* Italian Poetry
Selected readings in contemporay lyric poetry
Spanish

101* Introduction to Spanish
Intensive drill in the fundamentals of grammar, comprehension and speaking. Some reading, translation and composition. The language laboratory is used as an integral part of the course.
3 h. in the classroom, 2 h. language lab., Fall term

102* Introduction to Spanish
A continuation of Spanish 101*.
3 h. in the classroom, 2 h. language lab., Winter
Prereq: Spanish 101* or consent of Department

191* Intermediate Spanish
For students with some knowledge of Spanish. Seeks to reinforce the language, both oral and written, through selections from literary works and grammar review. The language laboratory is also used to increase understanding and speaking skills.
Students wishing to enrol will be required to take the Spanish Language Placement Test administered by the Department at the beginning of the Fall term.†
3 h. in the classroom, 1 h. language lab., Fall
Prereq: Spanish 101*/102* or Grade 13 Spanish

192* Intermediate Spanish
A continuation of Spanish 191*.
3 h. in the classroom, 1 h. language lab., Winter
Prereq: Spanish 191* or consent of Department

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.
3 hours; Year course

251* Composition and Conversation
Intensive language study based on literary texts, including grammar, comprehension, oral discussion and essay writing.
Prereq: Spanish 191*-192*, Fall term

252* Composition and Conversation
A continuation of Spanish 251*.
Prereq: Spanish 251*, Winter term

255* Survey of Spanish Literature
A brief survey of Peninsular Spanish literature since the Poema de Mio Cid.
Prereq: Spanish 191*-192*
Required of all honours and majors students. Prereq. to all 3rd-and 4th-year courses. Fall term

256* Survey of Spanish American Literature
A survey of Literary trends and most significant works from the Conquest to the present.
Prereq: Spanish 191*-192*
Required of all honours and majors students. Prereq. to all 3rd-and 4th year courses. Winter term

265* The Spanish Short Story
Selected stories from outstanding writers of the 19th and 20th centuries in Spain.
Fall term

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
Not offered in 1976-77.

316* The Theatre of the Golden Age
Not offered in 1976-77.

331* The Spanish Novel in Translation
An in-depth study of the peninsular novel, including the Picarouses. 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) requirements.

335* Golden Age Prose Before Cervantes
Study of some of the Spanish romances of chivalry, pastoral, and picarose novels, didactic writings, and writings of the mystics. Texts include some of the Amadís, and the Diana of Montemayor. Lazarillo de Tormes, selections from the Guzmán, the Nombres de Cristo, and from San Juan de la Cruz and Santa Teresa.
Fall term

336* Don Quijote
An in-depth study of the Quijote.
Required for all honours and majors students.
Winter term

344* Romantic Drama and Poetry in Spain
Not offered in 1976-77
Classics and Romance Languages

Course Descriptions

345* The Novel of the Nineteenth Century
Not offered in 1976-77.

346* Galdós
Study of *Fortunata y Jacinta* and two other representative novels of Pérez Galdós.  
*Winter term*

351* Advanced Composition and Conversation
Writing of essays and discussion based on selection themes or topics relating to Spain or Spanish America. Formal grammar and translation are also included.  
*Prereq: Spanish 251*-252*, *Fall term*

352* Advanced Composition and Translation
A continuation of Spanish 351*.  
*Prereq: Spanish 351*, *Winter term*

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*

396* Recent Spanish American Prose
A critical study of masterpieces in prose from Sarmiento to the present.  
*Winter term*

415* The Prose of the Generation of '98
A study of selected prose with emphasis on the novel and the philosophical essay.  
*Fall term*

416* Drama and Poetry of the Generation of '98
Spanish poetry and drama from Antonio Machado to Juan Ramón Jiménez.  
*Winter term*

441* Old Spanish
Introduction to the origins and development of the Spanish language, with emphasis on phonology and morphology.  
*Required of all honours students. Fall term*

442* Medieval Spanish Literature
Analysis of texts from the 11th to the end of the 15th century, including the *Poema de Mio Cid*, *El libro de buen amor*, and *La Celestina*.  
*Required of all honours students. 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*

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*

498* Senior Honours Reading Course
Selected readings in Peninsular and/or Spanish American literature, from the origins to the present day. List to be distributed on student's declaration of honours programme. To be tested by the whole section at the end of the 4th year.  
*Required for all honours students. Winter term*

Note 1
By arrangement, 400-level courses in 20th century Peninsular Literature and senior composition and conversation will be taught at Wilfrid Laurier University. Please check Cross-Registration procedures.
Course Descriptions
Dance Group

Assistant Professor, Chairman of Dance Co-ordinating Committee; Associate Dean, Faculty of Human Kinetics and Leisure Studies
W. N. Widmeyer, B.A. (Western Ontario), B.P.E. (McMaster), M.A. (California)

Dean, Faculty of Human Kinetics and Leisure Studies
G. S. Kenyon, B.P.E. (UBC), M.S. (Indiana), Ph.D. (N.Y.U.)

Professor,
N. J. Ashton, B.Sc. (McGill), M.S. (Michigan)

Assistant Professor
R. Priddle, B.P.H.E. (Toronto), M.Sc. (Springfield)

Lecturers
J. Jarvis, B.A. (Toronto)
R. Ryman, B.A. (York)
L. Smith

Instructor
G. Micelli, B.Sc. (Waterloo)

Undergraduate Course Descriptions

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 perspectives from which dance can be studied.
2 hrs./wk. lect., 2 hrs./wk. studio; 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 instructor
2 hrs./wk. lect., 2 hrs./wk. studio; Winter 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; Fall 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

265* 20th Century Ballet: Part 1 (History)
An in depth 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; Fall term

272* Technique and Notation Analysis of Ballet
A theoretical and practical study of ballet technique. The course will explore the principles and technique of basic ballet emphasizing movement analysis through Massine Notation.
Prerequisite: Dance 1911/192* or consent of instructor
1 hr. lecture, 3 hrs. studio; Fall and Winter terms

273* Technique and Notation Analysis of Modern Dance
A theoretical and practical study of modern dance technique. The course will examine the fundamental principles and technique of modern dance emphasizing movement analysis through Labanotation.
Prerequisite: Dance 1931/194* or consent of instructor
1 hr. lecture, 3 hrs. studio; Fall and Winter terms
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 of instructor
2 lectures, 2 studio, Winter term

364* Development 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.
2 hrs./wk. lect., 2 hrs./wk. tut., 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 262*, 265*
2 hrs./wk. lect., 2 hrs./wk. studio laboratory, Winter term

367* 20th Century Ballet: Part 2 (Choreography)
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 265*
2 hrs./wk. lect., 2 hrs./wk. studio, Fall term

372* Principles and Technique of Ballet
A theoretical and practical study of selected aspects of ballet. The student is asked to draw upon his knowledge of anatomy and basic mechanics in order to better understand and perform ballet movements.
Prerequisite: Dance 272* plus Kin 200*, or consent of instructor.
1 hr. lectures and 3 hrs. studio; Fall and Winter terms

373* Principles and Technique of Modern Dance
A theoretical and practical study of selected aspects of modern dance. The student is asked to draw upon his knowledge of anatomy and basic mechanics in order to better understand and perform modern dance movements.
Prerequisite: Dance 273* plus Kin 200*, or consent of instructor.
1 hr. lecture and 3 hrs. studio; Fall and Winter terms

461*/462* Research Project
An independent research project on an approved topic, supervised by a faculty member. Required of all students enrolled in Honours 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: Honours Dance 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

474* Directed Study on Special Topics
For the student who wishes 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: Consent of faculty; Fall and Winter terms

The Faculty of Human Kinetics and Leisure Studies also teaches HKLS 240* Man, Leisure, and Society.


Drama and Theatre Arts Group

Associate Professor, Chairman of the Department
W. R. Chadwick, B.A., M.A. (Toronto), Ph.D. (London)

Assistant Professor
K. J. R. Wylie, B.A. (U.B.C.), M.F.A. (Hawaii)

Lecturers
T. Bentley-Fisher, Drama Centre, London
M. van Dijk, B.A., M.A., Wellington
M. Evans
J. M. Kelman, B.A., Waterloo

General Programme
1) A total of fifteen courses (thirty half 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.
2) At least six (twelve half courses) of the students courses must be in Drama and Theatre Arts.
3) Drama 101* and 102* are the required pre-requisites for most Drama and Theatre Arts courses.
4) In addition students must satisfy the following requirements:
   A) Drama 221*
   B) Drama 243* or 244*
   D) Drama 371* or 372*
   E) Drama 409*
   F) Any three other Drama courses or other approved courses in related departments.

Note
A student who has taken English 362*/363* may not also take English 190*.

Minor Programme
Drama 101* and 102*, plus eight other half courses of which two must be in dramatic literature.

Undergraduate Course Descriptions

Sequence of Study
In the first two terms all students will take Drama 101* and 102*. All students are strongly advised to take Drama 251* in the Fall term of their second year.

The Honours programme is designed so that a student could work through a particular sequence of courses in one field (acting, directing, technical) which would in effect become an area of specialization. The 499 project in the fourth year would them presumably be centered on this specialization. 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
Introductory study of the theatre as a major art form. Selected plays as produced in their historical context. Contributions of the actor, designer, and technician to theatrical production. Lectures as well as practical workshops in smaller groups.

3 hours per week.
102* Introduction to the Theatre 2
An extension of the studies described in 101*.
Prereq: Drama 101*, 3 hours per week.

221* Introduction to Acting (221* and 222* formerly 225)
An introduction to the fundamentals of acting. This course stresses the development of the actor through laboratory experience. Introductory work in scene study and characterization is included, as well as acting discipline and vocabulary.
Class meets 4 hours per week.
Prereq: Drama 101* and 102*.

222* Intermediate Acting
An extension of the studies begun in Drama 221*, this course stresses development of the actor through scene study.
Class meets 4 hours per week.
Prereq: Permission of Instructor only.

226* Seminar in Techniques 1
A series of workshop seminars in such areas as stage movement, vocal production, etc. Class meets as arranged.
Prereq: Drama 101*, 102* and consent of instructor.

227* Seminar in Techniques 2
See Drama 226*
Prereq: Drama 101*, 102*, and consent of instructor.

231* Design for the Theatre 1 (Fine Arts 228B) (formerly 229)
An introduction to the problems of designing for the theatre. Work for the course will include the preparation of drawings and models as well as practical experience in the theatre.
Prereq: Drama 101* and 102*.

232* Design for the Theatre 2 (formerly 229)
An extension of the studies described in 231*.
Prereq: Drama 101* 102* and consent of instructor.

243* Introduction to Technical Production 1
(243* and 244* formerly 242)
Theory and practice of building, painting, rigging, and shifting scenery; construction of properties; familiarity with lighting instruments, sound equipment and their control systems. Students will be required to spend a certain number of hours working on department productions.
Prereq: Drama 101* and 102*

244* Introduction to Technical Production 2
An extension of the studies described above in 243*.
Prereq: Drama 101* and 102* and consent of instructor.

251* Survey of Dramatic Literature and Dramatic Theory 1
The Greek and Roman periods.
3 hours per week.

Note
This and the next four courses divide the dramatic literature and theory of the Western world into five historical periods. Each course will cover about fifteen plays and the major works of dramatic theory of the period.

252* Survey of Dramatic Literature and Dramatic Theory 2 (English 232*)
The Middle Ages, the Elizabethans and Jacobes (excluding Shakespeare) and the Spanish Golden Age.

253* Survey of Dramatic Literature and Dramatic Theory 3 (English 233*)
French neo-classicism, the Restoration period, the comedy of manners tradition through to the twentieth century.

254* Survey of Dramatic Literature and Dramatic Theory 4
The eighteenth, nineteenth and early twentieth centuries, romanticism and naturalism.

255* Survey of Dramatic Literature and Dramatic Theory 5
The twentieth century from Brecht to the present.

261* Introduction to Directing 1 (261* and 262* formerly 325*)
Analysis of production and performance problems from the director's point of view. Study in the principles of stage direction. Special projects in directing, including the production of a workshop production.
3-4 hours per week with lab sessions by arrangement
Prereq: Drama 101*, 102* and at least one dramatic literature class.

262* Introduction to Directing 2
Consideration of problems involved in the directing of a production. Each student in the course will be required to form his own production company and mount a play.
4 hours per week with labs by special arrangement
Prereq: Drama 261* two dramatic literature classes and permission.

301* Script Interpretation 1
Advanced study and analysis of plays in the process of production covering selected periods and types of playwriting.
Prereq: Drama 101*, 102* and two dramatic literature classes.

302* Script Interpretation 2
An extension of the studies described above in 301*.
Prereq: Drama 101*, 102*, and at least two dramatic literature classes.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>306*</td>
<td>Special Studies in Theatre Production 1  (formerly 326*)</td>
<td>Production participation and the study of selected problems of theatrical production. Classes meet 3 hours per night, 5 nights per week for eight weeks during production rehearsals.</td>
<td>Drama 101* and 102*</td>
</tr>
<tr>
<td>307*</td>
<td>Special Studies in Theatre Production 2  (formerly 327*)</td>
<td>See 306*(abc)</td>
<td>Drama 101* and 102*</td>
</tr>
<tr>
<td>321</td>
<td>Advanced Acting 1  (321* and 322* formerly 425)</td>
<td>Advanced work in acting. Course involves individual and ensemble work in selections from specific plays with attention given to various periods and styles in acting. 4 hours per week.</td>
<td>Drama 221* and 222*</td>
</tr>
<tr>
<td>322*</td>
<td>Advanced Acting 2</td>
<td>An extension of the studies described in Drama 321*.</td>
<td>Drama 321* or permission</td>
</tr>
<tr>
<td>343*</td>
<td>Theatre Technology 1  (343* and 344* formerly 442)</td>
<td>Advanced study and practice in the various aspects of the technology of the theatre. Production participation involving 3 hours per night for 5 nights a week for 2 1/2 weeks in either Fall or Winter term is required. 2 h. lect. and 3 h. lab. per week.</td>
<td>Drama 243* and 244*</td>
</tr>
<tr>
<td>344*</td>
<td>Theatre Technology 2</td>
<td>An extension of the studies described in Drama 243.</td>
<td>Drama 243* and 244*, and permission</td>
</tr>
<tr>
<td>351*</td>
<td>Canadian Drama</td>
<td>For a description of this course see English 316*.</td>
<td></td>
</tr>
<tr>
<td>361*</td>
<td>Advanced Directing 1  (361* and 362* formerly 422)</td>
<td>Each student in the course will be required to form his own production company and mount a play. 4 h. per week, labs by special arrangement.</td>
<td>Drama 261*, 262* and at least three dramatic literature classes and permission</td>
</tr>
<tr>
<td>362*</td>
<td>Advanced Directing 2</td>
<td>An extension of the studies described in Drama 361*.</td>
<td>Drama 361* and at least four dramatic literature classes and permission</td>
</tr>
<tr>
<td>371*</td>
<td>Theatre History 1  (371* and 372* formerly 329)</td>
<td>A survey of theatre history from classical Greece to 1700. 3 hours per week.</td>
<td>Drama 101* and 102*</td>
</tr>
<tr>
<td>372*</td>
<td>Theatre History 2</td>
<td>An extension of the studies described in Drama 371*.</td>
<td>Drama 101* and 102*</td>
</tr>
<tr>
<td>381*</td>
<td>Costuming 1  (381* and 382* formerly 330)</td>
<td>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.</td>
<td>Drama 101* and 102*</td>
</tr>
<tr>
<td>382*</td>
<td>Costuming 2</td>
<td>An extension of the studies described in Drama 381*.</td>
<td>Drama 101* and 102*</td>
</tr>
<tr>
<td>406*</td>
<td>(abc) Theatre Workshop 1  (formerly 426*)</td>
<td>Participation in stage production for advanced students.</td>
<td>Permission of the play director</td>
</tr>
<tr>
<td>407*</td>
<td>(abc) Theatre Workshop 2  (formerly 427*)</td>
<td>Participation in stage production for advanced students.</td>
<td>Permission of the play director</td>
</tr>
<tr>
<td>409*</td>
<td>Theatre Criticism  (formerly 430*)</td>
<td>Study and practice of the criticism of theatre production and performance. 3 hours per week. This course will not normally be taken until the student's final year.</td>
<td></td>
</tr>
<tr>
<td>490*</td>
<td>A-E Selected Seminars in Drama and Theatre Arts</td>
<td>Seminars in special areas of drama and theatre.</td>
<td>Permission of the department</td>
</tr>
<tr>
<td>491*</td>
<td>A-E Selected Seminars in Drama and Theatre Arts</td>
<td>Seminars in special areas of drama and theatre.</td>
<td>Permission of the department</td>
</tr>
<tr>
<td>499*</td>
<td>Senior Seminar</td>
<td>Required of all Honours Drama students and open only to students in their fourth year. It is designed to give students an opportunity to complete a comprehensive presentation in a major area of concentration during his/her senior year. The project may be of a practical nature (e.g. acting, directing, etc.) or it may be a research thesis. Each student will also be required to discuss the project in a public forum and write a comprehensive examination.</td>
<td></td>
</tr>
</tbody>
</table>
Department of Earth Sciences

Professor, Chairman of the Department
R. N. Farvolden, M.Sc. (Alberta), Ph.D. (Illinois)

Professor, President of the University
B. C. Matthews, B.S.A. (Toronto), A.M. (Missouri), Ph.D. (Illinois)

Professors
P. F. Karrow, B.Sc. (Queen's), Ph.D. (Illinois)
P. G. Morris, B.Sc. (London), M.Sc. (British Columbia), Ph.D. (McGill)

Associate Professors
E. C. Appleyard, B.Sc. (Western), M.Sc. (Queen's), Ph.D. (Cambridge)
C. R. Barnes, B.Sc. (Birmingham), Ph.D. (Ottawa)
J. A. Cherry, B.E. (Saskatchewan), M.S. (Cal. Berkeley), Ph.D. (Illinois)
P. Fritz, Dipl. Geol., Dr. Rer. Nat. (Technische Hochschule Stuttgart)
O. L. White, B.Sc. (Melbourne), M.A.Sc. (Toronto), Ph.D. (Illinois)

Assistant Professors
E. O. Frind, B.A.Sc., M.A.Sc., Ph.D. (Toronto)
J. P. Greenhouse, B.Sc., M.Sc. (British Columbia), Ph.D. (California)
D. E. Lawson, B.Sc., M.Sc. (New Brunswick), Ph.D. (Reading)
A. V. Morgan, B.Sc. (Leicester), M.Sc. (Calgary), Ph.D. (Birmingham)
E. J. Reardon, B.Sc. (St. Francis Xavier), Ph.D. (Penn. State)

Research Assistant Professor
R. W. Gillham, B.S.A. (Toronto), M.Sc. (Guelph), Ph.D. (Illinois)

Adjunct Professors
C. I. Dell, B.A., M.A. (Toronto), Ph.D. (Michigan)
R. M. Brown, B.Sc. (Bishops), Ph.D. (McGill)
P. H. von Bitter, M.Sc. (Acadia), Ph.D. (Kansas)

Senior Demonstrators
M. L. Copp, B.A. (Minnesota)
D. Nowlan, B.A. (Trinity)

Undergraduate Course Descriptions

Details of the undergraduate programmes offered by the Faculty of Science are to be found in Chapter 13.

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 lect., 3 h. lab.
Students who are taking, or have taken Science 100* may not take Earth 130 for credit because of overlapping material.

221* Geochemistry 1
Origin and abundances of elements. Chemical characteristics of sedimentary, igneous, and metamorphic rocks. The geological application and interpretation of geochemical data in sedimentary and exploration geochemistry. Introduction to isotope geology and radiometric dating.
2 lect., 3 h. lab., Winter, Spring terms

231* Mineralogy and Crystallography
2 lect., 3 h. lab., Fall term

232* Petrography
Optical properties and identification of minerals under the microscope. The study of rocks in thin section. The classification and identification of sedimentary, igneous, and metamorphic rocks.
Prereq: Earth 231*
2 lect., 3 h. lab., Winter, Spring terms

235* Stratigraphy
The principles of stratigraphy, and an introduction to the structural framework of North America.
2 lect., 2 h. lab., Fall term

1 Earth Sciences and Biology
2 Earth Sciences and Civil Engineering
3 Earth Sciences and Man-Environment Studies
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 lect., 2 h. lab., Fall term

260* Introductory Structural Geology
An introduction to the deformation of rocks, the effect of stress on rock materials, and 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 lect., 2 h. lab., Winter, Spring terms

331* Igneous Petrology
The principles and theories of igneous rock genesis. Silicate phase equilibria in magmatic systems. Magmatic differentiation; distribution and occurrence of magma types.
Prereq: Earth 231*, 241*
2 lect., 3 h. lab., Fall term

332* Metamorphic Petrology
Prereq: Earth 231*, 232*
2 lect., 3 h. lab., Winter term

333* Sedimentology 1
2 lect., 3 h. lab., 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.
Prereq: Earth 236*
2 lect., 2 h. lab., Fall term

342* Geomorphology
2 lect., 3 h. lab., 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.
Prereq: Earth 235*
2 lect., 2 h. lab., Winter term

355* Mathematical Geology 1
Introduction to the principles of probability and statistics and their application in the Earth Sciences. Evaluation of quantitative data; statistical models.
Prereq: Math 130 and an introductory course in computer programming
3 lect., Fall term

360* Introduction to Applied Geophysics
An introduction to applied geophysics, covering seismic, gravity, electric, electromagnetic, magnetic, radiometric and borehole logging methods.
Prereq: Physics 111-112* or consent of instructor
3 lect., 2 h. lab., Fall term

368* Geophysics 1
Prereq: Math 130, Phy. 121*-122* or equiv.
2 lect., 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*).
Prereq: Earth 368*
2 lect., 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 231*, 232*
3 lect., 2 h. lab., Winter term

421* Geochemistry 2
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.
Prereq: First year Chem., Earth 221*
2 lect., 3 h. lab., Fall term
427* Crustal Evolution
An analytical critique of the plate tectonics theory, its historical development, the evidence on which it is based, past and present criticisms. Tectonic syntheses based on the theory in the light of the world geology.
2 lect., 2 h. seminars, Winter term

432* Precambrian Geology
The geology, tectonics, stratigraphy and history of the Canadian Precambrian Shield. The early evolution of the earth’s crust. The Precambrian time scale and problems of geochronology. Life climate and physical conditions in Precambrian time.
2 lect., 2 h. lab., Winter term

433* Sedimentology 2
Prereq: Earth 333*
2 lect., 3 h. lab., Winter term

434* Biostratigraphy
Methods to 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.
Prereq: Earth 236* or 336*
2 lect., 2 h. lab./seminar, Fall term

435* Advanced Structural Geology
The geometry, kinematics and dynamics of structural geology. The relationship of structures from the microscopic to the megascopic scale; statistical studies of structural elements.
Prereq: Earth 260*
3 lect., 2 h. lab., Fall term

436 Honours Thesis
A course for honours Earth Sciences students only. 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 lect., 1 h. 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 lect., one hour tutorial, 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 lect., 3 h. lab., Fall term

456* Mathematical Geology 2
Boundary value problems in geophysics and hydrogeology. Mathematical modelling of geological systems, simulation.
Prereq: Earth 355* Math 130
3 lect., 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.
Prereq: Earth 360*
2 lect., 2 h. lab., 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.
Prereq: Earth 231*, 232*, 370*
3 lect., 2 h. lab., Fall term

480* Field Study
Depending on the demand and the availability of an instructor, a six week field course may be offered in an area of unusual geological interest during the spring or summer. This course will consist of two weeks of classroom lectures and one month in the field location. Expenses are to be paid by the student.
Prereq: consent of the instructor.
Department of Economics

Associate Professor, Chairman of the Department
R. R. Kearton, B.Comm. (Toronto), M.A. (Carleton), Ph.D. (Duke)

Associate Professor, Associate Chairman
A. Olsen, B.Comm. (Sir George Williams), M.B.A. (Western Ontario)

Associate Professor, Graduate Officer
W. R. Needham, B.Comm. (Carleton), M.A., Ph.D. (Queen's)

Assistant Professor, Undergraduate Officer
K. M. H. Bennett, B.A., M.A. (Queen's), Ph.D. (McGill)

Professors
J. H. Hotson, B. A. (Colorado College), M.A., Ph.D. (Penn.)
A. Koutsoyiannis, B.A. (Athens), Ph.D. (Manchester)
V. C. Walsh, B.A., M.A., Ph.D. (Trinity College, Dublin)

Associate Professors
L. F. Fletcher, B.Com (Mount Allison), A. M., Ph.D. (Brown)
S. K. Ghosh, B.S., M.S. (Calcutta), M.A., Ph.D. (Wisconsin)
C. Byrd, B.B.A., M.B.A. (Michigan)
N. E. Lavigne, C.R., B.A. (Western), M.Com. (Ottawa), M.B.A. (Detroit)

Assistant Professors
A. Andrikopoulos, B.A. (Athens), M.A. (Wayne State), Ph.D. (Southern California)
S. W. Kardasz, B.A. (Loyola)
G. Russell, B.Com., M.B.A. (McMaster), R.I.A.

Lecturers
S. Shinohara, B.A. (Tokyo), M.A. (Chicago) (part-time)
K. Stollery, B.A. (Southern California), M.A. (Queen's) (part-time)
R. M. Blair, B.Eng., M.B.A. (Queen's), C.A. (part-time)
R. Kilimnik, B.A. (Waterloo), M.B.A. (McMaster) (part-time)

Adjunct Professors
A. Headlam, F.C.A.
L. Seguin, B.Com. (McGill) C.A.

Course Descriptions
Economics

Associate 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, R.A., M.S. (Stanford), M.A., Ph.D. (U.C. at Berkeley) Department of Management Sciences

Undergraduate Course Descriptions

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*, 211* plus either 221* or 221+ at least four half courses in Economics at the 300 level or above. 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 with respect to 300 level courses).

The number of courses offered in a particular year will not necessarily include all of those listed below.

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 economic problems of society, the functioning of a mixed capitalistic enterprise system, the economic role of government, the composition of pricing of national output, pricing of productive factors, and income distribution.

102* Introduction to Macroeconomics
Determination of national income; the banking system; government fiscal and monetary policy; international trade and finance; and current economic problems.

Fall and Winter terms
Early in the Fall term the Department of Economics administers a test in Economics 101*|102* for students who have completed Economics in Year 5. Any student who scores at least 70 per cent in the test will be exempted from Econ. 101*|102* and may register for Econ. 201*|202*.

191* Introduction to Financial Accounting 1
Recording transactions: measuring income; preparation and analysis of financial statements; accounting for assets, liabilities, and owner equity.
2 lect., 2 h. lab., Fall and Winter

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.
Prereq: Economics 191*
2 lect., 2 h. lab., Fall and Winter

Early in the Fall term the Department of Economics administers a test in Economics 191*|192* for students who have completed Accounting in Year 5. Any student who scores at least 70 per cent in the test will be exempted from Econ. 191*|192* and may register for Econ. 291*|292*.

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. 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.
Prereq: Eco. 193* is a prereq. for Eco. 194* Winter and should be taken prior to Pol. Sci. 231* Spring.
Fall and Winter terms

201* Microeconomic Theory
Theory of consumer demand; production theory; market structure; resource pricing and allocation under perfect and imperfect competition.
Prereq: Eco. 101*, Fall and Winter

202* Macroeconomic Theory
Theory of the determination of the level of national income, employment and the price level.
Prereq: Eco. 102*, Fall and Winter

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.
Prereq: Eco. 101*, 102*, Fall and Winter

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.
Prereq: Eco. 101*, 102*, Fall and Winter

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.
Prereq: Eco. 101*, 102*, Fall and Winter

233* Regional Economics
Application of economic theory to the analysis of regional economic problems, including, for example, the problem of chronically depressed areas, and of regions whose economic activity is concentrated in one or two major industries.
Prereq: Eco. 201*, Winter term

241* Cost-benefit Analysis and Project Evaluation
Methods for evaluating private and public projects; decision rules; efficiency conditions and methods of conducting cost-benefit analysis. Application of the technique.
Prereq: Eco. 201*, Winter term

261* World Economic History
Not offered 1976/77.
# Course Descriptions
## Economics

<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>221 Statistics for Economists</td>
<td>321 Intro. Econometrics</td>
<td>413 Economic Growth Theory</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>421 Econometrics I</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>422 Econometrics II</td>
<td></td>
</tr>
<tr>
<td></td>
<td>233 Regional Economics</td>
<td>332 International Monetary Theory</td>
<td>432 International Economic Policy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>333 Interregional Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>335 Economic Development</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
263* Economic History of Canada
A study of the economic development of Canada; export staple theory, industrial structure and national policies analyzed in a Classical-Marxian framework.
Prereq: Eco. 101*, 102*, Winter term

291* Intermediate Financial Accounting 1
Includes a review of the foundations of accounting theory and the accounting process. This is followed by an in-depth treatment of the accounting problems associated with the asset side of the balance sheet. Included would be cash, temporary investments, accounts receivable, inventories, plant assets and intangibles.
Prereq: Eco. 191*, 192*, Fall and Winter

292* Intermediate Financial Accounting 2
The major subject matter of this course will be an in-depth treatment of the accounting problems associated with the equity side of the balance sheet. This would include bonds payable, pensions and leases, accounting for income taxes and shareholder’s equity (including earnings per share). The treatment of accounting changes and the statement of changes in financial position will also be covered.
Prereq: Eco. 191*, 192*, Fall and Winter terms

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 Microeconomics
Distribution theory; production, consumption and general equilibrium analysis; welfare economics.
Prereq: 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.
Prereq: Economics 202*, 231*, Winter term

303* Economic Thought
A critical survey of the development of economic thought from Adam Smith though 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.
Prereq: Eco. 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.
Prereq: 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.
Prereq: 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.
Prereq: 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 interntional trade to analyse interregional economic relations.
Prereq: Eco. 201*, 231*, (Eco. 233* 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.
Prereq: Eco. 101* (Eco. 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
Not offered 1976 77.
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.
Prereq.: Eco. 201* (Eco. 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
Not offered 1976-77.

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.
Prereq: Eco. 201*, 202*, Fall and Winter

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
Accounting and reporting of costs for inventory valuation and management control. Introduces product costing, overhead cost analysis, standard cost systems and responsibility accounting. Emphasis is placed upon the use of accounting information for decision making.
Prereq: Eco. 191*, 192*, Fall and Winter term

393*/394* Managerial Finance 1, 2
An introductory conceptual framework for decision making in financial management. Emphasis is placed upon the investment problem in long term assets, capital structure and dividend policy. Techniques studied will be applied to actual case situations.
Prereq: Eco. 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.
Prereq: Eco. 301*, 302*, Four-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.
Prereq: Eco. 301*, 302*, Four-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.
Prereq: Eco. 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.
Prereq: Eco. 201*, 202*, 211*, 221*, 321*, Fall, 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.
Prereq: Eco. 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.
Prereq: Eco. 301*, 302*, 331*, 332*, Winter terms

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.
Prereq: Eco. 231*, 301*, 302*, 341*, Fall term

Economics
442* Economics of the Public Sector 2
Fiscal stabilization, fiscal federalism, public pricing, international public finance, social security and other contemporary policy issues.
Prereq: Eco. 441*, Winter term

451* Advanced Topics in Resource Economics
Advanced analysis of selected topics in the area of energy, land, and labour resources.
Prereq: Eco. 201*, 202*, 231* 355*

461* Comparative Economic Systems
Not offered 1976-77.

481*-489* Special Studies
Research and reading courses under the direction of individual instructors. Admission by consent of instructor.

491* Advanced Accounting 1
Most of this course will be devoted to a comprehensive treatment of business combinations and long-term intercorporate investment. This will include a detailed consideration of the preparation of consolidated financial statements. Some consideration will also be given to the problems associated with the translation of foreign currency financial statements.
Prereq: Eco. 291* 292*, Fall term

492* Advanced Accounting 2
Consideration will be given to alternative accounting models for the determination of business income. Models involving price level adjustment, current values and combinations of these concepts will be covered. The balance of the course will be devoted to specialized topics such as partnership accounting, estates, trusts, liquidations and reorganizations.
Prereq: Eco. 291*, 292*, Winter term

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, Chairman
K. D. Srivastava, B.Sc., B.E. (Hons.) (Roorkee), Ph.D. (Glasgow), P.Eng.

Associate Professor, Associate Chairman (Graduate Studies)
Y. L. Chow, B.Eng. (McGill), M.A.Sc., Ph.D. (Toronto)

Professor, Associate Chairman, (Undergraduate Studies)
E. L. Heasell, B.Sc., Ph.D. (Imperial College, London)

Professor, Dean of Graduate Studies
L. A. K. Watt, B.Sc. (Manitoba), M.S. (Chicago), Ph.D. (Minnesota)

Professors
R. G. Anthes, B.A.Sc., M.A.Sc. (Toronto), Ph.D. (Illinois)
R. H. MacPhie, B.A.Sc. (Toronto), M.S., Ph.D. (Illinois)
J. Reeve, B.Sc., M.Sc., Ph.D. (Manchester), P.Eng.
D. J. 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
J. D. Aplevich, B.Eng. (Saskatchewan), Ph.D. (Imperial College, London), P.Eng.
I. F. Blake, B.Sc., M.Sc. (Queen's), M.A., Ph.D. (Princeton)
J. D. Cross, B.Sc. (Cardiff), M.Sc., Ph.D. (Carleton), P.Eng.
G. J. Dufault, B.A. (Ottawa), B.Sc. (Carleton)
J. A. Field, B.E. (Saskatchewan), M.A.Sc., Ph.D. (Toronto), P.Eng.
J. V. Hanson, B.A.Sc. (Toronto), M.Sc., Ph.D. (Imp. Coll. London)
J. S. Keeler, B.A.Sc., M.A.Sc. (Toronto), P.Eng.
W. N. Meikle, B.A.Sc., M.A.Sc. (Toronto), P.Eng.
B. Stott, B.Sc., M.Sc., Ph.D. (Manchester)
R. G. van Heeswijk, Dipl. Ing. (Delft, Holland), P.Eng.

Assistant Professors
M. I. Elmastry, B.Sc. (Cairo), M.A.Sc., Ph.D. (Ottawa), P.Eng.
T. Kameda, B.S., M.S. (Tokyo), Ph.D. (Princeton)
V. H. Quintana, I.I.E. (Chile), M.Sc. (Wisconsin), Ph.D. (Toronto)
E. Sadat, B.Sc. (Technion, Israel), M.S. (Washington, St. Louis), Ph.D. (Minnesota)
P. A. Vuorinen, B.A.Sc. (Toronto), Ph.D. (London)
W. J. Wilson, B.E., M.Sc. (Saskatchewan), Ph.D. (Cambridge), P.Eng.

Adjunct Professors
H. C. Card, B.Sc., M.Sc. (Manitoba), Ph.D. (Manchester) Oct. 1/75 to Sept. 30/76
J. Carr, B.A.Sc. (Toronto), M.A.Sc., Ph.D. (Waterloo) May 1/75 to Apr. 30/76

Visiting Professors
W. A. Brown, B.Eng., M.Eng. (Melbourne), Ph.D. (Queens Belfast) Sept. 1/75 to Dec. 31/75
K. C. Gupta, B.Sc. (Punjab), B.E., M.E. (Bangalore), Ph.D. (Pilani) Jul. 1/75 to Jun. 30/76
I. N. Hajj, B.E. (Beirut), M.S. (New Mexico), Ph.D. (Berkeley) Sep. 1/75 to Aug 31/76

Laboratory Director
R. L. Wright, P.Eng.

Undergraduate Programme

Details of the undergraduate programme in Electrical Engineering may be found on page 98. Each course extends over one term only.

Undergraduate Course Descriptions

14 Electrical Engineering 1
Kirchoff's Laws, mesh current and node voltage equations, super-position theorem, phasors, measuring instruments, power factor and its correction, magnetic circuits, transformers, introduction to d.c. and a.c. motors and generators, polyphase circuits.
Prerequisites: GE112, Math 12, Math 21 or equivalent

32 Electrical Engineering 2
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
Course Descriptions
Electrical Engineering

202 Seminar
General Seminar

203 Concepts in Electrical Engineering
A series of lectures by the E.E. Faculty and invited speakers surveying the areas of networks, devices, electronics, communications, computers, power, control, antennas, microwaves.

205 (Math 25) Advanced Calculus for Electrical Engineers I
Differential calculus 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.

221 Principles of Digital Logic Circuits
An introduction to digital systems, switching algebra, combinational logic analysis and synthesis. Minimization using map methods. Elementary treatment of sequential circuits including design of clocked circuits with specified transition tables. Number representation and arithmetic processes, Codes and parity.

233 Physical Electronics
Electromagnetic radiation, photoelectric effect, Compton effect; Wave aspects of particles; Structures of hydrogen atoms; many electron atoms; Solid State Physics, semiconductors, n and p-type materials, Fermi levels, mass action law, charge neutrality, diffusion; introduction to p-n junctions.

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.

261 Energy Processing & Conversion

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.

293 Measurement and Instrumentation 1
Safety in the laboratory, measurement errors, accuracy. The oscilloscope, d'Arsonval meters, rms and mean values, ac measurements, electrodynamic 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
Conditional probability and independence; Bayes' Theorem; random variables; functions of random variables; distribution functions; applications to reliability and failure rates; marginal and conditional distributions; correlation and applications to regression and statistical testing.

317 Signal Analysis Methods
Fourier series, periodic functions; Fourier transforms, non-periodic functions; The discrete Fourier transform, discrete time sequences; the Z transform, discrete time systems.

324 Introduction to Digital Circuits and Computers

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.

351 Electronics 1
Review of semiconductors. Boltzman relations; derivation of p-n junction, d.c. and a.c. characteristics; the bipolar transistor; derivation of d.c. and a.c. terminal characteristics, small and large signal models. Introduction to the insulated gate field effect transistor. (MOSFET).
352 Electronics 2
Large signal amplifiers; biasing networks and stability; single and multi-stage small-signal amplifiers; the hybrid-pi model; high and low frequency cut-off effects; feedback amplifiers; stability; oscillators; noise in electronic circuits; modulation and detection systems.

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; Electro-magnetic Fields; Maxwell’s equations; plane waves, reflection and refraction; Poynting vector; waveguides.

380 Introduction to Systems and Control
Mathematical modelling of systems and components; introduction to simulation; characteristics of feedback systems; signal flow graphs; frequency response; system stability by Routh-Hurwitz criterion, Nyquist plot and Root Locus techniques.

401 Seminar
General Seminar

402 Seminar
General Seminar

407 Numerical Methods

418 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 and demodulation techniques; channel and receiver noise.

419 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.

425 System Simulation
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; 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.

427 Computer Hardware Design

434 Quantum Electronics and Magnetics
Laser principles, 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.

435 Semiconductor Devices 1
Relaxation times, scattering mechanisms, ionisation rates, avalanche and Zener breakdown, recombination models. Review of p-n junction theory. Selected topics from: Photo devices, solar cells, Silicon controlled rectifiers, microwave devices, Schottky, varactor or light emitting diodes, junction field-effect devices.

436 Semiconductor Devices 2
Techniques for the design and realization of integrated circuit elements: Simple bipolar and MOSFET models. Current sources, d.c. level shifting, I.C. biasing, differential and output stages. Design and analysis of logic circuit elements and logic implementation: Active memories, RAM, ROM, shift registers.

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.

446 Algebra of Linear Systems
Continuous and discrete linear systems; linear transformations; finite field theory; polynomials over finite fields; matrix algebra, system decomposition.
453 General Electronic Circuits
Selected topics from: Applications of the MOST and JFET to modern circuits. Design of operational amplifiers, IC temperature compensation. Power supplies, amplifiers. Differential, low noise amplifiers, power amplifiers. Modulators, mixers, detector circuits, receiver front end design.

454 Pulse and Switching Circuits
Selected topics from: switching characteristics of semiconductor devices, non-sinusoidal wave generation and shaping, voltage and current sweeps, binary circuits, and gates, digital integrated circuits, DTL, DCTL, ECL, and TTL.

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.

463 Power Electronics
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.

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; coordinate systems, sequence impedances and transmission line constants; analysis of unbalanced systems protection techniques and fault analysis; voltage and reactive power control; power transfer and system stability; load flow; computer methods; transient response; introduction to HVdc transmission.

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.

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.

481 Control Systems
Performance specification, synthesis of single-input single output system; state variable representation for continuous and discrete time systems; analysis of multivariable systems.

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, Chairman of the Department
W. U. Ober, B.A. (Washington and Lee), Ph.D. (Indiana)

Assistant Professor, Associate Chairman
Undergraduate Officer
P. D. Beam, B.A. (Waterloo), M.A. (McMaster), Ph.D. (Toronto)

Associate Professor and Graduate Officer
N. C. Hulin, B.A. (Concordia), M.A. (Chicago), Ph.D. (Johns Hopkins)

Professor and Associate Dean, Undergraduate Affairs
J. C. Gray, B.A. (Washington State), M.A. (Connecticut), Ph.D. (Syracuse)

Professor and Associate Dean, Special Programs
K. L. Ledbetter, A.B. (Central College, Mo.), M.A., Ph.D. (Illinois)

Professors
J. Gold, B.A. (Birmingham), Ph.D. (Wisconsin)
G. R. Hibbard, B.A., M.A. (London)
C. F. MacRae, B.A. (Western), M.A. (McMaster), Ph.D. (Toronto)
W. R. Martin, M.A., D.Litt. et Phil. (South Africa)
W. K. Thomas, M.A., Ph.D. (Toronto)

Associate Professors
R. R. Dubinski, B.A., M.A. (Western), Ph.D. (Toronto)
A. I. Dust, M.A., Ph.D. (Illinois)
B. N. Honeyford, B.A., Ph.D. (Toronto)
H. E. Haworth, B.A. (Rollins), M.A., Ph.D. (Illinois)
P. M. Hinchcliffe, B.A. (British Columbia), M.A., Ph.D. (Toronto)

Associate Professors
R. M. Levitsky, 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)

W. R. Macnaughton, B.A. (Toronto), M.A., Ph.D. (Wisconsin)
E. F. Shields, B.A. (Chesterhill), M.A. (Villanova), Ph.D. (Illinois)
H. E. Haworth, B.A. (Rollins), M.A., Ph.D. (Toronto)

Assistant Professors
S. Fogel, B.A. (Carleton), M.A. (British Columbia), Ph.D. (Purdue)
R. N. Gosselink, B.A. (Kansas), M.A., Ph.D. (Colorado)

D. S. Keppel-Jones, B.A. (Notre Dame), M.A., Ph.D. (Queen's)
Sister M. Leon, S.S.N.D., B.A. (Toronto), M.A. (Detroit)

D. R. Letson, B.A. (Waterloo), M.A. (McMaster), Ph.D. (Toronto)
R. Lister, B.A., M.A., Ph.D. (Toronto)
E. P. McCormack, M.A. (Glasgow), Ph.D. (Manitoba)
S. E. McMullin, B.A., M.A. (Carleton), Ph.D. (Dalhousie)

J. S. North, B.A., M.A. (British Columbia), Ph.D. (Alberta)
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 joint Honours programmes involving English see page 75.

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.

Although the Department of English provides advisers to help students to choose their programmes, to arrange their courses, and to conform with the University, Faculty, and departmental regulations, students are urged to study the Calendar very carefully because they are themselves responsible for failure to abide by these regulations.

First Year

Either English 101 or 102 is the recommended first-year course. 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*, 245R and 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.

Undergraduate Course Descriptions

101 The Living Tradition
An examination of examples of the greatest literature 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 basic text will be the one-volume Norton Anthology.

102 Poem, Play and Story
Different kinds of literature will be explored so as to discover how the shape of a literary work contributes to its meaning. Students will read ballad, lyric, and narrative poetry; classic tragedy and comedy and absurdist, existential and expressionist plays; novels and short stories.

108* Themes of Literature
An exploration of the great variety of literature through thematic perspectives.

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
This course will attempt to acquaint the student with forms of the literary artist’s moral vision of man in “Utopian” writings. It will involve an examination of the role of the imagination in helping to inform and embody cultural ideals of various periods.

108*C Literature and Morality
Works in English literature from its beginnings are selected for their bearings on questions of morality.

108*E Women in Literature
A study of the nature and role of women in British, Canadian, and American literature. Works by both men and women 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 against existing norms. The course will examine a number of rebel types and concepts, moral implications and 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 centering on the theme of man in crisis, the stress being on the individual at variance with his inner self, his fellow man, or his world. The course will discuss the process in which wisdom and maturity are gained as the ultimate products of suffering.

109* Basic Writing Skills
The course provides training in the techniques that produce good university writing. It teaches such elements as focus of theme and development of central idea, use of supporting material, and methods of organization. The course moves from the paragraph to the essay, from exposition to argumentation. Ten to twelve short writing assignments, typically done within the class meetings, are required. Grammar review may be required of those students who demonstrate a need for it.

Note
Persons whose native language is not English should be registered in a section identified with the division suffix “Z”.

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 faculties, the course examines some of Shakespeare’s comedies, history plays, and tragedies. Shakespeare’s variety and flexibility in developing characters and dramatic structures are stressed, as are significant themes.
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 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 nations of the English-speaking world. Topics such as oral literature, myth, legend, tale, and märchen will be discussed.

204* Introduction to Folklore 2
Similar to 203* but dealing with folk-drama, ballads, songs, medicines, riddles, chants, proverbs, and charms.

205R* The Canadian Short Story
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. Students will be expected to work in some depth with individual authors.
Fall, Winter terms

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 adults. In considering the 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.

208B* Science Fiction
Various examples drawn, for instance, from Utopian and anti-Utopian science fiction, social science fiction, “gadget” science fiction, parapsychology, and alternate worlds and beings, will be considered. Some attention will be given to the historical development of the genre.

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 Kipling, Woolf, C. S. Lewis, George MacDonald, Kenneth Grahame, and Thurber 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 satirical cartoons and nightclub satire.

208E* Women Writers of the 20th Century
A study of such major 20th-century women writers as Woolf, Hellman, Murdock, McCarthy, Lessing, Lawrence, Plath and Atwood. Emphasis will be on the concerns of these writers with the roles of women, the writers’ 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 include: the impact of the landscape, rural-urban conflict, isolation, social conservatism, regional reality. Novels, poetry, drama, essays and biography may be considered.

208H* Arthurian Legend
The story of Arthur and his knights of the Round Table will be discussed as it is treated at various times in various works and genres. Such matters will be considered as the character of Arthur, the concept of Camelot, and the Fellowship of the Round Table.

208K* Detective Fiction
The history and characteristics of the “detective novel,” the “novel of crime,” and the “thriller.” Attention will also be given to the novel of intrigue and espionage. Such authors as Poe, Collins, Doyle, Chesterton, Hammett, Buchan, Greene, Deighton and Le Carre will be discussed. The course includes the examination of critical approaches to the form of detective fiction.
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. There is one weekly lecture and a weekly workshop where student writing is discussed. Six to eight essays will be required.

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 and to interpret the bewildering human experience. This course undertakes an exploration of the forms that attempt can take. 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* 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-Shakespearean 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 considers 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*, and 20th-century counterparts of these works.

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 use 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.

Note
*R courses are administered by Renison College.

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
Approaches to reality amid the confusion and uncertainty of 20th-century America. Emphasis on such major writers as Faulkner, Miller, and Cummings.

305 Old English
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
An study of Middle English literature with special emphasis of the work of Geoffrey 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 and short story during the period.

316* Canadian Drama
A study of plays by such dramatists as Merrill Denison, Robertson Davies, Gratien Gélinas (in translation), James Reaney, John Coulter, George Ryga and Michel Tremblay (in translation). Background for 20th-century drama will be provided in lectures.

330 Elizabethan Literature (excluding Drama)
A study of the principal writers of prose and of lyric and narrative poetry in England during and immediately preceding the reign of Elizabeth I. Reserved for special attention is Spenser's epic poem glorifying Elizabeth I and England – The Faerie Queene.

335* Creative Writing
Aimed at encouraging students to develop their creative and critical potentials, the course consists of supervised practice, tutorials, and seminar discussions.

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

346*A Realistic and Naturalistic Fiction
Special emphasis will be given to the works of Mark Twain, Henry James and Stephen Crane.
Prerequisite: English 290* or consent of instructor.

346*B American Poetry
A search for the American "voice" through a study of the major poets from Poe to Cummings.
Prereq: 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

347*B Colonial American Literature
The shaping of the American consciousness, with particular attention to such major figures as Edward Taylor, Benjamin Franklin, and Jonathan Edwards.
Prereq: English 290* or consent of instructor.

350 Seventeenth Century Non-Dramatic Literature
Special attention will be given to the poetry of Donne, Jonson, Herbert, Vaughan, and Marvell and to the prose works of Bacon, Burton, and Browne. Approximately half the course will be devoted to an intensive study of Milton's English poetry and a selection of his prose works.

355* Forms of Classical and Neo-Classical Satire
A study (in translation) of such classical forms of satire as formal verse satire and Menippean satire and their influence on English writers of the Renaissance and Augustan periods. Writers studied will include Horace, Juvenal, Donne, Marston, Pope, Petronius, Lucian, More and Swift.
(Same as Cl. Civ. 321*)

356* Pastoral and Mythological Aspects of Classical and Neo-Classical Poetry
A study (in translation) of pastoral and mythological aspects in both Classical and English writers of the Renaissance and Augustan periods. Writers such as Ovid, Shakespeare, Theocritus, Vergil, Spenser, Milton and Pope will be studied.
(Same as Cl. Civ. 322*)

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 dialects. Traditional, structural and generative approaches will be employed.

375 Linguistics and English Grammar
Linguistics and its application to the study of grammar and language. Included are 1) an introduction to descriptive and historical linguistics and the principles of linguistic analysis and 2) an evaluation of English grammars ranging from the traditional to the structural and transformational-generative.

376R* Our Changing Language: Syntax and Semantics 1
In its evaluation of modern systems of syntax, the course will provide a thorough and practical grounding in structure of language and will stress the need for semantic interpretation. (An extensive knowledge of syntax is not assumed.)
Prereq: English 141R* and 245R*, Fall term

377R* Our Changing Language: Syntax and Semantics 2
Continuation of English 376R*. The semantic approach expanded: meaning conditions form and practical significance in language teaching. Of interest to intending teachers of English as the native or as a second language.
Prereq: English 376R*, Winter term

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. 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
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.
3 h. a week; 2 h. lect., 1 h. consultation.

410 The Augustan Age
A study of English literature from 1660 to 1798; the comedy of the Restoration; the satire of Dryden, Swift, and Pope; the probing of mores and manners by Pope and Johnson; the emergence of the novel with Richardson, Fielding, and Sterne; and the transformation from classicism to romanticism.

415* Major Canadian Writers
An intensive study of the work of two or three major Canadian authors. Writers who may be studied include Morley Callaghan, F. P. Grove, Robertson Davies, A. M. Klein, Thomas Haliburton, Irving Layton, Margaret Atwood, and Margaret Laurence.
Prerequisite: Consent of instructor

430 The Romantic Movement
An historical and critical study of the principles and practice of the English Romantic authors from Blake to Keats, with primary emphasis on poetry.

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). Provision will be made for students who wish to study other writers such as Hopkins, Swinburne, Carroll, Morris or Pater.

460 British Literature from Shaw to Eliot
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

480J Senior Seminar
This course provides a study of the major works in those periods of English literature in which fourth-year honours students have not taken courses. It also provides a study in depth of selected authors and topics. Individual syllabi are prescribed for each student.

495 Supervision of Senior Honours Essay
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, School of Architecture, Department of Geography, Department of Man-Environment Studies, and School of Urban and Regional Planning. 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

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)
D. Estrin, B.A., LL.B. (Alberta)

Assistant Professor
T. McL. Semple¹, B.A. (Western), M.A., Ph.D. (Waterloo)

Adjunct Lecturers
F. J. Bunting
R. J. Pufall, B.A. (Waterloo)

Special Lecturer
D. G. E. Wicken, Diploma A.A.

Faculty members cross appointments as shown
¹ Man-Environment Studies and Environmental Studies

111* Introduction to the Study of the Future
Non-technical survey of current approaches to thinking about and refining views of the "Future". The role of images and scenarios, contributions of the arts and concepts of space and time. Impacts of regional science, ekistics, bioethics, synergetics, and prognostics. Paths to "inventing" the future and the comprehensive design of "optimum" environments.
No prerequisite. 3 hours.

195* Introduction to Environmental Problems
A discussion of some major environmental problems and issues such as the population explosion, the impact of urbanization of man's environment, environmental pollution, resource management, conservation, and environmental planning.
Not available to Man-Environment Studies
3 hours. Fall and Winter terms

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 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

252* Media Tools for Environmental Studies
An introduction to particular media and formats appropriate to the presentation of themes and issues of concern to environmentalists. Class activities will focus on the use of audio-slide, film and television presentations. Students will be expected to commit some of their own time to the use of equipment and the preparation of presentation formats. Students may be required to purchase certain materials.
Prerequisite: E.S. student only or consent of Instructors
3 hours. Fall and Winter terms

253* Media Tools for Environmental Studies – Advanced Level
A more in-depth approach to the use of the media and formats used in ES 252. There will be more emphasis on a participatory approach in the utilization of equipment and the preparation of software. Students will be expected to commit some of their own time to the use of equipment and preparation of presentation formats. Students may be required to purchase certain materials.
Prerequisite: ES 252 or consent of Instructors
3 hours. Winter term
358* Environmental Pollution and its Control
Guests and University of Waterloo lecturers, expert in their respective fields, discuss specific problem areas related to the environment. Representative topics include impact on groundwater of waste disposal, effect of air pollution on plant life, population problems, viruses in surface water, reutilization of waste materials.
No prerequisite
3 hours, Fall and Winter terms

380*/381* Environmental Studies Workshop
An interdisciplinary workshop focusing upon environmental issues in a project or research format. 
Prerequisite: 3rd and 4th year students in Environmental Studies; enrolment is by research team only with representatives from at least 3 units of the faculty (max. 7 people) and subject to selection of an advisor and a satisfactory project or research proposal.

400 Environmental Law
Conflict as the core of all aspects of environmental relationships. A review of several current conflicts in: community planning law; ecological law; and natural resource law. 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: 3rd and 4th year students
3 hours, evening, Year

411* Alternative Future Environments 1
Analysis of "ideal" environments of the past, including "utopian" communities. Scrutiny of current "concepts" of future environments, including distillation of works of Bell, Clarke, Commoner, de Chardin, de Jouvenal, Dror, Doxiadis, Ehrlich, Forrester, Fuller, Kahn, Mead, Meadows, McHale, Michael, Polak, Theobald, Thompson, Toynbee, and Ward.
Prerequisite: 3rd or 4th year standing
3 hours lecture

412* Alternative Future Environments 2
Examination of "issues" in futuristics and their "methodological" problems, with particular attention to resources utilization. Socio-Cultural Change Theory and Policy Science. Science Fiction, Extrapolation, and Technology Forecasting. Societal Indicators, Quality of Life, and Technology Assessment. Probable and Possible Urban Futures.
Prerequisite: ES 411*
3 hours lecture
Fine Arts

Professor, Chairman
V. Burnett, B.S. (Columbia), M.A. (California)

Professor
A. M. Urquhart, B.F.A. (Buffalo)

Associate Professors
N.-L. Patterson, B.A. (Washington)
H. Martens, B.A., M.A. (Minnesota), Ph.D. (Columbia)

Assistant Professors
J. Uhde, M.A. (Purkyne's University, Brno, Czechoslovakia), Ph.D. (Waterloo)

Lecturers
C. Crockford, B.Ed. (Alberta), M.A. (British Columbia)
B. Irland, B.F.A. (Illinois), M.F.A. (Massachusetts)
W. Janzen Jr., B.Mus. (Manitoba), M.M. (Wisconsin), A.M.M., G
E. Kliman, M.A. (Toronto)
A. Roberts

Requirements for Fine Arts
General B.A. in Art

To fulfill the requirements for a general degree in Fine Arts students must take at least 12 half courses in Fine Arts, at least four of which must be on the third year level. As part of the 12 required half courses, students majoring in studio work must take 110*, 111*, 120*, and at least seven half courses in studio work in addition to 120*; students specializing in art history must take, as part of their 12 required Fine Arts half courses, 110*, 111*, 120*, and at least six half courses in art history in addition to 110*, and 111*, and one half course in studio work in addition to 120*; students majoring in film history, as part of their twelve required half courses, must take 110*, 111*, 120*, and six half courses in film history; and those students specializing in film making must take, as part of their twelve required Fine Arts half courses, 110*, 111*, 120*, and four half courses in film making. Courses in music will be considered as electives and not as part of the regular Art programme 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 a part of their regular programme where their departments so direct.

Honours Programme

Students wishing to apply for admission to the Fine Arts Honours Programme should refer to the Honours Programme requirements included in Chapter 7. Since application to the programme must be made at the end of the third year of study, students should familiarize themselves with these requirements immediately upon deciding that this programme is of interest to them.

Undergraduate Course Descriptions – Fine Arts

110* Introduction to World Art 1
A comparative survey of Prehistoric and Ancient Art, and of Oriental, African, New World, and Oceanian Art, emphasizing visual form as an expression of its historical and cultural context.
No prerequisite. Fall term

111* Introduction to World Art 2
A comparative survey of Western Art from the Classical to the Modern period, 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, Winter term
210* Modern Art 1
An examination of the history of Modern Art from the late 18th century up to the time of Impressionism.
Prerequisite: Fine Arts 110* or consent of instructor, Fall term

211* Modern Art 2
A continuation of Fine Arts 210, commencing with Impressionism and proceeding through the major trends of the early 20th century up to the contemporary period.
Prereq: Fine Arts 210* or consent of instructor, Fall term

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.
Prereq: Fine Arts 110*/111*, or consent of instructor, Fall term

213* Italian Renaissance Art 2
A continuation of Fine Art 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, Winter term

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.
No prerequisite, Winter term

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*, Winter term

221* Fundamentals of Painting 2
Not offered 1976/77.

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*, Winter term

223* Fundamentals of Sculpture 2
Not offered 1976/77.

224* Introduction to Drawing
Half the time will be devoted to drawing from the model and the remainder to a series of drawing concepts. At least one field trip will be included — Art Gallery of Ontario or the Albright Knox in Buffalo.
Prerequisite: Fine Arts 120*, Fall and Winter term

225* 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*, Fall term

226* Introductory Graphics 2 (General Printmaking)
Introductory course in materials and methods of printmaking.
Prerequisite: Fine Arts 120* or consent of instructor

226A* Introductory etching with emphasis on Intaglio printing.
Fall term

226B* Not offered in 1976/77.

226C* Introductory silkscreen.
Winter term

227* Scientific Drawing
Not offered 1976/77.

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
Not offered 1976/77.

228B* The Visual Arts and the Theatre
An introduction to the problems of designing for the theatre. Work for the course will include the preparation of drawings and models as well as practical experience in the theatre projects. Specific arts will vary from year to year.
No prerequisite for Fine Arts majors; otherwise, consent of instructor. Fall term

228C* Images and Effigies
A study of contemporary and historical images and effigies in art, ritual, and drama, and a series of studio projects in which three-dimensional images are constructed.
Winter term
234* Introduction to Film Making 1
Not offered 1976/77.

235* Introduction to Film Making 2
Not offered 1976/77.

244* History of Film 1
General history of world cinema in its silent era (1985-1928), covering the work of outstanding directors and important movements and the contribution to the film medium as an independent art form. (Regular screening of a variety of films.)
Film fee, Fall term

245* History of Film 2 Sound Film
A continuation of Fine Art 244* the expression of film history into the sound era (since 1929) including the most recent period. (Regular screening of a variety of films.)
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.
Prereq: Fine 110*-111* or consent of Instructor.

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 Valasquez will be studied as well as the emergence of genre and landscape painting and the development of national schools.
Prereq: Fine Arts 312* or consent of Instructor.

314* Medieval Art 1
Not offered 1976/77.

315* Medieval Art 2
Not offered 1976/77.

316* Canadian Native Art
The arts and crafts of Canadian Indian and Inuit (Eskimo) peoples are examined with slide lectures, films, and student presentations.
No prerequisites. Fall term

317* Canadian Art 2
An examination of Canadian Art extending through the important styles of settlers, especially from Britain and France, in the seventeenth, eighteenth and nineteenth centuries, to the development of the nationalist styles of early twentieth century, culminating in contemporary Canadian art.
No prerequisite. Winter term

318* Canadian Ethnic and Traditional Arts
An historical survey of Canadian ethnic and traditional arts and crafts with student projects examining ethnic and traditional arts of the Waterloo region.
Winter term.

319* Contemporary Art
A seminar exploring contemporary artistic concepts through critical analysis, historical correlation discussions with artists and visits to studios and galleries.
Prerequisite: consent of instructor, Fall term

320* Advanced Painting 1
Not offered 1976/77.

321* Advanced Painting 2
Not offered 1976/77.

322* Advanced Sculpture 1
An introduction to clay, glaze materials and firing techniques. Three dimensional form will be explored with the emphasis on the handling of clay as an expressive medium, enhanced by surface treatment and a variety of firing procedures.
Lab fee.
Prereq: Fine Arts 222* or consent of instructor. Fall term
323* Advanced Sculpture 2
A continuation of Ceramic Sculpture (322). Organization and integration of sculptural concepts in clay to develop a series of sculptures using a choice of materials and techniques learned in 322.
Prerequisite: Fine 322*, Winter term.

323A* Assemblage
Not offered 1976/77.

324* Advanced Drawing
A course in which drawing is investigated as a means of expression and communication. An understanding of the human figure - its structure, 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 means of expression. Lab fee.
Prerequisite: Fine Arts 224 and consent of instructor, Fall term.

325* Advanced Drawing 2
Continuation of Fine Arts 324*.
Winter term.

326* Advanced Printmaking 1
The practice and study of various graphic techniques with emphasis on coloured intaglio, silk screen, and photographic processes. Lab fee.
Prerequisite: Fine Arts 226*, Fall term.

327* Advanced Printmaking 2
A continuation of Fine Arts 326* with emphasis on independent problems. Lab fee.
Prerequisite: Fine Arts 326*, Winter term.

328* Calligraphy
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 Fraktur.
Lab fee. No prerequisites. Fall term.

329* Illustration
Studio work in techniques and theory of book illustration, together with slide lectures on the history of printed forms.
Prerequisite: consent of instructor, Winter term.

334* Advanced Film Making 1
Not offered 1976/77.

335* Advanced Film Making 2
Not offered 1976/77.

346R*/347R* Special Topics in Film
Special topics will be announced from year to year.

348R* The Films of Chaplin
An exploration of themes and styles that make up the early and late work of Chaplin - the laughter and the melancholy, the loved and the abandoned, Charlie and Chaplin. Films and readings will be taken together in the examination of Chaplin's contribution to the cinema.
Prerequisite: Fine 244* or Fine 246R*/247R* (RS 266R*/267R*) or consent of instructor. Fall term.

370* Film Theory 1 (Anatomy of Film)
Discussion of the aesthetic aspects of cinematographic work (principles known as "film language").
Prerequisite: consent of instructor. Fall term.

371* Film Theory 2 (Film Aesthetics and Criticism)
An extension of Fine Arts 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 Arts 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.

390A* Methods in the History of Art
For students planning a Senior Honours Presentation in Art History as it is currently understood. Students will examine methods of formal and stylistic analysis, iconographical interpretation and the application of social and political history to understanding of works of art. Required of all art history majors who take Fine 490*/491*.
Prerequisite: consent of instructor.

391* Selected Subjects in Fine Arts
Studio and practice courses under the direction of individual instructors.
Admission by consent of instructor. Winter term.

420* Senior Seminar in Graphics Techniques 1
Admission by consent of instructor. Fall term.
Course Descriptions
Fine Arts

421* Senior Seminar in Graphics Techniques 2
Admission by consent of instructor
Winter term

434* Senior Seminar in Film Techniques 1
Not offered 1976/77.

435* Senior Seminar in Film Techniques 2
Not offered 1976/77.

470* Senior Seminar in Film Concepts 1
Admission by consent of instructor. Fall term

471* Senior Seminar in Film Concepts 2
Admission by consent of instructor. Winter term

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.

491* Senior Honours Presentation 2
A continuation of Fine Arts 490*

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 150G*/151G*, 254G*/255G*, 351G*/352G* and 2 half courses in Materials of Music available by cross-registration at Wilfrid Laurier University. Besides, students must demonstrate competence on one instrument (including voice) equal to Grade 10 standing at the Toronto conservatory of Music. The remaining courses must be selected in consultation with the Music Faculty.

A minor program in Music requires 10 half courses in Music including: 150G*/151G*, 2 of 254G*, 255G*, 351G* or 352G* plus any 6 other half courses including the option of Music Studio in voice, piano, woodwind, etc. Science 312* and/or Science 313*, Physics of Music, are applicable as music credits in a major or minor music programme.

Students from any faculty may take courses in Music on an elective basis.
### Course Descriptions

**Fine Arts**

#### 260G* Choral Literature 2
Choral Literature from the Renaissance period to the present will be introduced through singing reading sessions, discussion and performance. Repertoire will vary from year to year and will be suited to the existing choral ensemble.

*Prerequisite: 160G* or permission of instructor
*3 hours minimum. Fall term*

#### 261G* Choral Literature 2
Continuation of 260G*.

*Prerequisite: 260G* or consent of instructor
*3 hours minimum. 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.

*Prereq: 150G* or consent of 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
Not offered 1976/77.

#### 301G* Stratford Festival Seminar
Continuation of Fine Arts 300G*

*Not offered 1976/77.*

#### 351G* Ancient, Medieval and Renaissance Music
The study of music from pre-Christian times to approximately 1600.

*Prerequisite: 150G* or consent of instructor
*3 lectures. Fall term*

#### 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* or consent of instructor
*3 lectures. Winter term*

#### 355G*/356G* Music of the Classical Period (ca. 1750-1820)
*Not offered 1976/77.*

#### 360G* Music of the Church
A study of the music, and the philosophies of music of the Christian church from the beginning to the present. Singing and/or listening to the music will be an integral part of the course.

*Prerequisite: 150G* or consent of instructor
*3 hours minimum. Winter term*

#### 361G Music of the Church
*Not offered 1976/77.*

#### 366G* Music Studio
See 166G* for course description.

*Prerequisite: 266G* and consent of Music Faculty*

#### 380G*/381G* Directed Study in Music
*Prereq: Advanced standing in music and consent of the instructor*

#### 466G* Music Studio
See 166G* for course description.

*Prerequisite: 366G* and consent of Music Faculty*
General Engineering

Undergraduate Course Descriptions

000 Tutorial
Students will meet with a faculty member designated as their class professor. Performance in 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.

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.
1 hour per week.

061 History and Philosophy of Science
The major conceptual transformations in evolution of science and technology; Greek, modern classical, contemporary periods. Scientific technology as a determining characteristic of global civilization and some critical questions it poses.
3 hours per week. (Not open to Year I students)

062 Introduction to Human Communication Systems
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.
3 hours per week, lectures and seminars. (Not open to Year I students.)

101 Topics from Scientific Thought
Not being offered in 1976-77.

102 Introduction to the Sciences of Man
The course is intended to introduce 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.
3 hours per week. Year I non-technical elective.

103 Topics from the Arts and Humanities
The course will explore some of the major movements of thought which are shaping modern affairs and modern consciousness. The topics may vary but examples would be Marxism, racism, Freudianism, existentialism, the meaning of civilization, artistic expression and Christianity.
3 hours per week. Year I non-technical elective.

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 freehand sketching for communication of concept.
3 hours per week. Fall term.

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. Winter and Spring terms

113 Engineering Measurement
Nature of measurement, scales and measurement units. Concepts of accuracy, precision, systematic and random errors. Probability, normal distribution function, elementary sampling. Propagation of errors in calculations, formation of measurement specification.
3 hours lecture, term project
Fall term only

120 Engineering Synthesis
Principles of problem statement, analysis, concept of creation, planning, flow of information, physical, economic and financial feasibility, value of utility as related to the solution of engineering problems.
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.
3 hours lectures, 2 hours lab, 1 hour tutorial
Winter and Spring terms

250 Basic Concepts of Engineering and Applied Science
Not being offered 1976-77.
Department of Geography

Associate Professor, Chairperson of the Department
G. R. McBoyle, B.Sc., Ph.D. (Aberdeen)

Professor, President of the University
B. C. Matthews, B.A. (Toronto), A.M. (Missouri), Ph.D. (Cornell)

Professor, Dean of Environmental Studies
J. G. Nelson, B.A. (McMaster), M.A. (Colorado), Ph.D. (Johns Hopkins)

Associate Professor, Associate Chairperson
L. H. Russwurm, B.A., M.A. (Western), Ph.D. (Illinois)

Associate Professor, Associate Dean
(Electronic Studies Undergraduate Affairs)
A. G. McLellan, B.Sc., Ph.D. (Glasgow)

Associate Professor, Graduate Officer
W. B. Mitchell, B.A., M.A. (U.B.C.), Ph.D. (Liverpool)
(on Sabbatical Leave 1976-77)

Assistant Professor, Undergraduate Officer
G. Wall, B.A. (Leeds), M.A. (Toronto), Ph.D. (Hull)

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), (on Sabbatical Leave 1976-77)
R. M. Irving, B.A., M.A. (Toronto), Ph.D. (Minnesota)
R. R. Krueger, B.A., M.A. (Western), Ph.D. (Indiana)
R. E. Preston, B.A., M.A. (Washington), Ph.D. (Clark)

Associate Professors
C. R. Bryant, B.A., Ph.D. (London School of Economics), (on Sabbatical Leave 1976-77)
R. A. Bullock, B.A., M.A. (Belfast), Ph.D. (London)
J. C. Day, B.Sc., M.Sc., Ph.D. (Chicago)
J. S. Gardner, B.Sc. (Alberta), M.Sc., Ph.D. (McGill)
A. B. Yesik, M.A., Ph.D. (UMCS - Lublin, Poland)
C. G. Mulamoottil, B.Sc. (Mysore), M.Sc. (Bombay), Ph.D. (Delhi)
G. B. Priddle, B.A. (Western), M.A., Ph.D. (Clark)
D. F. Walker, B.Sc. (London), M.A., Ph.D. (Toronto)

Assistant Professors
T. E. Bunting, B.A. (York), M.A. (Western), Ph.D. (Toronto)
L. T. Guelfe, B.Sc. (Cape Town), M.A. (York), Ph.D. (Toronto)

B. Hyma, B.S., M.S. (Madras), M.S. (Sheffield), Ph.D. (Pittsburgh)
R. Johnson, B.A., M.A. (Windsor), Ph.D. (Minnesota)
E. R. Officer, B.A. (U.B.C.), M.A. (Wisconsin), (on Sabbatical Leave 1976-77)

Lecturer
D. J. Dudycha, B.A. (W.L.U.), M.A. (Waterloo)

Faculty members holding cross and/or joint appointments as shown
1 Planning, Geography and Biology
2 Geography, Planning
3 Renison College and Geography
4 Recreation 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 Topics in the Geography of Population
341* Historical Geography of Canada 2
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
204* Soviet Union
205* Africa
220 World Regional Geography
225R* Urbanization in Newly Developing Countries
226R* Population Growth and Resource Development in "Third World" Countries
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 American Society
Course Descriptions
Geography

322* Geographical Study of Canada
323* Geographical Study of a Selected Region
422* Canada
424* Soviet Union
425* Africa

Resource Management
356* Resource 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 1 Manufacturing and Transportation
412* Advanced Economic Geography 2 Industrial 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
449* 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
401* Glacial Geomorphology and Some Contemporary Applications
406* Tropical Geomorphology
407* Field and Lab Techniques in Geomorphology

Techniques and Methodology

General
252* Media Tools for Environmental Studies
253* Media Tools for Environmental Studies – Advanced Level

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 in Environmental Studies
307* Social Survey Techniques
315* 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
482* Geography and Education

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.
Undergraduate Course Descriptions

101* Introduction to Human Geography
An introduction to human geography through a survey of some of the concepts, methods, techniques and applications of geographic analysis of man’s cultural environment. The man-land theme, and the location analysis theme are emphasized throughout.
No prerequisite
2 hours lectures, 2 hours lab, Fall and Winter terms

102* Introduction to Physical Geography
An ecosystem approach to physical geography which emphasizes that man’s natural environment is an integrated system of which man is a part. Selected aspects of weather-climate, water, soils, biota, and landforms are studied and the flow of energy, water and matter and the resultant effects on the subsystems of the natural environment are emphasized.
No prerequisite
2 hours lectures, 2 hours lab, Fall and Winter terms

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 human geography. Times and meetings will be arranged individually.
No prerequisite
Fall and Winter terms

ES 111* Introduction to the Study of the Future
See Environmental Studies course description, page 261.

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

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

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

ES 195* Introduction to Environmental Problems
See Environmental Studies course description, page 261.

ES 200* Field Ecology
See Environmental Studies course descriptions, page 261.

201* Some Basic Topics of Physical Geography
Further study of energy and matter flows in the atmosphere and on the land. Specific topics 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

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, Fall and Winter terms

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, Fall and Winter terms

204* Soviet Union
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. Not offered in 1976-77

205* 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 hours, Fall term
Course Descriptions
Geography

220 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 occupation and utilization of urban and rural lands, and the effects of man's tools, techniques and institutions on the earth's surface.
No prerequisite. 3 hours, Year

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.
Prerequisite: Any Faculty of Environmental Studies course. 3 hours, Fall term

226R* Population Growth and Resource Development in "Third World" Countries
Some major problems of population explosion, food supply and economic development faced by the developing countries. The course also covers technological and ecological aspects of international agricultural development. Emphasis placed on case studies of selected countries from Tropical Africa, Asia, Tropical South America and the Caribbean region.
Prerequisite: Any Faculty of Environmental Studies course. 3 hours, Winter term

232* Geography of Population
No prereq. 2 hours lectures, 1 hour lab, Fall term

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 and Spring terms

ES 252* Media Tools for Environmental Studies
See Environmental Studies course descriptions, page 261.

ES 253* Media Tools for Environmental Studies – Advanced Level
See Environmental Studies course descriptions, page 261.

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 and Winter terms

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 Year 5 Maths. take Math 85*.
Prerequisite: only for students in General or Honours Geography, Planning, Man-Environment Studies, or Architecture
2 hours lecture, 1 hour lab, Fall and Winter terms

272* Computer Programming in Environmental Studies
The course emphasizes programming skills and applications in the context of environmental problems. Cross-listed with Planning and Man-Environment Studies
Prerequisites: Geog./M.-Env./Plan 271*, or consent of instructor. 3 hours, Winter term

2752 Introductory Air Photo Analysis and Remote Sensing
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.
Lab fee $12. Prerequisite: Geography 102* and a first-year human geography course, 2 hours lectures, 2 hours lab, Fall and Winter terms

300* Geomorphology and the Southern Ontario Environment
This course emphasizes field work and field trips in exploring the evolution of S. Ontario landforms. The identification of landforms, landform assemblages and their relationships. Selected 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.
Prerequisite: Geography 201*, or Earth Sciences 130 or consent of instructor.
2 hours lecture, 4 hours field lab, Fall term
Course Descriptions
Geography

301* Climatology
Prerequisite: Geography 201*. Not offered 1976-77.

302* Geomorphological Processes
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 under different climatic conditions and processes connected with glaciation and de-glaciation, and eolian, karst, coastal and fluvial landforms.
Prerequisite: Geography 201* or Earth Sciences 130 or consent of instructor
2 hours lectures, 2 hours lab, Fall and Spring terms

303* Physical Basis and the Geography of Water
The geography of water, including snow and ice. Specific topics include: the earth's water balance and cycle, the oceans, lakes and swamps, snow cover, ground ice, glacier ice and streams. Attention is directed to the impact of water on the earth's surface, the role of water in the earth's system, and water as a resource and hazard. Some field work.
Prerequisite: Geography 201* or consent of instructor
2 hours lectures, 2 hours lab, Winter and Spring terms

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, term to be arranged

311* Advanced Econ. Geog. 1 Manufacturing and Transportation
Manufacturing and transportation in the context of area economic development, both at regional and urban scales. This course aims at deepening conceptual insights as well as fostering an appreciation of their relevance to the understanding of particular areas. Empirical focus is on Canada and the United Kingdom.
Prerequisite: Geography 202* or consent of instructor
3 hours, Winter and Spring terms

315* Agricultural Geography
The study of agriculture as a system, and an analysis of the geographical dimensions of agricultural systems. Issues include the diffusion of innovations, regional evolution of agricultural structure and vertical integration. Structural problems in agriculture are emphasized through a comparative study of programs of government intervention in agriculture in Canada and Europe. Some field trips.
Prerequisite: Geography 202* or consent of instructor
3 hours, Fall term

316* Multivariate Statistics
The theory and application of multivariate statistics, with particular emphasis upon use of the computer. Same as Plan 316*.
Prerequisite: Geography 271* or consent of instructor
3 hours seminar and/or tutorial, Winter term

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
Not offered 1976-77.

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 and Spring terms

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

321* Geographical 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. Not offered 1976-77.
322* Geographical Study of Canada
Geographical basis of Canada and Canadian issues. Selected problems relating to nationalism, regionalism, environmental quality, urbanization, regional disparities and resource development.
No prerequisite, 3 hours, Fall term

323* Comparative Regional Problems
A geographical analysis of a selected issue in a variety of regional, environmental and cultural contexts. The topic will vary year to year. Possible topics include the following: the impact of technology, urbanization, regional disparities, agriculture, rural life-styles and energy.
Prerequisite: One of Geog. 203*, 204*, 205* or 220 or consent of instructor. Not offered 1976-77

330* Cultural Geography
Problems in the delimitation of cultural regions. A study of the diversity of man in his relations with his environment.
Prerequisite: A second-year human geography course 3 hours, Fall term

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 3 hours, Winter term

332* Special Topics in the Geography of Population
Detailed study of selected topics of population geography.
Prerequisite: Geography 330* or consent of instructor Not offered 1976-77

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 Not offered 1976-77

342* Historical Geography of Canada 2
The changing geographies of settlement and resource use in the nineteenth and early twentieth centuries.
Prerequisite: Geography 202* or consent of instructor Not offered 1976-77

345* Political Geography
The interrelationships of states and nations; centrifugal and centripetal forces within states; the location of capital cities and core areas; boundaries and frontiers; electoral geography; geopolitics.
Prerequisite: A second year human geography course or consent of instructor. Not offered 1976-77

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.
Prereq: Geog. 202* or 251* or consent of instructor. 3 hours, Fall, and Spring terms

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.
Prereq: Geog. 202* or Geog. 251* or consent of instructor. 3 hours, Fall term

356* Resources Management
Theoretical and conceptual approaches to resources studies emphasizing behavioural and economic considerations; evaluation of management practices in fisheries, forestry, water and minerals; research techniques.
Prerequisite: Geography 202* or consent of instructor 3 hours, Fall and Spring terms

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: ES 200* and only for 3rd and 4th year students 3 hours, Winter term

ES 358* Environmental Pollution and its Control
See Environmental Studies course descriptions, page 262.

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 hour lab, Winter and Spring terms
375* Air Photo Interpretation and Remote Sensing 1
The principles of air photo interpretation via in-depth analysis of elements of the air photo including rock types, landforms, drainage patterns, erosion characteristics, tonal variations, boundary characteristics, vegetation characteristics and patterns, and man-made features. Examples drawn from geology, geography and vegetation mapping. This course is a prerequisite for Geography 470*. Lab fee $12. Prerequisite: Geography 275* and Geography 201* or Earth Sciences 130, or consent of instructor. 2 hours lectures, 2 hours lab, Winter term

ES 380*/381* Environmental Studies Workshop
See Environmental Studies course descriptions, page 262.

381* The Nature of Geography
The past traditions in geography. Modern trends in geographical research and teaching. Prereq: Any three full geog. credits or consent of instructor. 2 hours seminar, Fall and Winter terms

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. Prereq: Third Year Hon. Geog. students or consent of instructor. 2 hours seminar, Fall term. Estimated cost to student: $50.00

ES 400 Environmental Law
See Environmental Studies course descriptions, page 262.

400* Climatic and Periglacial Morphology
Characteristics of the main principles of climatic and climatogenetic geomorphology. Examination of processes and forms related to the periglacial environment. Prerequisite: One of Geography 300*, Geography 302* or Earth Sciences 342* or consent of instructor. Fall term

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 influences 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. 3 hours seminar/lab, Fall term

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 1976-77.

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 of instructor. 3 hours lecture/lab, Fall term

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. Not offered in 1976-77

407* Field and Lab Techniques in Geomorphology
An analysis of the range of techniques used by geomorphologists. This course will involve intensive field, surveying, mapping and laboratory work. 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 hours, Fall term

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
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 356* or consent of instructor 
3 hours, Fall term

ES 411* Alternative Future Environments 1
See Environmental Studies course description, page 262.

411* Resource Studies
Study of natural resource problems, with particular attention upon the role of foreign investment and the global corporation in developing resources in Canada and other selected countries.
Prerequisite: Geography 356* or Geography 410*
Not offered in 1976-77

ES 412* Alternative Future Environments 2
See Environmental Studies course description, page 262.

412* Industrial Geography
A comparison course to Geography 311. The focus is on firms and industries. Emphasis will be placed on decision-making, multinational corporations, technological change, and analyses of the locational patterns of specific industries.
Prerequisite: Geography 311* or consent of instructor 
3 hours, Winter term

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.
Prereq: One of Geog. 356*, 311*, or 357* or consent of instructor. 3 hours lectures, Winter term

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.
Prereq: Geog. 356* and consent of instructor 
2 hr. seminar/workshop, and field work, Winter term

421 Europe and the Mediterranean
Detailed study of physical, cultural, economic and political geography of Europe, including 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 problems among the European countries, communist or non-communist.
No prerequisite 
3 hours, Year

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

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.
Not offered 1976-77

424* Soviet Union
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
Not offered 1976-77

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 
3 hours, Winter term

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., Polar Lands and Oceania.
Not offered 1976-77

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 1976-77

445* Advanced Political Geography
Selected topics in political geography with emphasis on 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. The interdisciplinary nature of conflict research is emphasized while focusing on concepts and contributions within the field of political geography.
Prerequisite: Geography 345* or consent of instructor
Not offered 1976-77
Course Descriptions
Geography

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

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

451* Soils Geography
An analysis of the factors affecting soil development and classification. Techniques of soil survey and land classification.
Prerequisite: ES 200* or consent of instructor
Not offered 1976-77

452* Problems of Rural Land Use
The nature of rural land use problems, and a critical evaluation of the methods of rural land use planning. Emphasis placed 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 alternative employment opportunities. Methods of analysis and decision making.
Prerequisite: Consent of instructor. Not offered 1976-77

460 Land Dereliction and Rehabilitation
Examination of the reasons for land dereliction, its processes, and effects. Analysis of rehabilitation techniques, includes principles of landscape architecture and optimizing ecological considerations and use of post operation areas. Students examine an area to prepare an objective and acceptable proposal in the form of a report of methods of operations and post operation rehabilitation. A small charge for field trip expenses of $15. to $20.
Prerequisite: Consent of instructor. Not offered 1976-77

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 form a significant part of the course. Lab fee $12.
Prerequisite: Geography 375* and Geography 300* or 302* or consent of instructor. Not offered 1976-77

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 infra-red and radar imagery, multiband imagery). Spectral analysis, image quality, image processing.
Prerequisite: Geography 375* or consent of instructor
Not offered 1976-77

475* Special Reading and Seminar on Selected Topics
Prerequisite: Honours Geography students and consent of instructor
2 hours seminar and/or tutorial, Fall and Winter terms

476 Special Readings and Seminar on Selected Topics
Prerequisite: 3 full credits in geography or consent of instructor. Not offered 1976-77

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 1976-77

481* Frontiers in Geography
Prerequisite: 3 full credits in geography or consent of instructor. Not offered 1976-77

482* Geography and Education
The foci of this course are geographical organizational concepts, educational principles and theory, and practice.
Prerequisite: In last year of Honours of General Geography programme and consent of instructor
3 hours, Winter term

490 Senior Honours Research Essay
Prerequisite: Honours Geography students only
3 hours seminar. Year
Department of Germanic and Slavic Languages and Literature

Associate Professor, Chairman of the Department
M. Richter, Staatsexament (Berlin and Bonn), M.A., Ph.D. (Toronto)

Professor, Associate Chairman (German)
S. Hoefert, B.A., M.A., Ph.D. (Toronto)

Associate Professor, Associate Chairman (Slavic)
A. Zweers, Doctorandus (Amsterdam), litt. Dr. (Groningen)

Professors
J. W. Dyck, A.B. (Bethel), M.A. (Missouri), Ph.D. (Michigan)
E. Heier, B.A., M.A. (British Columbia), Ph.D. (Michigan)
I. Levitsky, A.B. (Rochester), M.A. (Buffalo), Ph.D. (Duke)

Visiting Professor
H. Boeschenstein, Dr. phil. (Rostock), F.R.S.C.

Associate Professors
G. Brude-Firnau, Staatsexamen (Berlin), Ph.D. (Yale)
A. Donskov, B.A., M.A. (British Columbia), Dr. phil. (Helsinki)
M. Kuxdorf, B.A., M.A. (Waterloo), Ph.D. (Alberta)
H. W. Pantele, B.A. (Waterloo), M.A. (Cincinnati), Ph.D. (Waterloo)
W. Shelest, M.A. (Ottawa), Dr. phil. (München U.F.U.)
J. Whiston, B.A., M.A., Ph.D. (Minnesota)

Assistant Professors
F. Jakobsh, B.A., M.A. (Manitoba), Ph.D. (Waterloo)
D. G. John, B.A., M.A., Ph.D. (Toronto)

Visiting Assistant Professors
H. A. Goldman, A.B., A.M. (Cornell), Certificate and Ph.D. (Indiana)
J. J. Landwehr, Dr. phil. (Mannheim)

Lecturers
S. Dyck (Mrs.), B.A. (London), M.phil. (Waterloo) (part time)
H. Marsden (Mrs.), B.A. (Randolph-Macon), M.A. (Waterloo) (part time)
A. Newman (Mrs.), M.A. (Poznan, Poland) (part time)
T. Sommer (Miss), B.A., M.A. (Waterloo)
A. Strack (Miss), Staatsexamen (Tübingen and Berlin)

Undergraduate Course Descriptions

German

Note
During the first two years German courses are divided into two streams which allow for sequential development.
The two streams (A and B) are arranged according to a student's preparation in the language.

Stream A
Students with little or no knowledge of German
Stream B
Students with at least two years of High School German (or equivalent)

First Year
German 101/102
German 105/106
German 111/112

Second Year
German 201/202
German 211/212
German 231/232

In third year both streams merge, although Stream A students may take Stream B courses at the 200 level.

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, 3 hours
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 105*/106* or 111*/112*.) 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 h. classroom, 1 h. language lab. (One section, German 101A* offers more intensive oral practice with an additional language lab h. per week.)

102* First Year German
As 101*
Prerequisite: German 101* or equivalent

105* German for Reading Knowledge
The elements of German grammar with practice in pronunciation. Selected readings from the humanities and social sciences. This course prepares the student to read German independently with the aid of a dictionary. It can be used as a prerequisite for German 201*/202* only with special permission.
Open to all university students
One term, 3 hours

106* German for Reading Knowledge
As 105*
Prerequisite: German 105*

111* First Year Scientific 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 101*/102* or 105*/106*.)
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.
Open to all university students
One term, 3 hours

112* First Year Scientific German
As 111*.
Prerequisite: German 111* or equivalent

121* Studies in German Literature with Language Practice
Reading and discussion of representative 19th and 20th century texts. Authors and topics include: society and the dropout (Eichendorff); woman and society (Fontane); man, madness and machine (Hauptmann); the artist in crisis (Mann); the path to the self (Hesse); confronting the absurd (Kafka); the question of collective guilt (Frisch). This course includes a thorough review of German grammar and conversation practice.
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.
One term, 3 hours.

122* Studies in German Literature with Language Practice
As 121*.
Prerequisite: German 121*.

151* German Conversation and Grammar Review
Conversation on topics of everyday life as well as on political, social, and cultural aspects of the German-speaking countries: West and East Germany, Austria, and Switzerland. Comprehensive grammar review, vocabulary building, written practice. Language lab is recommended.
Prerequisite: This course is normally for students with at least two years of High School German. Other students with equivalent knowledge of German should obtain the permission of the instructor.
One term, 3 hours

152* German Conversation and Grammar Review
As 151*.
Prerequisite: German 151* or equivalent

201* Second Year German
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.
Prerequisite: German 102* or permission of instructor
One term, 3 h. plus one optional h. language lab

202* Second Year German
As 201*.
Prerequisite: German 201* or permission of instructor
211* 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.
Prereq: German 106*, 112* or equivalent
One term, 3 hours

212* Intermediate Scientific German
As 211*.
Prerequisite: German 211* or equivalent

231* German Through Contemporary Literature
Reading of selected contemporary texts with the goal of vocabulary building and the improvement of reading and comprehension. This course is mainly for students with only one year of German.
Prerequisite: German 102* or equivalent
One term, 3 hours

232* German Through Contemporary Literature
As 231*.
Prerequisite: German 231* or equivalent

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.
Prereq: German 122*, 152* or consent of instructor
One term, 3 hr., one optional hr. language lab

252* German Conversation and Composition
As 251*.
Prerequisite: German 251* or equivalent

271* German Thought and Culture
A survey of cultural currents to the time of the 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
Prerequisite: None; One term, 3 hours

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
Prerequisite: None; One term, 3 hours

275* German Culture in the 20th Century
German cultural trends are discussed in the light of social and political events up to 1945. Emphasis is placed on literary and artistic movements, especially Expressionism. Readings include selections from Mann, Hesse, Kafka and Brecht. Documentary films and slides are introduced. Taught in English; Prerequisite: None; One term, 3 hours

276* German Culture in the 20th Century
German cultural trends are discussed in the light of the postwar division into East and West. The influence of theatre and the media is discussed. Readings include selections from contemporary authors such as Grass, Dürrenmatt, Böll, Hochhuth, Weiss, and writers from East Germany.
Taught in English; Prerequisite: None; One term, 3 hours

281* Post-War Literature
Reading and interpretation of major works since 1945 in prose, drama and poetry. Main authors: Brecht, Borchert, Böll, Frisch, Dürrenmatt, Grass, Eich.
Prerequisite: German 122*, 152* or equivalent
Students with German 231*|232* are ineligible
One term, 3 hours

282* Post-War Literature
As 281*.
Prerequisite: German 281* or equivalent

291* Survey of German Literature
Introduction to the major periods of German literature. Reading and interpretation of representative texts.
Prerequisite: German 122*, 152* or 202*
One term, 3 hours

292* Survey of German Literature
As 291*.
Prerequisite: German 291* or equivalent

341* The Age of Goethe (Storm and Stress, Classicism)
Reading, interpretation, and critical analysis of representative works (Goethe, Schiller, Hölderlin, etc.).
Prerequisite: Second year standing; One term, 3 hours

342* The Age of Goethe (Romanticism)
Reading, interpretation, and critical analysis of representative works (Novalis, Tieck, Brentano, etc.).
Prerequisite: Second year standing; One term, 3 hours

343* Intermediate Conversation and Composition
This course is a continuation of German 202*. It offers conversation and composition on contemporary topics, vocabulary building, and exercises in grammar and stylistics on the intermediate level.
Prerequisite: German 202*. Not open to students who have credit for German 351*/352* nor for students in Honours German; one term, 3 hours
Course Descriptions
Germanic and Slavic Languages and Literature

344* Intermediate Conversation and Composition
As 343*  
Prerequisite: German 343*

351* Intermediate Conversation and Composition  
Conversation on modern topics. Exercises in advanced grammar, stylistics, and composition.  
Prerequisite: German 202* or 252*; One term, 3 hours

352* Intermediate Conversation and Composition  
As 351*.  
Prerequisite: German 351*.

361* Young Germany and Biedermeier
Reading, interpretation, and critical analysis of prescribed prose, drama and poetry (Grillparzer, Mörike, Stifter, Gotthelf, etc.).  
Prerequisite: Second year standing  
One term, 3 h., alternate years

362* Poetic Realism
Reading, interpretation, and critical analysis of prescribed prose, drama and poetry (Storm, Keller, Ludwig, Hebbel, Raabe, Fontane, etc.).  
Prerequisite: Second year standing  
One term, 3 h., alternate years

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.  
Prerequisite: Second year standing; One term, 3 hours

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.).  
Prerequisite: Second year standing; One term, 3 hours

391* Masterpieces of German Literature  
Not offered 1976/77.

392* Masterpieces of German Literature  
Not offered 1976/77.

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.  
Prerequisite: German 352* or equivalent; One term, 3 hours

452* Advanced Conversation, Grammar and Composition  
As 451*.  
Prerequisite: German 451*

461* Introduction to the History of the German Language with Readings in Middle High German  
Prereq: Second year standing  
One term, 3 h., alternate years

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, Reimmar der Alte, Walther von der Vogelweide, Nibelungenlied, Wolfram von Eschenbach, Meister Eckhart, Oswald von Wolkenstein, Johannes von Tepl, Sebastian Brant, etc.  
Prerequisite: German 461*; One term, 3 hours  
Offered in alternate years

471* German Poetry  
A study of the main thoughts, themes, forms, and schools in German poetry from the beginnings to Goethe.  
Prerequisite: Second year standing; One term, 3 hours  
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.  
Prerequisite: Second year standing  
One term, 3 h., alternate years

481* Humanism/Reformation  
Not offered 1976/77.

482* Baroque and Enlightenment  
Not offered 1976/77.

495*-498* Reading Courses in Approved Topics  
Open to fourth year students only. One term each, 3 hours

Russian  

Russian Workshop  
"Total Immersion" Russian Language Workshop. The programme consists of 2 sessions (12 days each) at the Russian Language Seminar in Dyuny (near Leningrad). Instruction is given daily for four hours by Russian professors on different levels according to the proficiency of the students.

Credits: 1 and 1/2 (for students who completed:
 a) first year Russian: 193*, 194*, 195*;
b) second year Russian: 293*, 294*, 295*;
c) third year Russian: 393*, 394*, 395*;
d) fourth year Russian 493*, 494*, 495*)

Students can receive up to six half credits prior to graduation.  
Prerequisite: Russian 102* or equivalent
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.
Open to graduate students of all departments
Two terms.

101* First Year Russian
(Artis 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* or 112*.
One term, 4 h. (lect. and language lab.)

102* First Year Russian
As 101*.
Prerequisite: Russian 101* or equivalent
One term, 4 hours

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 111* or 112*.
One term, 3 hours

112* First Year Russian
As 111*.
Prerequisite: Russian 111, Russian 101 or equivalent.
One term, 3 hours

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 hours

202* Intermediate Scientific Russian
As 201*.
Prerequisite: Russian 201* or equivalent
One term, 3 hours

251* Conversation, Composition, Grammar and Phonetics
The course is conducted largely in Russian and provides intensive 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 and Phonetics
As 251*.
Prerequisite: Russian 251* or equivalent
One term, 3 hours (lectures and language lab.)

261* Introduction to Russian Literary Movements
Reading of representative works from Russian Classicism, Romanticism, 19th Century Realism, and various periods of 20th century Russian literature.
Prereq: Russian 102* or permission of instructor
One term, 3 hours

262* Introduction to Russian Literary Movements
As 261*.
Prerequisite: Russian 261*; One term, 3 hours

271* Russian Thought and Culture
A survey of cultural history from 862 to 1861. Lectures will focus on major developments in literature, religion, philosophy, art, architecture, 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, 3 hours

Note
Arts students can take this course in their second or subsequent years; students for other faculties, in any year (Chapter 8 for course requirements in the Faculty of Arts).

272* Russian Thought and Culture
A survey of cultural history from 1861 to the present. Lectures will focus 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, 3 hours

281* Russian Short Story
A study of the form and a detailed examination of Russian short stories by major representative writers.
Prerequisite: Russian 102* or permission of instructor
One term, 3 hours

282* Russian Short Story
As 281*.
Prerequisite: Russian 281*; One term, 3 hours
341* Russian Drama
A study of the origins and development of Russian drama up to 1905. Reading and critical analysis of major works in various genres with emphasis on authors of the nineteenth century.
Prerequisite: Russian 102* or permission of instructor
One term, 3 hours

342* Russian Drama
As 341*.

351* Intermediate Conversation and Composition
Written reports on prescribed themes and topics.
Oral drill and translation.
Prerequisite: Russian 252* or equivalent
One term, 3 hours

352* Intermediate Conversation and Composition
As 351*.

381* The Peoples of the Soviet Union
Not offered 1976/77.

382* The Peoples of the Soviet Union
Not offered 1976/77.

391* Great Russian Novels.
Themes 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
Open to all students. One term, 3 hours

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
Open to all students. One term, 3 hours

441* East Slavic Epic Tradition
A study of the origins and development of the epic tradition in East Slavic literature as reflected in the byliny, military tales, and verse-tales from the earliest period to the end of the eighteenth century.
Prereq: Russian 102* or permission of instructor
One term, 3 hours

442* Russian Epic Tradition
Reading and critical interpretation of selected epic works from Pushkin to the present.
Prereq: Russian 441*; One term, 3 hours

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.
Prereq: Russian 352* or equivalent; One term, 3 hours

452* Advanced Conversation, Grammar and Composition
As 451*.

461* Twentieth Century Russian Literature
Reading, interpretation, and critical analysis of selected fiction and drama (Andreev, Bunin, Gorky, Kataev, Sholokhov, A.N. Tolstoy).
Prereq: Russian 102*; One term, 3 hours

462* Twentieth Century Russian Literature
Reading, interpretation, and critical analysis of selected fiction and drama (Arbusov, Bulgakov, Erenburg, Nabokov, Pasternak, Solzhenitsyn).
Prereq: Russian 461*; One term, 3 hours

481* Russian Poetry
Not offered 1976/77.

482* Russian Poetry
Not offered 1976/77.

485*/486* History of Russian Literature
The first part deals with the emergence of the Russian national literature, emphasizing the cultural and intellectual setting from the beginnings to 1917. The second part deals with Russian literature up to the present. Literary movements and major representative works not studied in other courses will be discussed.
Prerequisite: Russian 102*; One term each, 3 hours

496*/498* Reading Courses in Approved Topics
Open to fourth year students only.
One term each, 3 hours

Polish

101* First Year Polish
The fundamentals of Polish grammar are taught with emphasis on oral practice and pronunciation. An introduction to Polish culture is given as well. The instruction is in English.
Open to all university students. One term, 3 hours

102* First Year Polish
As 101*.
Prerequisite: Polish 101* or equivalent
One term, 3 hours
Course Descriptions
German and Slavic Languages and Literature

201* Intermediate Polish
This course will be conducted largely in Polish and provides intensive practice in grammar, composition, and conversation.
Prerequisite: Polish 102* or equivalent
One term, 3 hours

202* Intermediate Polish
As 201*.
Prerequisite: Polish 201* or equivalent
One term, 3 hours

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
As 101*
Prerequisite: Ukrainian 101* or equivalent
One term, 3 hours (lectures and language lab.)

151* Ukrainian Grammar and Conversation
For students with some knowledge of spoken Ukrainian but no previous formal training. The main objective is to achieve correct language usage, oral and written. The course emphasizes: grammar, syntax, reading of texts from literature and press, and the cultural background of the Ukrainian language and idiom.
Open to students of all departments
One term, 3 hours lectures, 1 hour language lab.

152* Ukrainian Grammar and Conversation
As 151*
Prerequisite: Ukrainian 151* or equivalent

201* Intermediate Ukrainian
This course will be conducted in Ukrainian and provides intensive practice in grammar, composition, and conversation.
Prerequisite: Ukrainian 102* or equivalent
One term, 3 hours (lectures and language lab.)

202* Intermediate Ukrainian
As 201*.
Prereq: Ukrainian 201* or permission of instructor
One term, 3 hours (lectures and language lab.)

301* Introduction to Ukrainian Literature
Reading and critical interpretation of texts chosen from the works of Skovoroda, Kotliarevsky, Shevchenko, Franko, L. Ukrainka and others.
Prerequisite: Ukrainian 202* or permission of instructor
One term, 3 hours

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).
Prerequisite: Ukrainian 301* or permission of instructor
One term, 3 hours

401* Ukrainian Romanticism
Not offered 1976/77.

402* Ukrainian Romanticism
Not offered 1976/77.
Department of History

Professor, Chairman of the Department
H. MacKinnon, B.A. (Montreal), Ph.L., S.T.L. (Gregorian), M.A. (Toronto), D.Phil. (Oxford)

Professor, Associate Chairman
G. M. Ostrander, B.A. (Columbia), M.A., Ph.D. (California - Berkeley)

Professors
R. W. Beachey, B.A. (Queen's), Ph.D. (Edinburgh)
M. J. Craton, B.A. (London), M.A., Ph.D. (McMaster)
P. Keresztes, M.A. (Toronto), Ph.D. (Graz)
W. Klaassen, B.A. (McMaster), Ph.D. (Oxford) (part time)

Adjunct Professors (W.L.U. and Guelph)
W. Stanford Reid, Ph.D. (Penn.), F.R.Hist.S.
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)
F. H. Epp, B.A. (Bethel College), M.A., Ph.D (Minnesota) G
P. J. Harrigan, R.A. (Detroit), A.M., Ph.D. (Michigan)
L. A. Johnson, B.A. (Waterloo), M.A., M.Phil.
R. C. MacGillivray, B.A. (Queen's), M.A., Ph.D. (Harvard)
E. P. Patterson, B.A. (Baylor), M.A. (Kansas), Ph.D. (Washington)
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) J

Assistant Professors
R. W. Guisso, B.A. (Toronto), D.Phil. (Oxford)
D. J. Horton, B.A. (Waterloo), M.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
W. O. Packull, B.A. (Guelph), M.A. (Waterloo), Ph.D. (Queen's) R
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)

Faculty member holds cross-appointment as shown
1 Classics
2 Sociology

Bachelor of Arts

a) General Programme
Students majoring in history should consult the General Programme requirements described in Chapter 7. They will normally choose one course from the Introductory and one course from the Level 2 Programme course listed below. In their third year they must also take at least one history course from the Level 3 listings (or History 349, or from the Senior Seminar listings, if permitted by the instructor). Two additional history courses must be chosen from an approved Departmental list. 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 7. The exact programme for each student will be worked out in consultation with a departmental advisor.
Undergraduate Courses

Note 1
The Department offers two categories of courses, Programme and Non-Programme. The Programme courses are divided into four basic categories to allow for sequential development. The four categories are as follows:

Level 1: Introductory courses (For General and Programme, Honours credit)

Level 2: Foundation courses (For General & Honours credit)

Level 3: Specialized courses (For Honours credit)

Level 4: Senior seminars (For Honours credit)

Other non-programme courses are offered at first and second year levels primarily as a service to other faculties and other disciplines.

Note 2
General students are reminded that they must take at least one 300 level course or Hist. 349 or a Senior Seminar, if granted permission— in order to complete their major. A student cannot take both a Non-Programme and a corresponding Honours course or second year course for credit: e.g., 123 or 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 123, 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.

1 Non-Programme Courses

These are courses designed especially for students in other faculties and other disciplines in Arts. Only within stated limits can they be used for credit towards a History major (cf. General and Honours programmes, pp. 79). No prerequisites. Not normally for Honours History credit.

105* The Meaning of Civilization
A survey of western civilization based on lectures, Kenneth Clark’s film series, “Civilization”, and on the reading of selected great books, including works by Marx, Freud and Mill. The focus of discussion will be on the nature, movement and costs of civilization itself.

Winter. Instructor: Johannesen

123 Major Themes in Canadian History
This course examines the development of social and economic class, race and cultural relations, growth and underdevelopment, imperialism and its consequences, and the evolving Canadian state.

Instructor: Johnson

123A* Major Themes in Canadian History 1
(Part 1 of 123).

Fall

123B* Major Themes in Canadian History 2
(Part 2 of 123).

Winter

130* The Modern World in Historical Perspective
This course will introduce students, through the interrelationships and interaction of selected themes, to the contemporary history of Europe, North America, and the Far East. Its format includes two interpretive lectures per week plus major films on twentieth century crises and optional discussion groups.

Fall, Winter, Spring. Instructors: Wynne, Eagles

201* Expansion of Europe from the 15th to the 18th Century
Not offered in 1976-77.

202* Expansion of Europe in the 19th and 20th Centuries
Not offered in 1976-77.

204A*-204K* Themes of History
History through thematic perspectives.

204A* Aborigines and Empires
Not offered in 1976-77.

204B* Empires and Missionaries
Not offered in 1976-77.
204C* Canadian Urban History
An historical examination of the urbanization process, the social, political and economic factors that shaped the Canadian city, and the relationship between selected metropolitan and hinterland areas.
Fall. Instructor: Johnson

204D* History of European Urban Society
This course will focus on the demographic changes that fostered towns, industrialization and the new class alignments. It will emphasize the European experiences of the 18th and 19th centuries.
Winter. Instructor: Harrigan

204E* War and Society in the Twentieth Century
A historical examination of the effects of war on Western European societies in the twentieth century. The effects of war on politics, economics, social structure and the arts will be some of the themes investigated.
Winter. Instructor: Stubbs

204F* The History of Education in Ontario, Part 1
An historical investigation of Ontario's educational system from its origins to the present. The course will emphasize the educational philosophies and practices of leading innovators such as Strachan, Ryerson, and Robarts, and the corresponding changes in structure and curriculum.
Fall. Instructor: MacKinnon

204G* The History of Education in Ontario, Part 2
This course will study (a) the impact of Ontario's educational system on politics and society since the early 19th century, (b) the relationship between education and the creation and perpetuation of elites, (c) education's influence on Ontario on social mobility and cultural identity, and (d) education's relationship to economic changes.
Winter. Instructor: MacKinnon

204H* The Individual and the Family in History
A survey of the changes in the quality and structure of life with special emphasis on love, marriage and the family in the West since the sixteenth century.
Fall. Instructor: Johannesen

204K* French Canadian Personalities of the Nineteenth and Twentieth Centuries
Not offered in 1976-77.

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 state of post-Reformation Europe. Within the chronological framework, cultural and social as well as political and institutional development will be examined.
Fall. Instructor: 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. Instructor: New

214A* Ireland since 1509: Part 1
A study of the political, social, and religious history of Ireland to 1800 with special attention to the Reformation and 17th-century rebellions.
Fall. Instructor: MacGillivray

214B* Ireland since 1509: Part 2
A study of the political, social, and religious history of Ireland from 1800 to the present, emphasizing the struggle for Home Rule and independence.
Winter. Instructor: MacGillivray

223* Canadian History to 1867
Not offered in 1976-77.

224* Canadian History since 1867
Not offered in 1976-77.

225 Canadian Culture and Society
This course will take the form of an inquiry into the nature of the Canadian experience. The social, political, and cultural evolution of Canada from New France to the present will be the major areas of discussion.
Instructor: McLaughlin

225A* Canadian Culture and Society 1
(Part 1 of 225).
Fall

225B* Canadian Culture and Society 2
(Part 2 of 225).
Winter

227* The History of Selected Racial and Regional Minorities in North America, Part 1
An examination of the formative years of the Afro-Canadian, Afro-American, and Native Indian communities in Canada and the United States.
Fall. Instructor: Walker

228* The History of Selected Racial and Regional Minorities in North America, Part 2
An examination of the emergence of minority assertiveness and the position of minorities in modern Canadian society.
Winter. Instructor: Patterson

225G* (RS 227G*) History of Christianity 1
The development of Western and Eastern Christianity to the end of the medieval period.
Fall. Instructor: Klaassen
236G* (RS 2286*) History of Christianity 2
Roman Catholicism, Eastern Orthodoxy and Protestantism from the Reformation to the present.
Winter. Instructor: Kleassen

2 Programme Courses

These courses are designed primarily for General and Honours History majors and other students in the Faculty of Arts, but are open also to all students (in some cases, a prerequisite or permission of the instructor is required).

Level 1 Introductory Courses

101 Crisis and Change in Western Civilization
Through lectures and small tutorials, this course will examine the major transformations experienced by the western world and introduce students to historical controversy and methodology. It is recommended for future honours history students as well as for students in other areas seeking an overview of the dynamics of Western Civilization.
Instructors: MacKinnon, Davis, Harrigan, Davies

101B* Crisis and Change in Western Civilization, 2
(Second half of 101).
Winter

101R* 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. Instructor: Packull

102R* Major Themes of Western Civilization 2
An introduction to the historical development of Western history from the Reformation to the present. The course will survey the economic, social and intellectual trends during the period.
Winter. Instructor: 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. Instructor: 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. Instructors: Walker, Craton, Guisso

120 An Introduction to Western Intellectual History
A foray into intellectual history, this course will explore seminal visions of the human predicament and its solution advanced by Western thinkers over the past 2,500 years. Designed for students willing to be challenged intellectually, this is a course without lectures, but with continuous reading and discussions in small seminars.
Instructors: Davies, New

125A* The Ancient World
This course will survey various aspects of ancient western civilization. The foundations of political life, social organization, and intellectual development will be considered, including the development of the Greek city-state and the Roman Empire.
Fall. Instructor: Wahl

125B* The Medieval World
A survey of selected topics designed to illustrate the development of medieval Europe. The end of the Roman political system and the formation of new political groupings in the West, the origins of feudalism, the crusades, and the Renaissance of the 12th century will be among the subjects considered.
Winter. Instructor: Wahl

125C* Early Modern Europe
This course will survey the chief features of early modern European society. Topics will include the Renaissance and Reformation, the expansion of Europe, Old Regime society, the scientific revolution and the Enlightenment.
Fall. Instructors: Smith, Harrigan

125D* Modern Europe
A survey of selected topics to illustrate the chief features of modern European history. Topics will include the French Revolution, the Industrial Revolution, liberalism, nationalism, and socialism, industrial society and the New Imperialism, the World Wars and their aftermaths.
Winter. Instructors: Smith, Harrigan

Level 2: Foundation Courses

3 hours. Lectures and tutorials. These are General and Honours courses and are open to students in other disciplines. No prerequisites.

250 History as an Intellectual Discipline
The 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.
Highly recommended for all Honours History students.
Instructor: New

251A*, B*, C*, D* Special Topics:
Courses to be mounted for one year only.
251A Twentieth Century America: Change and Conflict
This course will consist of an analysis of six or seven key issues in 20th-century American History, drawn in connected fashion from domestic and foreign politics. The emphasis will be on the ideas and the politics of change and conflict in modern America.
Instructor: Eagles

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. 255 and C. Civ. 251*, 252* may not both be taken for credit).
Instructor: Wahl

258 History of Medieval Europe
The political, cultural, economic and ecclesiastical development of Europe from 300 to 1300.
Instructors: Cherniavsky, MacKinnon

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.
Instructor: Davis

263* Europe in the Nineteenth Century
A study of Europe from the French Revolution to approximately 1900 with particular emphasis on the social forces that affected European society and the historical role of institutions in European society.
Fall. Instructor: 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. Instructor: Wynne

265 Canadian History
History 265 is a survey of Canadian history from New France to the present. It is thematic rather than strictly chronological, examining the major social, intellectual and political events in the development of the Canadian nation and the Canadian people.
Instructors: Cornell, McLaughlin

265A* Canadian History 1
(The first half of 265).
Fall

265B* Canadian History 2
(The second half of 265).
Winter

266 The History of Selected Racial and Regional Minorities in North America
Not offered in 1976-77. See Prof. Walker

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.
Fall. Instructor: 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.
Winter. Instructor: 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. Special attention will be given to revolutionary theories and the social changes which accompany revolutions.
Instructor: Packull

277 British Empire and Commonwealth History
A topical rather than 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 communications; in the second, sections on native peoples, colonial economics and history of the Commonwealth.
Instructor: Craton
Not open to students who have taken History 213

282 East Asian History
Chinese history from the Shang dynasty to the Opium War emphasizing the formation of a distinctive value system in the Chou; the creation of a unified and durable polity in the Han, the evolution of Confucianism, Taoism and Buddhism in their social context; the family system, the position of women, science and technology, poetry and the visual arts.
Instructor: Guisso

284* Latin America, Colonial Period
Study of the transfer of Iberian civilization from the Old World to the New emphasizing social history. Topics will include the destruction of native cultures, forced labour and slavery, colonial institutions, race mixture, 18th-century mercantilism, and the achievement of independence by the colonies.
Fall. Instructor: Smith
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 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. Instructor: Smith

291 African History
Not offered in 1976-77.

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.
Instructors: Johannesen, Ostrander

295A* History of the United States, 1776-1865
(Part 1 of 295).
Fall. Instructor: Johannesen

295B* History of the United States, since 1865
(Part 2 of 295).
Winter. Instructor: Ostrander

Level 3 Specialized courses

3 hours. Lectures and seminars. The following courses are open to all students above the First Year level. In every case the prerequisite is an Introductory or Foundation course appropriate to the subject, or the permission of the instructor. These courses grant 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.

340 Roman History to 337 A.D.
Not offered in 1976-77.

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. Instructor: Klaassen

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. Instructor: Klaassen

347G* Radical Reformation 1 (also RS 321G*)
Not offered in 1976-77.

348G* Radical Reformation 2 (also RS 322G*)
Not offered in 1976-77.

349 History as an Avocation
Special seminar recommended for all third year general majors in History. It will focus on history as an avocation, including the significance of history in law, education, governmental service, etc., and will require a research essay.
Prerequisite: 3rd year standing as a general major in History. Instructors: Faculty

351A, 351B, 351C, 351D Special Subject
Seminars and lectures in special fields. (See current department brochure for further information).

351A Africa and East Asia from World War II to the Present
A course designed to examine the response of two culturally diverse regions to the realities of the post-war world. The African section will focus upon the various forms taken by nationalist aspirations and independence movements in selected areas, while the East Asian section will contrast the communist and capitalist alternatives as developmental models in China and Japan.
Instructors: Beachey, Guisso

352 The United States in World Affairs
Not offered in 1976-77.

353 Medieval Church History from 312-1449
Not offered in 1976-77.

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. Instructor: 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. Instructor: Davies

357* German History 1648-1890
From the Great Elector to William II – The growth of Prussia from scattered domains to the dominating element of a modern nation state.
Fall. Instructor: Wynne

358* German History 1890-1950
The German Odyssey from the splendour of William II to the defeat of Hitler and the creation of two Germanies.
Winter. Instructor: Wynne
Course Descriptions

359* France in Revolution 1780-1870
Not offered in 1976-77.

360* French History Since 1870
Not offered in 1976-77.

361 English History 1485-1660
A study of achievements and crises in the Tudor and early Stuart periods.
Instructor: MacGillivray

362 British History Since 1760
Not offered in 1976-77.

363 Medieval English History
A study of government, church and society.
Instructor: Cherniavsky

364R* The Enlightenment, 1: Europe in Ferment
An examination of the 17th century background for the enlightenment era, especially the economic, political, social, and intellectual ferment of the period. The study will focus on continental Europe.
Instructor: Packull

365R* The Enlightenment, 2: Europe in the 18th Century
This term will focus on the Enlightenment itself, its religious and political implications, and the practice of Enlightened Despotism in France, Prussia, Austria, and Russia.
Instructor: Packull

366 European Intellectual History
Not offered in 1976-77.

368 International History Since 1870
A study of the international relations of the European states from the Franco Prussian War to the Cold War. Particular emphasis will be placed on an examination of the origins and consequences of the two World Wars.
Instructor: Stubbs

370 West Indian History
A study of the circum-Caribbean region from aboriginal times including European imperialism, the history of plantations, slavery and slave society, independence movements, and the problems posed by modernisation, underdevelopment and neo-colonialism.
Instructor: Craton

372 Problems in African History
Not offered in 1976-77.

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. Instructor: Epp

375 History of China
Not offered in 1976-77.

380 Canada 1867-1967
Not offered in 1976-77.

380A* Canada, 1867-1914
(Part 1 of 380).
Fall

380B* Canada Since 1914
(Part 2 of 380).
Winter

381 Studies in the History of Canadian Regionalism
The historical development of the self consciousness and particularism of the several Canadian regions in their British North American setting.

381A* Studies in the History of Canadian Regionalism, 1
(before 1867)
(Part 1 of 381).
Instructor: Cornell

381B* Studies in the History of Canadian Regionalism, 2
(since 1867)
(Part 2 of 381).
Instructor: Cornell

382 Canadian Intellectual History
Not offered in 1976-77.

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.
Instructor: Johnson

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

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

384 Canada in Crisis
Not offered in 1976-77.

386* Ontario History to Confederation
Not offered in 1976-77.

387* Ontario History Since Confederation
Not offered in 1976-77.
388 History of Canadian American Relations
Not offered in 1976-77.

389 Canada in World Affairs: The Twentieth Century
Not offered in 1976-77.

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.
Instructor: Patterson

391 Migrations to Canada and the United States since 1815
A history of major post-1815 migrations, notably those from Germany, Ireland, southern and eastern Europe, and Asia. The contrasting conceptions of a Canadian "vertical mosaic" and an American "melting pot" will be critically considered in historical perspective. Students will select special topics to pursue relating to the experience of any one particular ethnic group.
Instructor: Ostrander

392 The Foundations of American Civilization
An historical-critical examination of Puritanism and the Evangelical tradition; problems in economic and social change; and in literary and material culture.
Instructor: Johannesen

394 Twentieth Century Latin America
A topical examination of Latin America's historical experience in this century. A thematic approach will be followed.
Instructor: Smith

395 Law in the Ancient World
Not offered in 1976-77.

397 The Origins of the Common Law
An historical study of the origins and development of the Common Law. Topics in the history of Civil and Canon Law will be discussed to provide an introduction to the legal concepts of the Middle Ages and to give an appreciation of law as it exists today.
Alternates with History 395. Instructor: Wahl

399 Directed Studies in Special Topics
Study in a limited field under tutorial guidance. A high standard of written work will be expected.

399 A* Directed Studies in Special Topics
Study in a limited field under tutorial guidance. A high standard of written work will be expected.
Full

399B* Directed Studies in Special Topics
Study in a limited field under tutorial guidance. A high standard of written work will be expected.
Winter

Level 4: Senior Seminars

3 hours. Seminars and consultations. These seminars are designed for fourth year students who have taken relevant Level 2 or Level 3 courses, their equivalent elsewhere, or related courses in other disciplines. In all cases the instructor's permission is required.
The following seminars will not be offered in 1976-77: 411, 413, 414, 415, 423, 429, 450.

400 Roman History; Keresztes
401 Medieval History; MacKinnon
405 The Intellectual History of the Renaissance and Reformation; Davis
410 Early Modern English History; New**
411 English History from the 17th to the 19th Century; MacGillivray
412 19th and 20th Century British History; Wright
413 Modern French History; Harrigan
414 Modern European Intellectual History; Baker, Harrigan
415 Modern German History; Wynne
418 Russian History since 1861; Davies
420 Canada in the 19th Century; McLaughlin
421 Ontario History; Cornell**
423 Modern Quebec; Horton
425 20th Century Canadian History; English
426 Colonial American History; Johannesen
427 19th Century United States History; Ostrander**
428 Modern American History; Eagles
429 Modern Latin American History; Smith
430 British Imperial and Colonial History; Craton**
432 African History; Beachey
435 The History of Native Response to Colonial Rule; Patterson
436 Black History in North America; Walker
440 Far East; Guisso
450 Marxism and Canadian History; Johnson
453 20th Century International History; Stubbs**

**With permission of the instructor and the student's adviser, fourth year Honours students may also take the graduate research seminars as senior seminars; available in this way only are 410 (Early Modern England), 421 (Ontario), 427 (19th century U.S.A.), 430 (British imperial), 453 (20th century international).

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)

491 Directed Studies in Special Topics
Senior students only
*Not counted as Senior Seminars
Course Descriptions
Human Relations and Counselling Studies

Department of Human Relations and Counselling Studies

Assistant Professor, Acting Chairman
A. S. Wiener, B.A. (New Jersey), Ph.D.
(Wright Institute, California)

Professors
G. T. Barrett-Lennard, B.Sc., B.A. (Western Australia), Ph.D. (Chicago)
J. A. Dyal, B.A. (Oklahoma), Ph.D. (Illinois)
M. Lerner, B.A., M.A. (Ohio State Univ.), Ph.D.
New York University)
A. R. Mahler, B.S. (Western Reserve), M.A., Ph.D.
(Ohio State)

Assistant Professors
J. Goldstein, B.A. (McGill), M.A. (Columbia), Ph.D.
(Chicago)
R. O'Day, B.A. (British Columbia), M.A., Ph.D.
(Michigan)

Adjunct Professors
W. W. Dick, B.A., B.D. (Toronto), M.A., Ph.D.
(Ottawa)
O. Weizmann, B.A. (Ohio State), Ph.D. (Illinois)
J. L. Williams, B.A., M.A. (Alberta), Ph.D. (Missouri)
J. J. Wine, B.A. (Bridgewater College), M.S. (Iowa State), Ph.D. (Alberta)

Special 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 Psychology
2 Cross appointment in Counselling Services

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 programming 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 knowledge 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 72). 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.

Undergraduate Course Descriptions

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.

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.
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. 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
Organization 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 h. Prereq: Psych. 253*, or consent of instructor

252* Models of Human Community
3 hours. Prerequisite: Consent of Instructor

273* The Politics of Modern Humanism
A broad attempt to delineate and understand the origins of contemporary humanism with special emphasis on the institutions and philosophy of humanism in Canada. By way of an examination of the humanistic perspective, readings will be selected from among the following: Freud, Fromm, Maslow and Szasz.
3 hours

282* The Personal Dimensions of Inequality
An in-depth interdisciplinary analysis of the personal dimensions and consequences of social systems and relations which create, maintain and exacerbate inequalities that hinder and cripple existential growth and human development.
3 hours

300* Psychohistory and Personal Identity
An examination of how the creation of personal meaning and identity is affected by authoritarianism and movements for social liberation. Exploration of the personal impact of encounters with authoritarian systems and libertarian movements. Readings from some of the following: Bettelheim, Coles, Erikson, Fanon, Keniston, Lifton, Marcuse, Reich, and Vallieres.
Prereq: Consent of instructor. 3 hours

320* The Self-Analysis Group
The primary focus will be on understanding covert processes which operate in groups and which may facilitate or hinder functioning of innovative change and development. The course is designed to provide the participants with opportunities to experience directly and to analyze the effects of authority upon themselves and others.
Prereq: HR&CS 201* and consent of instructor. 3 h.

328* Self Change
A study of such methods of self change as: meditation, contemplation, relaxation, self-analysis, dream work, behavioral self control, and bio-feedback. A survey of theories of self change in personal counselling, and the interaction between self change and social change.
Prereq: HR&CS 120*, 201* or consent of instructor. 3 h.

355* Experiential Foundations of Counselling Studies
An examination of the work of Gendlin, Perls, Binswanger, May, Rogers, Boss, Whitaker and other contributors to experiential foundations of counselling. Dyadic and group counselling theory and practice from such experiential approaches as Gestalt, existentialism, and Daseins-analysis.
Prereq: HR&CS 120*, 201* or consent of instructor. 3 h.

370 (a, b, c)* Selected Social Projects
Students will work collectively on a social project to be selected each year; projects may include work with welfare recipients, mental patients, prisoners, etc. Class work will stress the development of more effective, accountable, and humane social services in the light of an empathic understanding of those whom human service professionals aim to help.
Prereq: For HR&CS majors only: consent of instructor. 3 h., credit basis only (CR/F)

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-f)* Directed Reading
Specially arranged for individual students.
3 hours. Prerequisite: Consent of instructor.
Department of Kinesiology

Associate Professor, Chairman of Department

Professor, Dean of the Faculty of Human Kinetics and Leisure Studies
G. S. Kenyon, B.P.E. (UBC), M.S. (Indiana), Ph.D. (N.Y.U.)

Assistant Professor, Associate Dean of Undergraduate Affairs of the Faculty of Human Kinetics and Leisure Studies
W. N. Widmeyer, B.A. (Western Ontario), B.P.E. (McMaster), M.A. (California)

Associate Professor, Associate Chairman Graduate Affairs
B. D. McPherson, B.A., M.A. (Western Ontario), Ph.D. (Wisconsin)

Assistant Professor, Associate Chairman Undergraduate Affairs
P. J. Bishop, B.Sc., B.P.E. (Waterloo), M.Sc. (Western Illinois), Ph.D. (Minnesota)

Professors
N. J. Ashton, B.Sc. (McGill), M.S. (Michigan)
R. Martens, B.Sc. (Kansas State), M.Sc. (Montana), Ph.D. (Illinois)

Associate Professors
H. J. Green, B.A., B.P.H.E. (Queen's), M.A. (Alberta), Ph.D. (Wisconsin)
D. Hayes, B.Sc., B.P.E., M.Sc., D.P.E. (Springfield)
M. E. Houston, B.Sc. (Toronto), Ph.D. (Waterloo)
D. A. Winter, B.Sc., M.Sc. (Queen's), Ph.D. (Dalhousie)

Assistant Professors
F. Allard, B.A., B.P.E., Ph.D. (Waterloo)
H. W. Gruchow, B.Sc., M.Sc., Ph.D. (Wisconsin)
P. G. King, B.P.E. (UNB), M.Sc., Ph.D. (Alberta)
R. Love, B.A., M.A., Ph.D. (Houston)
R. W. Norman, B.A., B.P.E. (McMaster), M.Sc. (Alberta)
C. H. Pierce, B.A. (Grinnell), M.A. (Depauw), Ph.D. (Kansas)
R. P. Schlegel, B.A. (Western Ontario), M.Sc. (Illinois), Ph.D. (Ohio State)
M. T. Sharratt, B.A., M.A. (Western Ontario), Ph.D. (Wisconsin)
W. E. Sime, B.Sc., M.Sc. (George Williams), Ph.D. (Pittsburgh)
J. A. Thomson, B.A., M.Sc. (McMaster), Ph.D. (Waterloo)
L. M. Wankel, B.P.E., B.Ed. (Saskatchewan), M.Sc., Ph.D. (Alberta)
I. D. Williams, M.S., Ph.D. (Illinois)

Lecturers
G. H. Baycroft, B.P.E., M.Sc. (Alberta)
R. D. Graham, B.A., M.A. (Western Ontario)
E. Roy, B.Sc. (Waterloo), M.P.E. (British Columbia)

Adjunct Professors
J. A. Israel, M.D. (Toronto), FRCS (C) (Toronto)
D. J. Pugliese, B.A., B.P.E. (McMaster), Ed.M. (Buffalo)

Faculty member holds cross appointments as shown
1 Sociology
2 Psychology

Faculty member holds joint appointment as shown
3 Psychology

Undergraduate Course Descriptions

Courses in Kinesiology and Health Studies are offered within the Department of Kinesiology. Descriptions of courses in Health Studies follows those for Kinesiology. For details of both programmes see Chapter 10.

Kinesiology

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
Course Descriptions
Kinesiology

103* Psycho-social Basis of Kinesiology
The study of human physical activity, from psychological, sociological, anthropological and historical perspectives is examined.
2 lectures, 1 tutorial, Winter term

116* Organic Chemistry
An introduction to fundamentals in general and organic chemistry.
3 lectures, Winter term

117* History of Sport and Physical Activity
Not offered in 1976-77.

200* Human Anatomy
A study of the human anatomical systems and their integration. Particular emphasis is placed on the skeletal, articular and muscular systems.
Prereq: Kin. 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 lab., alternating weeks, Winter

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
3 lectures, 2 hours lab., Fall term

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; as a problem. Leisure and social institutions: the family, the school, the church, the polity, the economy. Leisure and the future of man.
3 hours, Winter 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.
Prerequisite: Biology 303*, 304*
3 lectures, 2 hours lab., Fall term

317* Human Biochemistry
An elementary course in human biochemistry including the metabolism and function of proteins, carbohydrates, lipids, and hormones. Emphasis is placed on the application of biochemical principles to human movement.
Prerequisite: Kinesiology 116* or equivalent
3 lectures, Fall term

321* Introduction to the Biochanamics of Human Movement
Anatomical, neural and mechanical considerations in the qualitative and quantitative analysis of human movement are examined. Concepts related to the biostatics and biodynamics of linked segment models of human motion are introduced.
Prerequisite: Physics 103* Kin. 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
The nature and methodology of assessment is reviewed from theoretical and empirical perspectives. Taxonomies of motor performance are examined and principles developed for the measurement of specific construction in field and laboratory situations.
Prerequisite: Kinesiology 222*
3 lectures, 2 hours lab., Winter and Spring terms

340* An Introduction to Sports Medicine
An introductory course to the area of sports medicine, including the prevention, care and rehabilitation of common sports injuries. Considerable attention is directed towards the mechanisms of traumatic injuries as well as the management in the acute, intermediate and advanced stages of injury care.
Prereq: Kin. 200*, 3rd and 4th year students only
3 lectures, 2 hours lab., Fall and Winter terms
Course Descriptions
Kinesiology

341* Selected Topics in Sports Medicine
A course for those students wishing additional study in the area of athletic medicine. Topics to be presented include trauma to the head and vertebral column, internal injuries, heat problems and the medical and non-medical use of drugs in sport.
Prequisites: Kinesiology 340*, 300*, 317*
3 lectures, 2 hours laboratory, Winter term

346* Nutrition (Health Studies 346*)
An elementary course in nutrition with special emphasis on diet for sport and certain physiological conditions.
Prequisite: Kinesiology 317* or equivalent
3 lectures, Winter term

352* Aging, the Aged and Leisure: A Sociological and Social Psychological Perspective (Sociology 373*)
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.
Prereq: Soc. 101* and one other Soc. course
3 lectures, Fall term, every other year, beginning 1976

353* Personality and Motivation in Physical Activity (formerly 451*)
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.
Prereq: Psych. 101* and one other Psych. course
3 lectures, Fall term

354* Group Processes in Physical Activity (formerly Kin 455)
An examination of the social influences and group processes which occur within sport teams. Topics include conformity, the influence of onlookers and co-actors, leadership, group structure, and cohesion.
Prereq: 2 term courses in Psych., or consent of instructor
3 lectures, Winter and Spring terms

355* Motor Learning
An introduction to the concepts and theories of learning motor skills. Laboratory sessions enable the student to participate in a variety of commonly used experimental procedures which relate to concepts and theories presented in lectures.
Prequisite: Kinesiology 222*
3 lectures, 2 hours lab., Winter term

356* Information Processing in Human Perceptual Motor Performance
An information processing model of perceptual-motor behaviour is 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.
Prequisite: Kin 355* or instructor's consent
2 lectures, 1 tutorial, Winter and 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.
Prequisites: Kinesiology 300* and 317*
3 lectures, 2 hour lab, Winter and Spring terms

402* Hydrospace, Altitude and Aerospace Physiology
An examination of man’s cardiorespiratory responses at rest and during work to selected stresses of hyperbaric and hypobaric environments.
Prereq: Kin 300*, 3 hours lect., Fall 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*.
Prequisite: Kinesiology 300* and 321*
3 lectures, 2 hours lab, Winter term

410* Growth, Development and Aging (Health Studies 410*)
The changing capacities and interest of man are studied as he grows and develops. The contribution of physical activity to growth, and physical, psychological development is examined.
Prequisites: Kinesiology 200* and Biology 303*
3 lectures, Fall and Spring terms

420* Kinesiological Considerations in Equipment Evaluation
The principles of evaluation and design of equipment for human use are studied from a kinesiological perspective.
Prequisites: Kinesiology 321* and 340*
3 hours lecture, Field trips, Fall term

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, Winter term
425* Biomechanics of Human Movement
The quantitative analysis of human movement from a biomechanical perspective, including some neural control processes. Static, kinematic and kinetic analyses of single and multi-segment models of a variety of human movement forms are conducted.
Prerequisite: Kinesiology 321*
3 lectures, 2 hours lab., Fall and Spring terms

426* Biophysical Signal Processing and Control Systems
Basic electricity and electronics for the student with a biophysical background. Application of signal processing techniques to biophysical signals encountered by kinesiology students. Modelling of biophysical systems, control systems associated with human movement and performance.
Prereq: Kin 321*, Kin 300*, Kin 355* or permission of instructor. Three hours lecture, two hours lab., Fall term

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. Details are 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 300*
2 lectures, 2 hours lab., Winter term

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.
Prereq: Soc. 101* and one other Soc. 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. Emphasis is given to the uniqueness of the individual personality and how a person reacts to different situations.
Prerequisite: Kinesiology 353*
3 hours lecture, Winter term

470* Seminar in Kinesiology
An examination of current major issues and trends in Kinesiology. Students select areas of major interest from a series of faculty introduced topics.
Prerequisite: 4th year Kinesiology students
3 hours, Fall, Winter & Spring terms

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: Consent of department
Fall, Winter and Spring terms

480* Coaching Foundations
A study of basic principles and philosophies of coaching today. Emphasis is placed upon the application of kinesiological principles of performance as well as social, organizational and resource problems pertinent to each of several sport sections.
The specific sections offered are: Kin 481T-Volleyball, Kin 482T -Basketball, Kin 483T-Gymnastics, Kin 484T-Racquets, Kin 485T-Football, Kin 486T-Ice Hockey, Kin 487T-Field Hockey, Kin 488T-Aquatics, Kin 489T-Track and Field. Students must complete a minimum of three (3) sport sections before credit is given.
Prerequisite: 3rd or 4th year Kin students
9 separate sections: Fall, Winter, and Spring terms

Courses not Offered in 1976-77
Kin 171* History of Sport and Physical Activity

Physical Activities Courses
All activity courses are elective and non-credit. Students should consult with a faculty advisor concerning the applicability of these courses for entry into careers such as teaching. The following activity courses are elective and non-credit.

Kin 180 Elem. Basketball, W, S
Kin 183 Elem. Gymnastics, F, W
Kin 187 Beginner Swimming, F
Kin 188 Elem. Aquatics, F, W
Kin 281 Elem. Volleyball, F
Kin 282 Elem. Lacrosse, W
Kin 283 Int. Gymnastics (M), W
Kin 284 Int. Gymnastics (W), W
Kin 285 Elem. Football, F, S
Kin 286 Elem. Badminton, W
Kin 287 Elem. Soccer, F
Kin 288 Elem. Wrestling, W
Kin 289 Elem. Rugger, F
Kin 381 Elem. Tennis, F, S
Kin 382 Elem. Squash, W  
Kin 383 Elem. Golf, F, S  
Kin 384 Elem. Handball/Paddleball, W  
Kin 385 Elem. Field Hockey, F, S  
Kin 386 Elem. Ice Hockey, W  
Kin 387 Elem. Curling, W  
Kin 388 Int. Aquatics, W  
Kin 389 Elem. Track & Field, F, S  
Kin 389A Outdoor Skills Camp, F  
Kin 481 Adv. Volleyball, W  
Kin 482 Adv. Basketball, F, S  
Kin 483 Adv. Gymnastics, W  
Kin 484 Adv. Racquets, W  
Kin 485 Adv. Football, F, S  
Kin 486 Adv. Ice Hockey, W  
Kin 487 Adv. Field Hockey, F, S  
Kin 488 Adv. Aquatics, W  
Kin 489 Adv. Track & Field, F, S  
Kin 489A Ski School, W

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, genetic), early growth and development, puberty and adolescence, fitness, nutrition, consumer behaviour, and lifestyle determination.  
3 hours 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 hours lectures, Winter term

240* Man Adapting  
A study of human biological variation in relation to various physical, biological, and social environmental influences, with emphasis on the relevance of these factors to health and disease.  
3 hours lectures, Winter term

241* Epidemiology  
An introduction to the study of factors governing the occurrence of diseases in human populations, using selected diseases to illustrate methods of transmission and identification of risk factors.  
3 hours lectures, Winter term

302* An Introduction to Biomathematics  
(Mathematics 302)  
Course material has been selected with particular reference to some of the fundamentals or medical science including macromolecular processes, environmental health, genetics and genetic engineering, aging processes and theories and quantitative models which describe events in these areas. Topics include types of distributions, data processing and simple differential equations as they relate to biological phenomena.  
Prerequisite: Kin 116* or 1st year Chemistry or consent of instructor. 2 hours lectures, Full term

303* An Introduction to Biomathematics  
(Mathematics 302)  
A continuation of Health Studies 302*.  
Prerequisite: Health Studies 302*  
2 hours 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 hours 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 hours lectures, Winter and Spring terms

348* Social Psychology of Health Behavior  
The study and application of basic social psychological processes in relation to selected health-related behaviors (e.g., family planning, overeating, smoking, non-medical drug use, cardiovascular risk factors, patient compliance, medical care utilization).  
Prerequisite: H.S. 140*, 141*  
3 hours lectures, Winter & 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 health behavior problems.  
Prereq: Health Studies 140*. Psychology 101, or consent of instructor. 3 hours lect., Fall and Spring terms

410* Growth, Development and Aging (Kin 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 hours 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 of thesis form.
*Prerequisite: Completion of Health Studies 431*

440* Marriage and Family
An exploration of societal and psychological phenomena related to human sexuality, marriage and family through the study of sex-role socialization, family structure, mate selection, marital roles, marital conflict and its resolution, family planning and alternatives to marriage and family.
*Prerequisite: Sociology 101 and Psychology 101, or consent of instructor. 3 hours lectures, Fall term.

442* Epidemiology of Chronic Diseases
An investigation of the epidemiology of selected "non-infectious" diseases. Specific disease 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 lectures, Winter term

445* Seminar in Health Behaviour
A study of current issues pertaining to health and health behaviour. Topics include pertinent research in the field of health which have significant values to the individual, family and community, as well as a study of the problem areas in health behaviour.
*Prerequisite: HS 348, 349 3 hours 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
**Management Sciences Option**

(2 hours lecture and one hour lab per week)

**404 Organizational Behaviour**

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.

**405 Managerial Economics**

Designed to give an appreciation of the usefulness of basic concepts from economics in managerial decision making. Topics include costs (as foregone opportunities and in accounting terms), production as a process in time relating costs to benefits.

**406 Managerial Decision Making 1**


**407 Managerial Decision Making 2**


*Prerequisite: MS 406*

**Production/Industrial Engineering Option**

3 hours lectures and 1 hour lab per week

**21 Applied Probability and Statistics**


**23 Engineering and Managerial Economics**

Economics of the firm with emphasis on managerial decisions. Price and output decisions. Choosing among alternative production processes and input combinations. Evaluating make-or-buy decisions, equipment service life, and new products. Analytical tools include marginal analysis, linear programming, and capital budgeting techniques.
31 Industrial Statistics and Design of Experiments
Prerequisite: MS 21 or equivalent

43 Economics of Enterprise and Benefit Cost Analysis
Applications of models of household and enterprise behaviour. Seller strategy in consumer and industrial markets. Valuation of nonmarket goods. Examples include use of buyer behaviour data to determine market segments, and evaluation of a public investment.
Prerequisite: MS 23 or equivalent

44 Industrial Psychology

46 Optimization Models for Policy Analysis

47 Stochastic Models of Industrial Operations
Classification of stochastic processes. Recurrent events including birth and death processes, and branching processes. Waiting line models and applications. Markov processes and decision problems. Applications include inventory control, reliability, equipment replacement, maintenance, design of service facilities, etc.
Prerequisites: MS 21 or equivalent, MS 46

51 Systems Simulation
Systems as multicomponent, bounded interacting objects. Conservative and non-conservative systems. Physical and mathematical analogues and models. Model formulation and computability. Event distribution models and Monte Carlo simulation, with industrial examples. Cybernetic (or dynamic) simulation, with industrial examples.
Prerequisite: MS 46 or MS 406.

52 Management Information Systems
The information system as a component of the organization; relation to the management process and decision making; data and information in the organization; components of an information system; data bases; human considerations in implementation. Industrial examples.
Prerequisite: MS 44 or MS 404.

53 Decision Theory and Organization
Group interactions and the problems of industrial macroorganizations. Discussion of organizational decision-making and control process, with particular emphasis on the relevant theories of structural relations of organizations.
Prerequisite: MS 44 or MS 404.
Department of Man-Environment Studies

Professor, Chairman

Associate Professor, Undergraduate Officer
A. T. O'Brien, B.S. (Marymount), Ph.D. (Fordham)

Professor

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. Horton, B.A. (Wheaton), M.A. (Northwestern)
W. Shalinsky, B.A., B.S.W. (McGill), 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)
G. O. Michalenko, B.A., Ph.D. (Saskatchewan)
A. V. Morgan, B.A. (Leicester), M.A. (Calgary), Ph.D. (Birmingham)
T. McL. Semple, B.A. (Western Ontario), M.A., Ph.D. (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
J. E. Robinson, B.Sc. (Waterloo) (part time)

Faculty members holding cross/and/or joint appointment(s) as shown
1 Planning and Man-Environment Studies
2 Man-Environment Studies and Anthropology
3 Architecture, Geography, Man-Environment Studies and Planning
4 Man-Environment Studies and Earth Sciences
5 Planning, Man-Environment Studies and Biology
6 Psychology and Man-Environment Studies

Undergraduate Course Descriptions

ES 111 Introduction to the Study of The Future
See Environmental Studies course descriptions, page 261.

120 Environmental Issues and the Natural Sciences
Survey and analyses of selected environmental issues drawing upon concepts and theories from the natural and life sciences. Content of course closely integrated with M-Env 130 and organized into thematic units dealing with human and community studies, resource and environmental management, technology and society inter-relationships.
Prerequisite: Honours Man-Environment Studies
To be taken concurrently with M-Env 130
3 hours, Year

130 Environmental Issues and the Social Sciences
Survey and analyses of selected environmental issues drawing upon concepts and theories from the social sciences and humanities. Content of course closely integrated with M-Env 120 and organized into same thematic units.
Prerequisite: Honours Man-Environment Studies
To be taken concurrently with M-Env 120

150 Environmental Issues: Methods & Techniques
Series of concurrent six week workshops to introduce methods and techniques appropriate for investigating different environmental problems. Students to select any four from a series of workshops such as field studies, laboratory analyses, questionnaire design, survey research, small group dynamics and participant observation of social interactions.
Prerequisite: Honours Man-Environment Studies
3 hours, Year

190 Seminar-Workshop
Faculty-supervised individual or small group investigation of selected environmental issues to help develop skills for defining and resolving problem situations. Related or different topics may be selected for the fall and winter terms.
Prerequisite: Honours Man-Environment Studies
6 hours, Year

ES 195 Introduction to Environmental Problems
See Environmental Studies course descriptions, page 261.

ES 200 Field Ecology
See Environmental Studies course descriptions, page 261.
230* Interpreting Man-Environment Interrelationships
Review and comparison of different analytical approaches and modes of reasoning appropriate for understanding man-environment interrelationships including systems reasoning, the scientific method of enquiry, models of Man, anticipation of futures, and subjective modes of knowing.
Prerequisite: Honours Man-Environment Studies
3 hours, Winter term

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

241* Social Change
An analysis of major theories of social change, the sources and patterns of change processes, with emphasis on the environmental context.
No prerequisite. 3 hours, 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.
Prerequisite: Anth. 102 or permission of instructor
3 hours, Fall term

ES 252* Media Tools for Environmental Studies
See Environmental Studies course descriptions, page 261.

ES 253* Media Tools for Environmental Studies – Advanced Level
See Environmental Studies course descriptions, page 261.

260* Visual Perception and Communication
A study of man's perception of his environment, as influenced and represented by mass media. A special emphasis will be placed on visual education and the role of media in Canada in the development of children’s perceptions.
No prerequisite. 3 hours, Fall term

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 Year 5 mathematics take Math 85.
Prereq: For students in Environmental Studies
2 hours lecture, 1 hour lab, Fall and Winter term

272* Computer Programming in Environmental Studies
The course emphasizes computer programming skills and applications in the context of environmental problems.
Prerequisite: GeogMan-Env|Plan 271 or consent of instructor
3 hours, Winter term
Cross-listed as Plan 272 and Geog. 272

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 instructor
2 hours or equivalent, Fall and Winter terms

290 Seminar-Workshop
Individual or small group investigation of selected environmental issues. Topics chosen to reflect a "futures studies" orientation.
Prerequisite: Honours Man-Environments Studies
6 hours, Year

310* Psychological Man
The psychological correlates of the different 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

320* Environmental Economics
Principal economic concepts and their environmental implications. Examination of the economic approach to environmental quality. Introduction to social benefit-cost analysis as applied to environmental problems.
Prerequisite: Honours Man-Environment Studies or Introductory Economics course or consent of instructor
3 hours, Winter term. Cross-listed as Economics 357

330* Psycho-Social Aspects of Environmental Design
Accquire a flexible frame work 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

331* Environmental Issues in a Global Perspective
Environmental issues of world-wide significance examined in the broader context of population and socio-economic development, and the changing pattern of relations among have and have-not countries. Illustrative case studies drawn from experiences of the United Nations system and other sources.
Prereq: Hon. Man-Environ. Studies or instructor consent
3 hours, Fall term
Course Descriptions
Man-Environment Studies

335* Anthropology and Education
A seminar on certain theories of socialization, acculturation, and enculturation. These theories will be related to what in the west is usually categorized as "education". There will also be some emphasis on understanding how field work should be done in educational settings. Students should be prepared to do some field work themselves.

340* Special Topics in Environmental Science
Application of the natural or life science disciplines to selected problems of environmental importance. Emphasis is placed on the scientific principles and concepts used for analyzing problems in detail.
Prerequisite: Honours Man-Environment Studies
3 hours. Fall and Winter terms

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

351* Organization and Environmental Management
Analysis of selected governmental or other organizations performing important functions of policy issues and goals. Programme planning, budgeting, and delivery processes. Role of different specialists and "generalists", nature and extent of public participation.
2 hours seminar. Winter term

355* 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.
3 hours. Fall term. Cross-listed as Science 350

357* Conservation and Resource Management
Ecologic and economic approaches to the planning and management of renewable resources including forests, agricultural lands, fish and wildlife, water resources, oceans, parks and outdoor recreation uses. Essentially the same as Geog. 357 and Plan 357.
3 hours. Fall term

ES 358* Environmental Pollution and its Control
See Environmental Studies course descriptions, page 262.

360* Man and Nature
A brief study of various cultural beliefs and attitudes towards "Nature and Environment" in different periods of history and in different societies. Such concepts as "Natural order", Biological Rhythms, and Man's relationship to nature will be explored.
Prerequisite: Consent of instructor. 3 hours. Winter term

361* Contemporary Media of Communication and Human Environment
A study of history of media and their role in the cultural evolution of man. An exploration of the influence of mass media in literate and non-literate societies will be made, with special reference to social and political changes.
Prerequisite: M-Env. 260 or the consent of instructor
4 hours. Winter term

375* Special Readings or Seminar on Selected Topics
Prerequisite: Consent of instructor
2 hours or equivalent. Fall and Winter terms

ES 380*/381* Environmental Studies Workshop
See Environmental Studies course descriptions, page 262.

390 Seminar-Workshop
390A (1 course credit)
390B (2 course credits)
Individual or small group project emphasizing multidisciplinary treatment of environmental problems. Work encouraged on situations of interest to community organizations, government agencies or other groups. Extra credit only by consent of faculty.
Prerequisite: Honours Man-Environment Studies
6, 12 hours, Year

ES 400 Environmental Law
See Environmental Studies course descriptions, page 262.

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: Hon. Man-Environ. Studies or instructor consent
3 hours. Year

ES 411* Alternative Future Environments 1
See Environmental Studies course descriptions, page 262.

ES 412* Alternative Future Environments 2
See Environmental Studies course descriptions, page 262.
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 Studies and consent of instructor; non-majors, consent of instructor.
2 hours, Winter term; 6-8 weeks, Spring term

445 Technology Assessment and Policy Analysis
The focus of this course is upon technology assessment processes and systems with particular attention to actors, information, decisions, strategies, issues and policy analysis. In the context of technological developments, policy statements and policy-making structures and processes will be examined.
Prerequisite: Honours Man-Environment Studies fourth year or consent of instructor. 3 hours, Year

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.
Prereq: Hon. Man-Environ. Studies or instructor consent 2 hours seminar, Year

470 Environmental Teaching and Learning
Examination of physical and social environments which induce particular kinds of learning. Practical training and experience in project development and coordination, leadership and group facilitation processes.
Prerequisite: 3rd and 4th year Honours Man-Environment Studies and consent of instructor. 3 hours, Year

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

480 Honours Seminar: Special Topics
Topics will be selected from areas of special interest and experience of individual faculty members, reflecting current research or other academically related activities. Topics will change from year to year.
Prerequisite: Honours Man-Environment Studies 3 hours, Year

490 Senior Honours Assignment
490A (1 course credit)
490B (2 course credits)
490C (3 course credits)
A project of sufficient scope to demonstrate mastery of problem solving and communication skills on a selected problem or issue concerning man-environment interrelationships. Variable credit only by consent of faculty.
Prerequisite: Honours Man-Environment Studies 6, 12, 18 hours, Year
Faculty of Mathematics

Dean of the Faculty of Mathematics
W. F. Forbes, Ph.D., D.Sc. (London), D.I.C.

Associate Deans
K. D. Fryer, B.A. (Western), Ph.D. (Toronto)
P. J. Ponzo, M.A. (Toronto), Ph.D. (Illinois)

Associate Dean, Graduate Studies
D. D. Cowan, B.A.Sc. (Toronto), Ph.D. (Waterloo)

Assistant to the Dean
R. G. Dunkley, B.A. (Western)

Director of First Year Studies
P. C. Brillinger, B.A. (McMaster), M.A. (Waterloo)

Director of Computing Centre
P. H. Dirkse, M.A. (Waterloo)

Course Descriptions
Mathematics Faculty Members

Department of Applied Mathematics

Associate Professor and Chairman of the Department
C. F. A. Beaumont, B.A. (McMaster), M.A. (Toronto),
(Sabbatical Leave, 1975-76)

Associate Professor and
Acting Chairman of the Department
I. J. Mcgee, B.A.Sc. (Toronto), M.Sc. (Waterloo), Ph.D.
(Yale)

Professors
J. Cizek,1 R.N.Dr. (Charles University, Prague), C.Sc. 
(Czechoslovak Academy of Sciences, Prague)
H. F. Davis, Ph.D. (M.I.T.)
B. Forte,2 Ph.D. (Pisa), Habil.D.Sc. (Rome), (Sabbatical 
Leave, 1975-76)
(London), F.Inst.P.
M. S. Klamkin, B.Ch.E. (Cooper Union), M.S. (Brooklyn) 
M.A. McKiernan,3 M.A. (Loyola), Ph.D. (I.I.T.)
J. Paldus,1 R.N.Dr. (Charles University, Prague), C.Sc. 
(Czechoslovak Academy of Sciences, Prague), 
(Sabbatical Leave, 1975-76)
D. G. Wertheim, B.A. (McMaster), Ph.D. (Toronto)

Associate Professors
C. B. Collins, B.Sc. (London), Ph.D. (Cambridge)
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)
P. K. McCourt,1 B.Sc., Ph.D. (U.B.C.)
P. J. Ponzo, M.A. (Toronto), Ph.D. (Illinois)
J. Wainwright, B.Sc. (Natal), Ph.D. (South Africa)
R. A. Wentzel, B.Sc. (Acadia), Ph.D. (Western)

Assistant Professors
G. W. Horndeski, B.Sc. (Washington University), Ph.D. 
(Waterloo)
S. P. Lipshitz, B.Sc.Hons. (Natal), M.Sc. (South Africa), 
Ph.D. (Witwatersrand)
R. G. McLenaghan, M.Sc. (Queen’s), Ph.D. (Cantab.)
M. E. Snyder, B.Sc. (Western), M.Sc. (Waterloo)
Lecturer
B. J. Marshman, Ph.D. (Waterloo)

Postdoctoral Fellow
N. Tariq, B.Sc. (Special) in Mathematics, M.Sc. in Mathematics (London), Ph.D. (New Brunswick)

Adjunct Professors
D. Lovelock, Ph.D. (Natal), D.Sc. (Natal)
H. Rund, Ph.D. (Cape Town), Habilitation (Freiburg)

Faculty members holding cross-appointments as shown
1 Applied Mathematics and Chemistry
2 Applied Mathematics and Statistics and Computer Science
3 Pure Mathematics and Applied Mathematics

Department of Combinatorics and Optimization

Professor and Chairman of the Department
R. C. Mullin, B.A. (Western), Ph.D. (Waterloo)

Professor and Associate Chairman of the Department
D. H. Younger, Ph.D. (Columbia)

Distinguished Professor
W. T. Tuttle, Ph.D. (Cantab.), F.R.S.C.

Professors
G. Berman, M.A., Ph.D. (Toronto)
J. Edmonds, B.A. (Geo. Washington), M.S. (Maryland)
K. D. Fryer, B.A. (Western), Ph.D. (Toronto)
P. L. Hammer, Ph.D. Math. (Bucharest)
R. C. Read, M.A. (Cantab.), Ph.D. (London)

Associate Professors
J. A. Bondy, D.Phil. (Oxon)
R. N. Burns, B.Sc. (Toronto), Ph.D. (Waterloo)
C. E. Haff, B.S. (Sanford.), Ph.D. (Waterloo)
R. A. Honsberger, B.A. (Toronto), M.A. (Waterloo)
D. M. Jackson, Ph.D. (Cantab.)
H. Shank, M.Sc. (Chicago), Ph.D. (Cornell)

Assistant Professors
M. Best, M.Math. (Waterloo), Ph.D. (U.C. Berkeley)
A. R. Conn, B.Sc., (Imperial College), M.Sc. (Manitoba), Ph.D. (Waterloo)
G. B. Faulkner, B.A.Sc. (Toronto), Ph.D. (Waterloo)
L. B. Richmond, M.Sc. (Manitoba), Ph.D. (Alberta)
P. Schellenber, Ph.D. (Waterloo)
S. A. Vanstone, Ph.D. (Waterloo)

Research Associate
C. Charalambous, B.Sc. (Surrey), Ph.D. (McMaster)

Lecturers
E. Anderson, B.A. (McMaster)
R. G. Dunkley, B.A. (Western)

(Part-time)
P. Zima, M.Sc. (Prague)

Adjunct Professors
P. Erdős, Ph.D. (Budapest), D.Sc. (Manchester)
E. L. Johnson, B.S. (Georgia Tech.), Ph.D. (U.C. Berkeley)
C. St. J. A. Nash-Williams, Ph.D. (Cantab.), F.R.S.E.
R. G. Stanton, B.A. (Western), Ph.D. (Toronto)
R. E. Woolsey, Ph.D. (Texas)

Faculty Member holding cross-appointment as shown
1 St. Jerome's and Combinatorics & Optimization
Department of Computer Science

Professor and Chairman of the Department
J. D. Lawson, B.A.Sc. (Toronto), Ph.D. (Waterloo), F.I.M.A.

Professor and Associate Chairman of the Department
E. G. Manning, M.Sc. (Waterloo), Ph.D. (Illinois)

Professors
J. A. Brzozowski, M.A.Sc. (Toronto), Ph.D. (Princeton)
D. D. Cowan, B.A.Sc. (Toronto), Ph.D. (Waterloo)
B. Forte, Ph.D. (Pisa), Habil.D.Sc. (Rome)
C. Froese Fischer, M.A. (U.B.C.), Ph.D. (Canterbury), (On Leave, 1975-76)
W. M. Gentleman, B.Sc. (McGill), Ph.D. (Princeton), (Sabbatical Leave, 1975-76)
J. W. Graham, M.A. (Toronto)
T. Pietzukykowski, M.A. (Warsaw), Ph.D. (Polish Acad. Sci.)

Associate Professors
E. A. Ashcroft, B.A. (Cantab.), Ph.D. (Imperial College)
K. Culix, M.Sc., R.N.Dr. (Prague), Ph.D. (Czechoslovak Acad. Sci.)
J. A. George, M.Sc. (Alberta), Ph.D. (Stanford)
J. G. Linders, M.A.Sc. (Toronto), Ph.D. (Imperial College), (Sabbatical Leave, 1976)
J. Ll. Morris, B.Sc. (Leicester), Ph.D. (St. Andrews)
J. I. Munro, B.A. (New Brunswick), M.Sc. (U.B.C.), Ph.D. (Toronto)
R. B. Simpson, M.A.Sc. (Toronto), Ph.D. (Maryland)

Assistant Professors
P. C. Brillinger, B.A. (McMaster), M.A. (Waterloo)
V. A. Dyck, M.Math. (Waterloo), (Leave of Absence, 1975-76)
M. van Emden, M.Eng.Math. (Technische Hogeschool, Delft, The Netherlands), Ph.D. (Amsterdam)
K. O. Geddes, B.A. (Saskatchewan), M.Sc., Ph.D. (Toronto)
J. F. Gentleman, M.S. (Chicago), Ph.D. (Waterloo)
J. Majithia, B.Sc. (London), M.Eng., Ph.D. (McMaster)
M. Malcolm, B.Sc., M.S.Eng. (Denver), M.S., Ph.D. (Stanford)
D. F. Morgan, B.Sc. (Rose Polytechnic Inst.), M.S. (Michigan), Ph.D. (Waterloo)
R. W. Peebles, B.Sc. (McGill), Ph.D. (Pennsylvania)
L. D. Rogers, B.Sc. (McGill), Ph.D. (Waterloo)
G. Sager, Ph.D. (Washington)
J. A. Smith, M.A. (Waterloo), (part-time)
J. W. N. Wong, Ph.D. (U.C. Los Angeles)

Course Descriptions
Mathematics Faculty Members

Research Assistant Professors
C. M. Hoffmann, Vordiplom (Hamburg), M.A. (Indiana), Ph.D. (Wisconsin)
T. S. E. Maibaum, B.Sc. (Toronto), Ph.D. (London)
R. T. Moenck B.Sc. (Sussex), M.Sc., Ph.D. (Toronto)
J. W. Welch, B.Sc. (McGill), Ph.D. (Waterloo)

Research Associate
G. Miller, B.A. (Calif. State College), Ph.D. (U.C. Berkeley)

Lecturer
R. J. Beach, M.Math. (Waterloo)

Adjunct Professor
P. H. Dinksen, M.A. (Waterloo)

Faculty Members holding cross-appointments as shown
1 Applied Mathematics and Statistics and Computer Science
2 Computer Science and Statistics
3 Statistics and Computer Science
4 Electrical Engineering and Computer Science
Department of Pure Mathematics

Professor and Chairman of the Department
R. A. Staal, Ph.D. (Toronto)

Distinguished Professor

Professors
G. E. Cross, M.A. (Dalhousie), Ph.D. (U.B.C.)
D. Z. Djokovic, Ph.D. (Belgrad)
H. Haruki, Ph.D. (Osaka)
P. Hoffman, B.A. (Toronto), Ph.D. (Manchester)
M. A. McKiernan, M.A. (Loyola), Ph.D. (1.1.7.)

Associate Professors
J. G. Anderson, M.Sc. (Durham), Ph.D. (Newcastle)
J. A. Baker, M.A. (Saskatchewan), Ph.D. (Waterloo)
S. Burris, Ph.D. (Oklahoma), (Sabbatical Leave, 1975-76)
L. J. Cummings, Ph.D. (U.B.C.)
G. Dankert, Dip.Math. (TH. Hanov), Ph.D. (Cologne), (Sabbatical Leave, 1976)
W. J. Gilbert, M.A. (Cantab.), D.Phil. (Oxon.)
D. A. Higgs, B.Sc.Hons. (Witwatersrand), M.A. (Cantab.), Ph.D. (McMaster)
P. L. Kannappan, B.Sc. (Annamalai), Ph.D (Washington)
A. Kerr-Lawson, B.A. (Toronto), M.A. (Chicago), Ph.D. (McMaster), (Sabbatical Leave, 1976-77)
D. Mowat, Ph.D (Waterloo)
F. C. Y. Tang, B.Sc. (Hong Kong), M.S. (South Carolina), Ph.D. (Illinois), (Sabbatical Leave, 1976)

Assistant Professors
L. J. Dickey, M.A. (Arizona), Ph.D. (Wisconsin)
J. Malz, Ph.D. (Toronto), (Sabbatical Leave, 1976)
E. M. Moskal, B.A. (Toronto), Ph.D. (Illinois)
C. T. Ng, B.Sc. (Chinese Univ.), Ph.D. (Waterloo), (Leave of Absence, 1976)
K. A. Rowe, B.S. (Toronto), M.S. (Wisconsin), Ph.D. (Illinois), (Sabbatical Leave, 1976)
C. C. S. Sastri, M.Sc. (Andhra), Ph.D. (New York)
F. Zorzitto, M.Sc. (Windsor), Ph.D. (Queen's)

Research Associate
G. T. Diderrich, Ph.D. (Wisconsin)

Postdoctoral Fellow
D. Hoffman, B.S. (Union College Schenectady, N.Y.)

Faculty members holding cross-appointments as shown
1 Pure Mathematics and Applied Mathematics
2 Pure Mathematics and Philosophy
3 St. Jerome's and Pure Mathematics

Department of Statistics

Professor and Chairman of the Department
J. C. Kalbfleisch, Ph.D. (Waterloo)

Associate Professor and
Associate Chairman of the Department
J. F. Lawless, Ph.D. (Waterloo)

Associate Professor and
Associate Chairman of the Department
J. C. Young, B.A.Sc. (Toronto), M.Sc. (Waterloo), Ph.D. (Edinburgh)

Professors
G. A. Barnard, M.A., D.Sc. (Cambridge), (part-time)
W. F. Forbes, Ph.D., D.Sc. (London), D.I.C.
B. Forte, Ph.D. (Pisa), Habil.D.Sc. (Rome)
W. M. Gentleman, B.Sc. (McGill), Ph.D. (Princeton)
V. P. Godambe, M.Sc. (Bombay), Ph.D. (London)
B. E. Reilly, B.A.Sc. (Toronto), D.I.C., Ph.D. (London), F.S.S.
D. A. Sprott, Ph.D. (Toronto)
M. D. Vogel-Sprott, B.A. (McMaster), Ph.D. (Toronto)

Assistant Professors
G. W. Bennett, Ph.D. (Adelaide)
M. A. Bennett, B.A. (Nottingham), F.S.A., F.C.I.A.
W. H. Cherry, Ph.D. (Melbourne)
J. D. Kalbfleisch, Ph.D. (Waterloo)
W. S. Rickert, Ph.D. (Waterloo)
M. E. Thompson, B.Sc. (Toronto), Ph.D. (Illinois)
R. V. Thysell, B.Sc. (Montana), Ph.D. (Iowa)

Assistant Professors
A. Brender, B.Sc. (McGill), Ph.D. (U.C. Berkeley)
K. S. Brown, Ph.D. (Waterloo)
J. F. Gentleman, M.S. (Chicago), Ph.D. (Waterloo)
R. J. MacKay, B.Sc. (Waterloo), Ph.D. (ToronTo)
C. Minder, Dipl.Math (Basel), Ph.D. (Waterloo)
H. H. Panjer, Ph.D. (Western)
J. C. Robinson, M.A.Sc., P.Eng., Ph.D. (Waterloo)
J. B. Whitney, M.A. (Western), Ph.D. (Toronto)

Research Associate
S. Esterby, B.A. (Queens)

Research Assistant Professor
P. A. McBride-Warren, B.A. (Dallas), Ph.D. (Kansas State)

Lecturers
R. L. Brown, B.Math. (Waterloo), A.S.A.
C. Springer, M.Sc. (McGill)
Adjunct Professors
S. N. Afriat, M.A. (Cambridge), D.Phil. (Oxford)
I. P. Fellegi, Ph.D. (Carleton)
A. Finch, Ph.D., D.Sc. (London), D.I.C.
R. C. Frecker, B.Sc. (Memorial), M.D. (Dalhousie)
J. Gani, Ph.D. (Australian Nat'l Univ.), D.Sc. (London), D.I.C.
M. Zelen, B.Sc. (City College, New York), M.A. (North Carolina), Ph.D. (American)

Postdoctoral Fellows
J. A. Chapman, Ph.D. (Waterloo)
J. A. Jackson, M.A. (Cambridge), M.B., B.Chir. (Cambridge), (part time)

Faculty members holding cross-appointments as shown.
1 Applied Mathematics and Statistics and Computer Science
2 Computer Science and Statistics
3 Chemical Engineering and Statistics
4 Statistics and Psychology
5 Psychology and Statistics
6 Statistics and Computer Science

Strategy Board Members

University of Waterloo Faculty of Mathematics
R. S. Aberg
General Manager
Corporate Planning
Shell Canada Limited

W. R. Clark
General Manager
Personnel and Community Relations
Simpsons, Limited

R. G. Clifford
Vice President
Central Region
IBM Canada Limited

P. D. Drouillard
Assistant Director General
Planning and Evaluation
Public Service Canada

W. A. R. MacFadden
Partner
Coopers and Lybrand

J. V. Masterman
Vice President (Operations)
Mutual Life Assurance Co. of Canada

E. L. Pursey
Comptroller
Canada Imperial Bank of Commerce

Dr. C. D. Sadleir
Manager
Information Systems
Reed Paper Ltd.

G. F. Sekely
Director
Information Systems
Canadian Pacific Limited

H. J. M. Watson
Assistant Comptroller
Management Information Services
The Steel Company of Canada Ltd.

R. P. Wismer
Manager
Systems Development
Noranda Mines Limited

D. T. Wright
Deputy Provincial Secretary
Secretariat for Social Development
Province of Ontario

The University of Waterloo Strategy Board was established to provide liaison between the Faculty of Mathematics and knowledgeable representatives from key sectors of the economy. Board meetings are normally held twice a year.
Renumbering of Mathematics Courses

In 1976, the Faculty of Mathematics renumbered its course offerings in accordance with the departments within the faculty. The abbreviated forms for the courses are as follows:

AM – Applied Mathematics
C&O – Combinatorics & Optimization
CS – Computer Science
Math – Mathematics
Mthel – Mathematics Elective
PM – Pure Mathematics
Stat – Statistics

Listed below are the old and new course numbers. The new Mathematics numbering system has been incorporated only in the Mathematics program section (Chapter 12). All other sections which show reference to Mathematics courses have used the old numbering system. The new numbering will be reflected in all sections of succeeding calendars.

Service Courses

<table>
<thead>
<tr>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 12</td>
<td>Math 110</td>
</tr>
<tr>
<td>Math 21</td>
<td>Math 114</td>
</tr>
<tr>
<td>Math 22</td>
<td>Math 210</td>
</tr>
<tr>
<td>Math 25</td>
<td>Math 211</td>
</tr>
<tr>
<td>Math 31</td>
<td>Math 215, 216</td>
</tr>
<tr>
<td>Math 32</td>
<td>CS 210</td>
</tr>
<tr>
<td>Math 35</td>
<td>Math 212</td>
</tr>
<tr>
<td>Math 44</td>
<td>Math 414</td>
</tr>
<tr>
<td>Math 52</td>
<td>Stat 210</td>
</tr>
<tr>
<td>Math 73 a</td>
<td>CS 112</td>
</tr>
<tr>
<td>Math 73 b</td>
<td>CS 113</td>
</tr>
<tr>
<td>Math 73 c</td>
<td>CS 114</td>
</tr>
<tr>
<td>Math 73 d</td>
<td>CS 115</td>
</tr>
<tr>
<td>Math 81</td>
<td>Math 101 a, b</td>
</tr>
<tr>
<td>Math 82</td>
<td>Math 102</td>
</tr>
<tr>
<td>Math 83</td>
<td>Math 103</td>
</tr>
<tr>
<td>Math 84</td>
<td>Math 104</td>
</tr>
<tr>
<td>Math 85</td>
<td>Math 105</td>
</tr>
<tr>
<td>Math 100</td>
<td>Math 100</td>
</tr>
<tr>
<td>Math 122 a</td>
<td>CS 118</td>
</tr>
<tr>
<td>Math 131 a</td>
<td>Math 111 a</td>
</tr>
<tr>
<td>Math 131 b</td>
<td>Math 111 b</td>
</tr>
<tr>
<td>Math 243</td>
<td>Stat 204, 205</td>
</tr>
<tr>
<td>Math 253 a</td>
<td>Stat 202</td>
</tr>
<tr>
<td>Math 323 a</td>
<td>Stat 300</td>
</tr>
<tr>
<td>Math 450</td>
<td>AM 405</td>
</tr>
<tr>
<td>Math 515</td>
<td>Stat 500</td>
</tr>
<tr>
<td>Math 122 a</td>
<td>CS 118</td>
</tr>
</tbody>
</table>

Math Courses

<table>
<thead>
<tr>
<th>Old</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathel 101 a</td>
<td>AM 101</td>
</tr>
<tr>
<td>Mathel 101 b</td>
<td>AM 111</td>
</tr>
<tr>
<td>Math 112 a</td>
<td>CS 116</td>
</tr>
<tr>
<td>Math 112 b</td>
<td>CS 117</td>
</tr>
<tr>
<td>Math 119 a, b</td>
<td>Math 124 a, b</td>
</tr>
<tr>
<td>Math 120 a, b</td>
<td>Math 120 a, b</td>
</tr>
<tr>
<td>Math 122 a</td>
<td>CS 140</td>
</tr>
<tr>
<td>Math 129</td>
<td>Math 134 a, b</td>
</tr>
<tr>
<td>Math 130</td>
<td>Math 130 a, b</td>
</tr>
<tr>
<td>Math 132 a</td>
<td>CS 180</td>
</tr>
<tr>
<td>Math 132 b</td>
<td>CS 150</td>
</tr>
<tr>
<td>Math 201 a</td>
<td>AM 230</td>
</tr>
<tr>
<td>Math 201 b</td>
<td>AM 240</td>
</tr>
<tr>
<td>Math 217</td>
<td>Math 220 a, b</td>
</tr>
<tr>
<td>Math 219</td>
<td>Math 221 a, b</td>
</tr>
<tr>
<td>Math 223 a</td>
<td>Stat 220</td>
</tr>
<tr>
<td>Math 223 b</td>
<td>Stat 221</td>
</tr>
<tr>
<td>Math 225 a</td>
<td>Stat 270</td>
</tr>
<tr>
<td>Math 228</td>
<td>PMath 230</td>
</tr>
<tr>
<td>Math 229</td>
<td>Math 231 a, b</td>
</tr>
<tr>
<td>Math 233</td>
<td>Stat 230, 231</td>
</tr>
<tr>
<td>Math 234 a</td>
<td>AM 260</td>
</tr>
<tr>
<td>Math 234 b</td>
<td>AM 270</td>
</tr>
<tr>
<td>Math 235 a</td>
<td>Stat 273</td>
</tr>
<tr>
<td>Math 235 b</td>
<td>Stat 284</td>
</tr>
<tr>
<td>Math 236</td>
<td>Math 226</td>
</tr>
<tr>
<td>Math 237</td>
<td>Math 230 a, b</td>
</tr>
<tr>
<td>Math 239 a, b</td>
<td>C&amp;O 239 a, b</td>
</tr>
<tr>
<td>Math 240 a</td>
<td>CS 210</td>
</tr>
<tr>
<td>Math 240 b</td>
<td>CS 240</td>
</tr>
<tr>
<td>Math 300 a, b</td>
<td>C&amp;O 330 a, b</td>
</tr>
<tr>
<td>Math 301 a</td>
<td>AM 330</td>
</tr>
<tr>
<td>Math 301 b</td>
<td>AM 340</td>
</tr>
<tr>
<td>Math .307</td>
<td>C&amp;O .337</td>
</tr>
<tr>
<td>Math 312 a, b</td>
<td>Math 322 a, b</td>
</tr>
<tr>
<td>Math 314 a</td>
<td>CS 370</td>
</tr>
<tr>
<td>Math 314 b</td>
<td>CS 371</td>
</tr>
<tr>
<td>Math 319</td>
<td>Math 321</td>
</tr>
<tr>
<td>Math 320 a</td>
<td>CS 330</td>
</tr>
<tr>
<td>Math 320 b</td>
<td>CS 331</td>
</tr>
<tr>
<td>Math 329</td>
<td>Math 331</td>
</tr>
<tr>
<td>Math 330 a</td>
<td>PMath 363</td>
</tr>
<tr>
<td>Math 330 b</td>
<td>PMath 362</td>
</tr>
<tr>
<td>Math 330 c</td>
<td>PMath 361</td>
</tr>
<tr>
<td>Math 332 a, b</td>
<td>Math 332 a, b</td>
</tr>
<tr>
<td>Math 334 a</td>
<td>CS 472</td>
</tr>
<tr>
<td>Math 334 b</td>
<td>CS 474</td>
</tr>
<tr>
<td>Math 335 a</td>
<td>Stat 373</td>
</tr>
<tr>
<td>Math 335 b</td>
<td>Stat 383</td>
</tr>
<tr>
<td>Math 336 a</td>
<td>Stat 374</td>
</tr>
<tr>
<td>Math 336 b</td>
<td>Stat 384</td>
</tr>
<tr>
<td>Math 338 a</td>
<td>Stat 350</td>
</tr>
<tr>
<td>Math 338 b</td>
<td>Stat 351</td>
</tr>
<tr>
<td>Math 339 a</td>
<td>Stat 340</td>
</tr>
<tr>
<td>Math 339 b</td>
<td>Stat 341</td>
</tr>
<tr>
<td>Math 340 a</td>
<td>CS 340</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Math 340 b</td>
<td>CS 342</td>
</tr>
<tr>
<td>Math 341</td>
<td>PMath 341</td>
</tr>
<tr>
<td>Math 342</td>
<td>PMath 351</td>
</tr>
<tr>
<td>Math 343</td>
<td>PMath 332</td>
</tr>
<tr>
<td>Math 344 a</td>
<td>PMath 367</td>
</tr>
<tr>
<td>Math 349 a</td>
<td>Stat 331</td>
</tr>
<tr>
<td>Math 349 b</td>
<td>Stat 442</td>
</tr>
<tr>
<td>Math 351 a, b</td>
<td>C&amp;O 351 a, b</td>
</tr>
<tr>
<td>Math 352 a, b</td>
<td>C&amp;O 352 a, b</td>
</tr>
<tr>
<td>Math 353 a</td>
<td>C&amp;O 353 a</td>
</tr>
<tr>
<td>Math 360 a</td>
<td>AM 362</td>
</tr>
<tr>
<td>Math 360 b</td>
<td>AM 372</td>
</tr>
<tr>
<td>Math 361 a</td>
<td>AM 382</td>
</tr>
<tr>
<td>Math 361 b</td>
<td>AM 395</td>
</tr>
<tr>
<td>Math 362 a</td>
<td>AM 365</td>
</tr>
<tr>
<td>Math 362 b</td>
<td>AM 371</td>
</tr>
<tr>
<td>Math 363</td>
<td>AM 361</td>
</tr>
<tr>
<td>Math 371 a</td>
<td>CS 369</td>
</tr>
<tr>
<td>Math 372 a</td>
<td>CS 360</td>
</tr>
<tr>
<td>Math 380 a</td>
<td>PMath 380 a</td>
</tr>
<tr>
<td>Math 380 b</td>
<td>PMath 380 b</td>
</tr>
<tr>
<td>Math 401 a</td>
<td>AM 430</td>
</tr>
<tr>
<td>Math 401 b</td>
<td>AM 440</td>
</tr>
<tr>
<td>Math 406</td>
<td>PMath 443</td>
</tr>
<tr>
<td>Math 407</td>
<td>PMath 464</td>
</tr>
<tr>
<td>Math 408</td>
<td>PMath 432</td>
</tr>
<tr>
<td>Math 409</td>
<td>PMath 462</td>
</tr>
<tr>
<td>Math 410 a</td>
<td>PMath 445 a</td>
</tr>
<tr>
<td>Math 410 b</td>
<td>PMath 445 b</td>
</tr>
<tr>
<td>Math 411 a</td>
<td>PMath 446 a</td>
</tr>
<tr>
<td>Math 411 b</td>
<td>PMath 446 b</td>
</tr>
<tr>
<td>Math 412 a</td>
<td>PMath 447 a</td>
</tr>
<tr>
<td>Math 412 b</td>
<td>PMath 447 b</td>
</tr>
<tr>
<td>Math 413</td>
<td>AM 461</td>
</tr>
<tr>
<td>Math 417 a</td>
<td>C&amp;O 437 a</td>
</tr>
<tr>
<td>Math 417 b</td>
<td>C&amp;O 437 b</td>
</tr>
<tr>
<td>Math 418 a</td>
<td>C&amp;O 438 a</td>
</tr>
<tr>
<td>Math 418 b</td>
<td>C&amp;O 438 b</td>
</tr>
<tr>
<td>Math 425</td>
<td>PMath 441</td>
</tr>
<tr>
<td>Math 426</td>
<td>PMath 467</td>
</tr>
<tr>
<td>Math 428</td>
<td>PMath 444</td>
</tr>
<tr>
<td>Math 429</td>
<td>PMath 466, C&amp;O 439</td>
</tr>
<tr>
<td>Math 430</td>
<td>PMath 461, C&amp;O 430</td>
</tr>
<tr>
<td>Math 432</td>
<td>PMath 452</td>
</tr>
<tr>
<td>Math 433</td>
<td>PMath 451</td>
</tr>
<tr>
<td>Math 434</td>
<td>AM 481</td>
</tr>
<tr>
<td>Math 435 a</td>
<td>Stat 474</td>
</tr>
<tr>
<td>Math 435 b</td>
<td>Stat 486</td>
</tr>
<tr>
<td>Math 436</td>
<td>PMath 430</td>
</tr>
<tr>
<td>Math 437 a</td>
<td>Stat 475</td>
</tr>
<tr>
<td>Math 437 b</td>
<td>Stat 485</td>
</tr>
<tr>
<td>Math 438 a</td>
<td>Stat 450</td>
</tr>
<tr>
<td>Math 438 b</td>
<td>Stat 451</td>
</tr>
<tr>
<td>Math 439 a</td>
<td>Stat 452</td>
</tr>
<tr>
<td>Math 439 b</td>
<td>Stat 453</td>
</tr>
<tr>
<td>Math 441</td>
<td>AM 465</td>
</tr>
<tr>
<td>Math 442</td>
<td>AM 473</td>
</tr>
<tr>
<td>Math 443</td>
<td>AM 485</td>
</tr>
<tr>
<td>Math 444</td>
<td>AM 495</td>
</tr>
</tbody>
</table>
Mathematics Undergraduate Course Descriptions

Note
Course descriptions are given under the new course numbers introduced in 1976.

Math 120a Calculus
Functions and limits, differentiation of algebraic and trigonometric functions, applications of the derivative, the differential, Riemann sums, the first and second fundamental theorems of the integral calculus.
3 hour lectures, 1 hour tutorial

Note
M120a is not open to Honours Math. students.

Math 120b Calculus
Differentiation and integration of exponential and logarithmic functions, techniques of integration, applications of integration, indeterminate forms, sequences, convergence of series, power series.
3 hours lectures, 1 hour tutorial

Note
M120b is not open to Honours Math. students.

Math 124a Algebra and Geometry
Elementary number theory, mathematical induction, binomial theorem, monotone sequences, inequalities, complex numbers, elementary functions of a complex variable, polynomials and polynomial equations.
3 hours lectures, 1 hour tutorial

Note
M124a is not open to Honours Math. students.

Math 124b Algebra and Geometry
Determinants and matrices, vectors in two and three space, quadric surfaces, systems of equations, elementary linear transformations.
3 hours lectures, 1 hour tutorial

Note
M124b is not open to Honours Math. students.

Math 130a Calculus
Functions and limits, the derivative, differentiation of algebraic and other functions, applications of the derivative, the integral, applications of the integral.

Math 130b Calculus
Techniques of integration, convergence of series, power series. Some elementary differential equations.

Math 134a Algebra and Geometry
Integers and diophantine equations, congruences, induction and the binomial theorem, rational and real numbers, inequalities, complex numbers, polynomial equations.

Math 134b Algebra and Geometry
In 2 and 3 dimensions: vectors, lines and planes, linear transformations, matrices, determinants, circles and spheres, geometry of the triangle, quadric surfaces, inequalities.

Math 220a Advanced Calculus
Differential calculus of functions of several variables, double integrals and applications.

Note
M220a is not open to Honours Math. students.

Math 220b Advanced Calculus
Triple integrals, line integrals, Green's theorem, infinite series, ordinary differential equations.

Note
M220b is not open to Honours Math. students.

Math 221a Linear Algebra
A selection of topics from: vector spaces, linear maps, matrix theory, inner products, bilinear and quadratic forms, and applications.
3 hours lectures

Note
M221a is not open to Honours Math. students.

Math 221b Linear Algebra
A continuation of Math 221a.

Note
M221b is not open to Honours Math. students.

Math 226 Elementary Differential Equations
2 hours lectures; two terms

Note
M226 is not open to Honours Mathematics students.

Math 230a Advanced Calculus
Differential calculus of functions of several variables: limits and continuity, partial derivatives; differentiability, chain rule, Taylor's formula, extreme values, mappings and Jacobians. Integral calculus of functions of several variables: multiple integrals, iterated integrals, change of variables, applications to area and volume calculations.
Math 230b Advanced Calculus

Math 231a Linear Algebra
A selection of topics from: vector spaces, systems of linear equations, transformations, matrices, inner products, determinants, invariant subspaces, canonical forms, bilinear forms, quadratic forms, and applications.

Math 231b Linear Algebra
A continuation of Math 231a.

Math 321 Abstract Algebra
Rings, integral domains, fields, groups. Quotient groups and quotient rings. The emphasis is on examples rather than on proofs of theorems.

Two terms

Note
M321 is not open to Honours Math. students.

Math 322a Introduction To Real Analysis
Elementary properties of the real number system including the completeness property and its relation to the concepts of limit, continuity and differentiability; mean value theorem; Riemann integration and the integrability of continuous and monotonic functions; uniform convergence and power series; the residue calculus, and applications. The emphasis will be on applications.

3 hours lectures

Note
M322a is not open to Honours Math. students.

Math 322b An Introduction To Complex Variable Theory
Complex numbers; continuity, differentiability, analyticity of functions; the Cauchy-Riemann equations; solution 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
M322b is not open to Honours Math. students.

Math 331 Abstract Algebra
Groups, rings, fields and other algebraic structures. Quotient structures. Selected applications.

Two terms.
Department of Applied Mathematics
Undergraduate Course Descriptions

Note
Course descriptions are given under the new course numbers introduced in 1976.

AM 230, 240, 330, 340, 430, 440 is 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.

AM 101a Applications of Mathematics
Models using difference equations will be formulated for examples drawn from biology, economics and psychology.
3 hours lectures, 1 hour tutorial. Fall term.

AM 101b Applications of Mathematics
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.

AM 230 Applications of Mathematics
Ordinary differential equations will be applied to models drawn from biology, economics, physiology and physics.
Prerequisite: M 101, 120, 130, or consent of instructor.
2 hours lectures, 1 hour tutorial.

AM 204 Applications of Mathematics
Other examples from biology, ecology, economics, physiology and physics will be discussed using sets of differential equations.
Prerequisite: AM 230 or M 220
2 hours lectures, 1 hour tutorial.

AM 260 Mathematical Modelling
Mathematical models for problems in the physical and biological sciences. Typical problems chosen from ecology, special relativity, spread of epidemics, rumours and tumors. Solutions to problems will be obtained primarily by differential equations.
Prerequisite: M 130

AM 270 Mathematical Modelling
Further mathematical models from various disciplines. An introduction to Newtonian mechanics will also be included in the course.
Prerequisite: AM 260 or consent of instructor.

AM 330 Applications of Mathematics
Partial differential equations are applied to diffusion processes, blood flow and wave phenomena.
Prerequisite: M 220 or equivalent, or consent of instructor
2 hours lectures, 1 hour tutorial.
Course Descriptions
Applied Mathematics

AM 382 Calculus of Variations
Prerequisite: M 230 or consent of instructor.
2 hours lectures, 1 hour tutorial. Fall term

AM 395 Mechanics
Prerequisites: M 230, AM 382 or consent of instructor.
2 hours lectures, 1 hour tutorial. Winter term

AM 389 Reading Course
AM 399 Reading Course

AM 405 Applied Analysis
2 hours lectures.

AM 430 Applications of Mathematics
Integral equations and integral transforms will be applied to systems with memory.
Prerequisite: Consent of instructor.
2 hours lectures. Fall term

AM 440 Applications of Mathematics
Students will construct a model and interpret it as a project.
Prerequisite: Consent of instructor.
2 hours lectures. Winter term

AM 461 Non-Linear Differential Equations
Non-linear mechanics, stability, quasi-linear and strongly non-linear systems, linear periodic systems, non-linear integral equations.
Prerequisite: AM 361 or consent of instructor.
2 hours lectures. Two terms

AM 462 Measure and Integration
The theory of measure and the Lebesgue integral.
2 hours lectures. Fall term

AM 465 Quantum Mechanics
Prerequisites: M 231, AM 371 or consent of instructor.
2 hours lectures, two terms

AM 466 Fluid Mechanics
Fundamental equations of inviscid fluids, compressibility, vorticity; two and three dimensional irrotational, incompressible flow, Blasius’ theorem, Joukowski hypothesis.
Prerequisite: AM 365.
2 hours lectures, 1 hour tutorial. Fall term

AM 468 Topics in Applied Mathematics
A selection of topics given by members of the Applied Mathematics Department. Typical topics are: elasticity, fluid mechanics, electromagnetic theory, statistical mechanics, perturbation theory, calculus of variations, partial differential equations, distribution theory.
Prerequisite: Consent of instructor.
2 hours lectures. Fall term

AM 472 Linear Operators
Linear operators in Hilbert spaces. Compact operators. Introduction to functional analysis.
2 hours lectures. Winter term

AM 473 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, the Reissner-Nordstrom solution. Topics from cosmology, Petrov classification, spinors, gravitational waves, special solutions.
Prerequisite: AM 362. Consent of instructor.
2 hours lectures. Winter term

AM 476 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.
Prerequisite: AM 466.
2 hours lectures, 1 hour tutorial. Winter term

AM 478 Topics in Applied Mathematics
Same as in 468.
Prerequisite: Consent of instructor.
2 hours lectures, Winter term
AM 481 Differential Equations
Prerequisite: Consent of instructor. Two terms.

AM 482 Differential Geometry
Differentiable manifolds, tensors and forms. Connexions. Riemannian manifolds.
Prerequisites: M 231 and 230
2 hours lectures. Two terms.

AM 485 Electromagnetism
Applications of the Maxwell equations. Reflection and refraction. Introduction to wave guides and antennae.
Prerequisite: Consent of instructor.
2 hours lectures. Fall term

AM 486 Statistical Mechanics
Applications of probability theory to theoretical Physics.
2 hours lectures. Fall term

AM 488 Control Theory
Prerequisite: Consent of instructor.
2 hours lectures. Fall term

AM 489 Reading Course
2 hours a week. One term.

AM 495 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 Venants' principle.
2 hours lectures, 1 hour tutorial. Winter term.
Prerequisite: AM 365.

AM 499 Reading Course
2 hours a week. One term.

Department of Combinatorics and Optimization
Undergraduate Course Descriptions

Note
Course descriptions are given under the new course numbers introduced in 1976.

C&O 239a An Introduction to Combinatorics
Recommended for students wishing an introduction to discrete mathematics.
Prerequisite: Math 124/134.
2 hours lectures, 2 hours tutorial.

C&O 239b An Introduction to Optimization
Prerequisite: Math 124/134; 239a is Not a prerequisite.
2 hours lectures, 2 hours tutorial, one term

C&O 330a Mathematical Discovery and Invention 1
A study of about 100 challenging problems taken from many areas of elementary mathematics - number theory, combinatorics, geometry, probability, logic.
2 hours lectures, one term

C&O 330b Mathematical Discovery and Invention 2
A study of about 100 challenging problems taken from many areas of elementary mathematics - number theory, combinatorics, geometry, probability, logic.
Prerequisite: None. C&O 330a is Not a prerequisite to C&O 330b. 2 hours lectures, one term

C&O 337 Combinatorial Geometry

C&O 351a Introduction to Graph Theory and Combinatorics 1
A study of the basic concepts and problems of graph theory: connection, minimum path problems; bipartite graphs, the marriage problem; 1-factors of arbitrary graphs; planar graphs.
Prerequisite: Math 239 recommended.
2 hours lectures, one term

C&O 351b Introduction to Graph Theory and Combinatorics 2
Hamiltonian circuits in a graph, four colour problem, other colouring problems: directed graphs, balanced orientations; an introduction to the theory of enumeration, with applications to counting graphs and other combinatorial objects.
Prerequisite: Math 239 and Math 351a recommended.
2 hours lectures, one term
Course Descriptions  
Combinatorics and Optimization

C&O 352a Fundamentals of Optimization 1  
Optimization techniques common to a wide variety of operations research and engineering problems, and of fundamental theoretical interest. Linear programming, simplex method, duality and complementary slackness, sensitivity analysis, integer programming, games.  
Prerequisites: Math 231/221 and Math 230/220.  
2 hours lectures, one term

C&O 352b Fundamentals of Optimization 2  
Network programming, optimal paths, trees, transportation problems, k-th best policies. Applications to PERT, CPM, dynamic programming, equipment replacement, knapsack problems, optimal man-job assignments, warehousing problems. Continuous optimization techniques, Lagrange multipliers. Applications to inventory theory, capital budgeting, regression analysis.  
Prerequisites: Math 231/221 and Math 230/220.  
2 hours lectures, one term

C&O 353a Modelling and Optimization  
An applications oriented course that illustrates how various mathematical models and methods of optimization can be used to solve problems arising in business, industry and science.  
2 hours lectures, one term

C&O 437a Optimizational Combinatorics 1  
Prerequisite: C&O 352a or consent of instructor.  
2 hours lectures, one term

C&O 437b Optimizational Combinatorics 2  
Recommended for students interested in theoretically advanced study in Combinatorics and Optimization or Computer Science.  
Prerequisite: C&O 437a or consent of instructor.  
2 hours lectures, one term

C&O 438a Combinatorial Applications of Computer 1  
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.  
Prerequisites: At least one computer programming language. Math 321/331. 2 hours lectures, one term

C&O 438b Combinatorial Applications of Computers 2  
Prereq: At least one computer programming language.  
Math 331, C&O 438a. 2 hours lectures, one term

C&O 446a History of Mathematics 1  
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.  
Prerequisites: No formal prerequisites are demanded.  
2 hours lectures, one term

C&O 446b History of Mathematics 2  
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).  
Prerequisites: No formal prerequisites are demanded.  
2 hours lectures, one term

C&O 451a Nonlinear Optimization 1  
Recent algorithms for constrained and unconstrained optimization problems will be presented. Topics will include Newton, quasi-Newton, conjugate gradient, feasible direction, and penalty algorithms.  
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

C&O 451b Nonlinear Optimization 2  
Nonlinear Programming: convergence conditions and convergence rates for some unconstrained optimization methods, introduction to the Kuhn-Tucker conditions and duality theory for nonlinear programmes, optimality conditions for a quadratic programme.  
Prerequisite: C&O 451a or consent of the instructor.  
2 hours lectures, one term
C&O 452a Linear and Integer Programming
(Theory, Applications and Related Topics) 1
Convex sets, geometric motivation for the Simplex Algorithm. Simplex Algorithm. Revised Simplex Algorithm. Degeneracy. Post-optimal analysis (parametric programming, sensitivity analysis, etc.) Applications, Duality Theory, Dual Simplex Algorithm. Prerequisites: Linear Algebra and Elementary FORTRAN or consent of instructor. 2 hours lectures, one term

C&O 452b Linear and Integer Programming
(Theory, Applications and Related Topics) 2
Primal Dual Algorithms. Transportation Problem. Decomposition of large systems. Formulation of integer, mixed integer, and discrete programming problems. Methods of solution (cutting plane methods, implicit enumeration, branch-and-bound, etc.). Partitioning methods. Applications, computerized methods of solution. Prerequisites: C&O 452a or 352a or consent of instructor. 2 hours lectures, one term

C&O 453a Queuing Theory 1
Queueing models are analyzed, including, single channel queues of infinite and finite capacity; infinite and finite customer populations. Multi-server queues in series or parallel with homogeneous and heterogeneous servers. Models incorporating customer behavior including balk ing, reneging and jockeying. Prerequisite: Introductory Probability. 2 hours lectures, one term

C&O 454a Game Theory 1
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. Prerequisites: Math 231 and basic probability theory. 2 hours lectures, one term

C&O 454b Game Theory 2
N-person games; Shapley value; metagames. Prerequisite: C&O 454a.

C&O 455a Mathematical Programming 1
Dynamic Programming – deterministic decision process problems; monotonic path problems, equipment replacement, single and multidimensional resource allocation, reduction of dimension by use of Lagrange multipliers, optimal reliability, shortest path problems, cargo loading problem, the travelling salesman problem, introduction to optimal control, an aggregate scheduling problem of inventory. Prerequisite: C&O 352a or consent of instructor. 2 hours lectures, one term

C&O 455b Mathematical Programming 2
Dynamic Programming – stochastic decision process problems; stopping time problem, time delay, certainty equivalence, stochastic path problems, series and parallel feedback control, discrete time variational problems, irregular problems. Prerequisite: C&O 455a. 2 hours lectures, one term

C&O 456a Scheduling (Math 456a)
Single machine job shops, parallel machines, flow-shop scheduling, the general m/n job shop. Capital budgeting, distribution problems occurring in scheduling trucks, trains, and in warehouse movements. 2 hours lectures, one term. Prerequisites: C&O 352 recommended.

C&O 456b Boolean Methods in Discrete Optimization
(Math 456b)

C&O 457a Information Retrieval 1
This course will be concerned with the combinatorial problems of retrieving data from a store and discusses the principal algorithms for doing this. Methods for constructing appropriate relational structures and their stability are considered, as well as devices for improving substantial gains in efficiency.

C&O 457b Information Retrieval 2
This course considers the application of combinatorial structures, such as block designs, to information retrieval. The construction of such structures will be considered together with methods for optimising a general model for the retrieval problem.
C&O 458a Graph Theory 1
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.
Prerequisite: C&O 351 or consent of instructor. 2 hours lectures, one term

C&O 458b Graph Theory 2
Continuation of topics covered in 458a.
Prerequisite: C&O 458a. 2 hours lectures, one term

C&O 459a Algebraic Graph Theory 1
C&O 459b Algebraic Graph Theory 2

C&O 460a Combinatorics 1
Enumerative Mathematics, Combinatorial identities, generating functions, counting of labelled and unlabelled objects, theorems of Polya, Redfield-Read, and de Bruijn, permanents, combinatorial decompositions.
Recommended as a useful preliminary for Math 785 "Planar graphs" and Math 792 "Enumerative combinatorial theory".
Prerequisite: A knowledge of elementary group theory (Math 331). 2 hours lectures, one term.

C&O 460b Combinatorics 2
The existence and construction of error correcting codes, projective geometries, orthogonal Latin squares, balanced incomplete block design and other combinatorial configurations.
Recommended for C&O 780 Combinatorial Analysis.
Prerequisite: Theory of finite groups, rings and fields (Math 331). 2 hours lectures, one term.

Department of Computer Science
Undergraduate Course Descriptions

Note
Course descriptions are given under the new departmental course numbers introduced in 1976.

CS 112 Introduction to Solving Business Problems By Computer
Introduction to algorithms. Emphasis on the solution of mathematical problems in business. Concept and properties of an algorithm, language and notation for describing algorithms. Analysis of problems, development of models and algorithms; implementation in procedure-oriented languages (FORTRAN IV and BASIC), the execution of these programs using several systems.
2 hours lectures, 2 hours tutorial, one term. Offered in the Fall and Winter terms.

Note
CS 112 is a prerequisite for CS 113, 114, 115.

Note
Only one of CS 112, CS 116, CS 118 and CS 140 can be taken for credit.

Note
CS 112 cannot be counted for credit towards a B.Math degree.

CS 113 Modelling & Simulation For Business Applications
An introduction to the techniques of modelling, simulation and analysis of business systems. Simulation is developed as an effective tool for studying various types of business system environments. Students will be required to develop and run simulation models using both GPSS and DYNAMO programming languages.
Prerequisite: CS 112 or the equivalent. An introductory statistics course. 3 hours lectures, Winter term.

Note
CS 113 cannot be counted for credit towards a B.Math degree.

CS 114 The Computing Process
For students who must have an understanding of the terminology, hardware (computing Machinery), software (computer programs), and financial and management aspects of the computing process. Topics include: development of computing machinery and programming languages; methods of job processing; development/maintenance of application programs; organization and management of a computer installation; uses of specialized applications packages.
Prerequisite: CS 112 or the equivalent. 2 hours lectures, Winter term.
Course Descriptions
Computer Science

Note
Only one of CS 114, CS 117 can be taken for credit.

Note
CS 114 cannot be counted for credit towards a B.Math degree.

CS 115 Introduction to File Processing
File processing is an integral part of most commercial applications. Introduction to file processing techniques such as file maintenance, sorting and report generation. Language and notation for describing such algorithms. Analysis of problems dealing with files, and development of algorithms for their solution. Introduction to procedure-oriented languages (usually COBOL) for solving such problems.
Prerequisites: CS 112 or the equivalent.
2 hours lectures, 2 hours tutorial (laboratory). Fall term

Note
Credit will only be granted for one of CS 115 or CS 180.

Note
CS 115 cannot be counted for credit towards a B.Math degree.

CS 116 Introduction to Computers
This course provides students in programmes of study which do not emphasize Mathematics with an appreciation of the capabilities and limitations of machine computing and a reasonable capability for programming in one or more programming languages. Topics will include: concept of an algorithm, representation of information, programming in a higher level language, concept of a compiler.
2 hours lectures, 1 hour tutorial, Fall term

Note
Credit will only be granted for one of CS 112, CS 116, CS 118 or CS 140.
CS 116 cannot be counted as a credit towards a B.Math General or Honours degree.

CS 117 Applications and Implications of Computers
A continuation of the concepts introduced in CS 116 – the applications of computers to several fields and the impact (past, present and future) of computing on society.
Prerequisite: CS 116.
2 hours lectures, 1 hour tutorial. Winter term.

Note
Credit will only be granted for one of CS 117 or CS 150.
CS 117 cannot be counted as a credit towards a B.Math General or Honours degree.

CS 118 Introduction to Scientific Problem Solving by Computer
An introduction to the analysis of scientific problems, development of mathematical models and algorithms for their solution; implementation in a procedure-oriented language (normally FORTRAN IV). Topics discussed are: solution of equations, computation of integrals, graph plotting, and simulation.
Prerequisite: Year 5 mathematics is recommended.
2 hours lectures, 2 hours tutorial, one term.
Offered in the Fall, Winter and Spring terms

Note
Only one of CS 112, CS 116, CS 118 and CS 140 can be taken for credit.

Note
Both CS 140 and CS 180 may be taken for credit.

CS 140 Introduction to Mathematical Problem Solving by Computer
An introduction to the analysis of mathematical problems, development of mathematical models and algorithms for their solution; implementation in a procedure-oriented language (normally FORTRAN IV). Topics discussed are: solution of equations, computation of integrals, graph plotting, and simulation.
Prerequisite: Year 5 mathematics is recommended.
2 hours lectures, 2 hours tutorial, one term.
Offered in the Fall, Winter and Spring terms

Note
Only one of CS 112, CS 116, CS 118 and CS 140 can be taken for credit.

Note
Both CS 140 and CS 180 may be taken for credit.

CS 150 Introduction to Computer Science – Characteristics of Computers
Introduction to machine and assembly-language programming and basic machine architecture. The representation of data. Address modification, indexing and indirection. Character manipulation, floating point operations and subroutine linkage. Characteristics of peripheral devices. A survey of software which assists user programs: compilers, loaders, input-output routines, operating systems.
Prerequisite: CS 116, CS 118 or CS 140 or CS 180.
2 hours lectures, 2 hours tutorial (laboratory), one term.
Normally offered in the Fall and Winter terms

Note
Credit will only be granted for one of CS 117 or CS 150.
CS 180 Introduction to Computer Science – Programming and File Processing
Introduction to the use of computers. Concept of an algorithm. Language and notation for describing algorithms. Analysis & solution of problems dealing with files. Introduction to a procedure-oriented language (usually COBOL). The preparation and debugging of programs in such a language. Topics: file processing and maintenance, sorting, report generation and file design.
Prerequisite: Year 5 mathematics.
2 hours lectures, 2 hours tutorial (laboratory), one term. Normally offered in the Fall and Winter terms.

Note
Credit will only be granted for one of CS 115 or CS 180.

CS 210 Introduction to Numerical Computing
A survey of numerical procedures with emphasis upon computer implementation using the FORTRAN IV programming language. Topics include: interpolation, curve fitting, solution of non-linear equations, numerical integration, numerical solution of ordinary and partial differential equations, matrix algebra and solution of systems of linear equations.
Prerequisite: An introductory programming course.
2 hours lectures, 2 hours problems, one term. Offered in the Fall and Spring terms.

CS 240 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. ALGOL and SNOBOL will normally be the languages used.
Prerequisite: CS 140 or CS 180 or the equivalent. CS 150 is recommended. 2 hours lectures, 2 hours tutorial. Offered in the Fall, Winter and Spring terms.

CS 330 Computer Applications in Business
A discussion of the algorithms for the storage and retrieval of information using storage media such as disks and tapes. The techniques developed are applied to a number of general business applications areas such as billing, inventory control and general ledger accounting. Good systems design and programming practices will be stressed throughout the course.
Prerequisite: CS 180
2 hours lectures, 2 hours tutorial, one term.

Note
CS 330 and CS 340 cannot both be taken for credit.

CS 331 Computer Applications in Business
A continuation of the topics presented in CS 330.
Prerequisite: CS 330.
2 hours lectures, 2 hours tutorial, one term.
CS 371 Introduction to Scientific Computation:
Numerical Approximation
Polynomial interpolation; least squares and minimax approximation; numerical integration and differentiation; numerical solution of initial value problems and boundary value problems. As in Math 314a, the intent is to expose students to modern computational techniques for solving mathematical problems.
Prerequisites: Knowledge of a high level language, preferably FORTRAN, Math 221 or 231 and Math 220 or 230. 2 hours lectures, 2 hours tutorial, one term

CS 446 Scientific Applications Software
Practical computing problems 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; Current programming techniques; Design and use of program libraries and human engineering of input and output; Magnetic tapes and bulk storage.
Prerequisites: Any two of: CS 370, CS 371, CS 472, CS 474, CS 340, CS 342. 3 hours lectures, one term

CS 450 Computer Architecture
This course is intended to prepare the student to choose a suitable computer for a given application. Review of combinational and sequential logic circuits. Discussion of modules or 'building blocks' - central processing units, stores, input/output systems, and bus structures. Case studies of machines.
Prerequisite: CS 369 or equivalent. 3 hours lectures, one term.
Offered in the Fall, Winter and Spring terms

CS 452 Real Time Application of Minicomputers
This course is intended to give students experience with mini-computers and their applications to process control, data acquisition and communication. A major part of the course involves hands-on experience.

CS 454 Principles of Operating Systems
Basic concepts of computer hardware; Program translation; program 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; File systems; Reliability; Protection; System performance, measurement and evaluation.
Prerequisites: CS 340, CS 342. Also recommended as a prerequisite or corequisite is CS 450. 3 hours lectures, one term.

CS 456 Data Communications
This course is intended to introduce students to the basic concepts of data communication, the computer-communications interface, and new telecommunications services. Topics include basic queueing theory, data communications and the telephone network, computer architecture for data communications, protocols, error handling, multiplexing and switching, and packet switching networks.
Prerequisites: The equivalent of CS 240, CS 340, CS 342, STAT 230, C&O 453. 3 hours lectures, Winter term

CS 462 Formal Languages
Prerequisite: CS 360. 3 hours lectures, one term.
Offered in the Spring and Fall terms

CS 464 Computability and Recursive Function Theory
Models of the computational process as reflected by computers, linguistic systems, functional specifications, transformational systems, formal logic, etc. Equivalence of these models. Computational complexity for specific models and abstractions fitting all models. Formal reducibilities between computational problems, and the complexity of these reducibilities.
Prerequisite: CS 360. 3 hours lectures, Winter term

CS 466 Algorithm Design and Analysis
Design of good algorithms and analysis of the resources they consume. Lower Bounds on the resource requirements of algorithms to compute certain functions. Problems from the following areas are discussed in this light: Sorting and order statistics, data structures, arithmetic computations, the NP-complete problems.
Prerequisites: CS 360 and CS 340. 3 hours lectures

CS 468 Program Verification
Methods of program verification. Implications for structured programming. Inductive reasoning about recursive programs and recursively defined data structures.
Prerequisite: CS 360. 3 hours lectures, Winter term

CS 472 Numerical Algebra
Prerequisites: CS 370. 3 hours lectures, 2 hours tutorial, one term.
Offered in the Spring and Fall terms.
CS 474 Numerical Approximation
Prerequisites: CS 371. 3 hours lectures, 2 hours tutorial, Winter term.

CS 476 Numerical Solution of Differential and Integral Equations
Prerequisite: Consent of the instructor. 3 hours lectures, Fall term

CS 478 Partial Differential Equations
Prerequisite: Consent of the instructor. 3 hours lectures, Winter term

CS 482 Business Systems Analysis
Prerequisites: CS 330 and CS 331 or CS 340 and fourth year standing. 3 hours lectures, one term

CS 484 Simulation
Simulation techniques are used to study systems which do not lend themselves to analysis. This course introduces the basic notions of simulation as well as 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.
Prerequisites: CS 330 and CS 331, or CS 340 and fourth year standing. 3 hours lectures, one term

CS 498 Advanced Topics in Computer Science
CS 499 Readings in Computer Science

Department of Pure Mathematics
Undergraduate Course Descriptions

Note
Course descriptions are given under the new departmental course numbers introduced in 1976.

PMath 230Y Introduction to Pure Mathematics
Examples and results in modern geometry, number theory and analysis; the historical sources of modern mathematics.
2 hours lectures. Two terms

PMath 341Y Algebra
Fundamentals of group, ring, field theory, and other algebraic structures.
Corequisite: Math 231alb. 3 hours lectures. Two terms

PMath 351Y 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.
Prerequisite: Math 230alb. 2 hours lectures. Two terms

PMath 352Y Complex Analysis 1
Analysis of complex numbers; fundamental theorems of holomorphic functions; meromorphic functions.
Prerequisite: Math 230alb. 2 hours lectures. Two terms

PMath 361 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

PMath 362 Projective Geometry
Projective spaces over fields, collineations and correlations, quadric curves and surfaces. References to non-euclidean geometries.
Prerequisite: Math 231alb. 3 hours lectures. One term

PMath 363 Geometry of the Complex Numbers
The plane of complex numbers. The group of circle preserving mappings and its subgroups. Connections with non-euclidean geometries (Laguerre, Minkowski).
Prerequisite: Math 231alb. 3 hours lectures. One term

PMath 367 Topology 1
Intuitive set theory, metric spaces, point set topology.
3 hours lectures. One term
PMath 380a Introduction to Information Theory with Applications
2 hours lectures, 1 hour tutorial. One term

PMath 380b Information Theory with Applications
Measures of expected conditional information. Maximizing expected conditional information. Applications to communication theory and programming. Basics in questionnaire theory.
Prerequisite: PMath 380a
2 hours lectures, 1 hour tutorial. One term

PMath 399 Readings in Pure Math

PMath 430Y Introduction to Mathematical 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.
Prerequisite: Consent of instructor.
2 hours lectures. Two terms

PMath 432Y 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 PMath 430.
2 hours lectures. Two terms

PMath 441Y Theory of Numbers
Multiplicative-algebraic theory of numbers. Foundations of natural number theory. Elements of additive-combinatorial number theory.
Corequisite: Math 331 or PMath 341.
2 hours lectures. Two terms

PMath 443 Linear Algebra 2
Continuation of linear algebra. Main topics: representations of endomorphisms, structure of bilinear forms, multilinear products.
Prerequisite: Math 331 or PMath 341.
2 hours lectures. One term

PMath 444a Lattice Theory 1
Ordered sets, lattices, and Galois connections. Applications in algebra, geometry and logic.
Consent of instructor. 2 hours lectures. One term

PMath 444b Lattice Theory 2
2 hours lectures. One term.

PMath 445a Ring Theory 1
Continuation of the theory of rings and modules.
Prerequisite: Math 331 or PMath 341.
2 hours lectures. One term

PMath 445b Ring Theory 2
2 hours lectures. One term

PMath 446a Group Theory 1
Permutations, Cayley Theorem, Sylow Theorem, Jordan-Hölder Theorem, nilpotent and solvable groups, direct and semidirect products, free groups.
Corequisite: Math 331 or PMath 341.
2 hours lectures. One term

PMath 446b Group Theory 2
Continuation of group theory 1
2 hours lectures. One term

PMath 447a Field Theory 1
Field extensions and Galois theory.
Prerequisite: Math 331 or PMath 341.
2 hours lectures. One term

PMath 447b Field Theory 2
2 hours lectures. One term.

PMath 451a Real Analysis 2a
An introduction to integration and measure theory with emphasis on the real line.
Prerequisite: Math 332a or PMath 351.
2 hours lectures. One term

PMath 451b Real Analysis 2b
2 hours lectures. One term.

PMath 452a Complex Analysis 2a
Further properties of holomorphic and meromorphic functions. Riemann surfaces.
Prerequisite: Math 332 or PMath 352.
2 hours lectures. One term

PMath 452b Complex Analysis 2b
2 hours lectures. One term.

PMath 461, C&O 430 Finite Geometries
Corequisite: PMath 362. 2 hours lectures. One term

PMath 462 Foundations of Geometry
An axiomatic treatment of geometry. Geometrical structures, such as projective planes and inversive planes.
2 hours lectures. One term
PMath 464 Algebraic Geometry
An introduction to the theory of algebraic varieties. Special topics such as the Theorem of Riemann-Roch.
Prerequisite: Math 331 or PMath 341.
2 hours lectures. One term

PMath 465a Differential Geometry 1
Selections from: Differentiable manifolds, Tensors and Forms, Connexions, Riemannian manifolds.
Prerequisites: Math 231alb and Math 230alb.
2 hours lectures. One term

PMath 465b Differential Geometry 2
2 hours lectures. One term

PMath 466 Combinatorial Topology
Homology theory or complexes. Theorems of invariance, covering, and duality.
2 hours lectures. Two terms.

PMath 467 Topology 2
Continuation of general topology; selected topics from other branches of topology.
Prerequisite: PMath 367. 2 hours lectures. One term.

PMath 470Y Functional Equations
Cauchy's, Pexider's and similar equations. Equations for polynomials and for trigonometric functions. Reduction to differential equations. General methods and theorems. Iteration. Applications. Further topics, such as equations for functions of several variables, or equations for analytic functions, or equations on algebraic structures.
2 hours lectures. Two terms.

PMath 499 Readings in Pure Math

Department of Statistics
Undergraduate Course Descriptions

Note 1
Course descriptions are given under the new departmental course numbers introduced in 1976.

Note 2
Except where indicated, all courses have three lectures hours per week for one term.

Stat 202 Elementary Statistics for Biologists
Elementary probability, populations, samples and distributions with Biological examples. Methods for data summary and presentation including an introduction to interactive programming. Estimation, hypothesis testing, two-sample techniques and paired comparisons. Contingency tables.
2 hours lectures, 1 hour laboratory; one term

Note
Stat 202 is for Science students only.

Stat 204 Statistics for the Physical Sciences 1
2 hours lectures, 1 hour laboratory; one term

Note
Stat 204 is for Science students only.

Stat 205 Statistics for the Physical Sciences 2
Prerequisite: Stat 202 or 204.
2 hours lectures, 1 hour laboratory; one term

Note
Stat 205 is for Science students only.

Stat 210 Applied Probability and Statistics
3 hours lectures, 1 hour tutorial; one term

Note
This course is for students in Mechanical Engineering, and is cross listed in Management Sciences as MS21.
**Stat 220 Introduction to Statistical Methods 1**
Descriptive statistics, graphical methods, model fitting; correlation, regression and the method of least squares. Probability theory; discrete and continuous random variables.  
**Prerequisites:** M120 or M130, one of CS116, CS118, CS140. 3 hours lectures, 2 hours tutorial; one term.

**Note**
Stat 220 is not open to Honours Mathematics students. Credit will be given for only one of Stat 220, 230.

**Stat 221 Introduction to Statistical Methods 2**
Tests of significance, maximum likelihood estimation and large sample theory; estimation and testing in the normal distribution.  
**Prerequisite:** Stat 220 or 230. 3 hours lectures, 2 hours tutorial; one term.

**Note**
Stat 221 is not open to Honours Mathematics students. Credit will be given for only one of Stat 221, 231.

**Stat 230 Probability**
The laws of probability, discrete and continuous random variables, expectation, central limit theorem.  
**Prerequisite:** M120 or M130. 3 hours lectures, 2 hours tutorial; one term.

**Note**
Credit will be given for only one of Stat 220, 230.

**Stat 231 Statistics**
Estimation, tests of significance, probability plots. Contingency tables, normal distribution theory, simple linear regression.  
**Prerequisite:** Stat 230. 3 hours lectures, 2 hours tutorial; one term.

**Note**
Credit will be given for only one of Stat 221, 231.

**Stat 270 Mathematics of Investment**
The theory of rates of interest and discount. Annuities and sinking funds with practical applications to mortgage and bond questions. Yield rates.  
**Note**
Only one of Stat 270, 273 can be taken for credit. Students planning to enroll in Honours Actuarial Science should take Stat 273.

**Stat 273 Mathematics of Finance**
The theory of rates of interest and discount including the theoretical continuous case of forces of interest and discount. Annuities and sinking funds, including the continuous case. Practical and theoretical applications, primarily to mortgages and bonds. Yield rates.  
**Prerequisite:** First year calculus.

**Stat 284 Introduction to Life Contingencies**
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.

**Stat 300 Principles of Survey Design**
The design of surveys of human or natural populations for research and planning. How to take a representative sample; efficient estimation of population quantities and sample size determination; ways of reducing response bias.  
**Prerequisite:** An introductory half course in Statistics. 2 hours lectures, 1 hour tutorial per week; one term.

**Note**
Stat 300 cannot be taken for credit towards a Mathematics degree.

**Stat 330 Introduction to the Theory of Statistics**
**Prerequisite:** Stat 221 or 231.

**Note**
Credit will be given for only one of Stat 330, 350.

**Stat 331 Applied Regression Analysis**
Review of Normal, t, Chi-squared and F distributions and their applications. Introduction to the design of experiments. Analysis of variance, multiple linear regression.  
**Prerequisite:** Stat 221 or 231 or the equivalent.

**Note**
Credit will be given for only one of Stat 331, 351.

**Stat 332 Sampling**
Introduction to sampling of survey populations. Elementary sampling designs. Efficiency comparisons for sampling designs and estimation procedures.  
**Prerequisite:** Stat 221 or 231 or the equivalent.

**Note**
Credit will be given for only one of Stat 332, 454.
**Stat 340 Probability and Stochastic Processes 1**
**Prerequisite:** Stat 221 or 231.

**Stat 341 Probability and Stochastic Processes 2**
**Prerequisite:** Stat 340 or consent of instructor.

**Stat 350 Mathematical Statistics 1**
Continuous random variables; moments and moment generating function; distribution of t, chi-squared, and F, and their applications. Large sample theory.
**Prerequisite:** Math 230, Stat 231 or consent of instructor.

**Note**
Credit will be given for only one of Stat 330, 350.

**Stat 351 Mathematical Statistics 2**
The multivariate normal distribution, its properties and uses; quadratic forms and Cochran's theorem; multiple regression; introduction to the analysis of variance.
**Prerequisite:** Stat 350, Math 231.

**Note**
Credit will be given for only one of Stat 331, 351.

**Stat 373 Finite Differences**
A course in the calculus of finite differences, to include: summation, numerical integration and differentiation, relation between integration and summation; error theory; topics in Numerical analysis.
2 hours lectures. 1 hour problems. one term.

**Stat 374 Life Contingencies – Single Life Function**
An advanced course on problems with single lives, including population theory.
**Prerequisite:** Stat 284.

**Stat 383 Topics in Actuarial Mathematics**
Topics in Actuarial Science for students intending to take the professional examinations.
**Prerequisites:** Stat 273, 373.

**Stat 384 Life Contingencies – Multiple Life Functions**
An advanced course on problems with multiple lives; multiple decrement theory; accidental death and disability benefits.
**Prerequisite:** Stat 374.

**Stat 430 Experimental Design 1**
The requirements for a good experimental design prior to the accumulation of data. The concepts of randomization, replication and experimental error as applied to basic designs; the completely randomized block and Latin square designs. Analysis of variance. Introduction to factorial designs.
**Prerequisite:** Stat 331 or 351 or consent of instructor.
2 hours lectures; one term

**Note**
Credit will be given for only one of Stat 430, 452.

**Stat 431 Experimental Design 2**
Factorial experiments, confounding, fractional replication. Applications of designs. Incomplete block designs. Analysis of covariance.
**Prerequisite:** Stat 430. 2 hours lectures; one term

**Note**
Credit will be given for only one of Stat 431, 453.

**Stat 440 Exploratory Data Analysis**
**Prerequisite:** Stat 331 or 351, and ability to program in Fortran. 2 hours lectures; one term

**Stat 442 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.
**Prerequisite:** Stat 221 or 231; Math 220 or 230.

**Stat 444 Statistical Methods with Socio-Economic Applications 1**
**Prerequisites:** Stat 331 or 351.
2 hours lectures and one hour seminar; one term

**Stat 445 Statistical Methods with Socio-Economic Applications 2**
**Prerequisite:** Stat 444.
2 hours lectures and one hour seminar; one term.
Course Descriptions
Statistics

Stat 450 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.
Prerequisite: Stat 350/1. 2 hours lectures; one term.

Stat 451 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.
Prerequisite: Stat 450 or permission of instructor.
2 hours lectures; one term.

Stat 452 Theory of Experimental Design 1
Logical requirements of designed experiments. Design and analysis of basic complete designs with fixed effects, random effects, or both. Analysis of covariance. Latin squares. Applications.
Prerequisite: Stat 331 or 351 or consent of instructor.

Note
Credit will be given for only one of Stat 430, 452.

Stat 453 Theory of Experimental Design 2
Construction and analysis of incomplete designs: latin square, confounded, fractional factorial, incomplete block. Applications.
Prerequisite: Stat 452 or consent of instructor.

Note
Credit will be given for only one of Stat 431, 453.

Stat 454 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.
Prerequisite: Stat 331 or 351.

Stat 455 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.
Prerequisite: Stat 454. 2 hours lectures; one term.

Stat 456 Topics in Probability Theory
Prerequisite: Stat 340/1 or consent of instructor.
2 hours lectures; one term.

Stat 467 Topics in Statistics 2
2 hours lectures; one term.

Stat 468 Reading in Statistics 1

Stat 469 Readings in Statistics 2

Stat 474 Advanced Topics in Actuarial Mathematics
Prerequisites/corequisites: Stat 284, 374, 384, or consent of instructor.

Stat 475 Construction of Life Tables
Methods of analysis of data to produce raw rates for mortality and other tables.
Prerequisite: Stat 273, 284, or consent of instructor.

Stat 476 Introduction to Demographic Statistics
Mathematical applications in demography.
Prerequisite or corequisite: Stat 284 or consent of instructor.

Stat 480 Life Insurance Systems
Selected topics for the advanced actuarial student.
Prerequisite: consent of instructor.

Stat 485 Risk Theory
Prerequisites: Stat 221 or 231 or consent of instructor.

Stat 486 Graduation of Life Tables
Prerequisite: Stat 373.

Stat 500 Principles of Survey Design
The design of surveys of human or natural populations for research and planning. How to take a representative sample; efficient estimation of population quantities and sample size determination; ways of reducing response bias.
Prerequisite: An introductory half course in Statistics. 2 hours lectures, 1 hour tutorial per week; one term.

Note
Stat 500 is intended for senior undergraduate and graduate students in faculties other than Mathematics. It cannot be taken for credit towards a Mathematics degree.

Stat 520 Introduction to Mathematical Statistics
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 206a Introduction to Mathematics Education
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 texts.

Note
This course is offered only to students in the Co-op Teaching Option.

Mthel 302a Applications of Mathematics to the Biological Sciences 1
The course material has been selected with particular reference to some of the fundamentals of Medical Science including Macromolecular processes, Environmental Health, Genetics and aging processes and quantitative models which describe events in these areas.

Theories and models for age-related changes: (i) Qualitative and quantitative changes in structural and functional proteins.
2 hours lectures, 1 hour tutorial, one term

Mthel 302b Applications of Mathematics to the Biological Sciences 2
Theories and models for age-related changes: (ii) Nucleic acids, genetics and cellular organization; (iii) Biochemical evolution.
2 hours lectures, 1 hour tutorial, one term

Mthel 303a Readings in Modern Mathematics
A course based upon readings from the works of modern mathematicians selected to illustrate the nature of contemporary mathematics, its achievements, and its range of application. The course requirements will consist of prose reports upon assigned readings.
Prerequisite: Consent of instructor.
2 hours lectures, one term

Mthel 304a 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.
Prerequisite: Consent of instructor. 3 hours lectures.

Mthel 304b 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.
Prerequisite: Consent of instructor. 3 hours lectures.

Mthel 305a General Life Insurance 1
Types of Life Insurance contracts and their uses, basis of risk measurement, deficiency reserves, modified valuation methods, non-forfeiture values, dividend formulae, selection of risks, substandard risks, and principles of reinsurance.
No prerequisites. 3 hours lectures, one term

Mthel 305b General Life Insurance 2
Legal aspects of life insurance, settlement options, principles of group and industrial insurance, organization and structure of life insurance companies, financial statements, the mathematics underlying insurance taxation.
Prerequisite: Mthel 305a. 3 hours lectures, one term

Mthel 402a Topics in Mathematical Aspects of Chemistry, Biology and The Medical Sciences 1
Topics will be selected from the area of epidemiology and mathematical models of disease processes with special reference to heart disease and cancer.
Prerequisite: Mthel 302a or consent of the instructor. 2 hours lectures, one term.

Mthel 402b Topics in Mathematical Aspects of Chemistry, Biology and The Medical Sciences 2
Factors contributing to various disease processes will be discussed, with special references to the quantitative evaluation of environmental factors relevant to human disease and aging processes.
Prerequisite: Mthel 302a or consent of the instructor. 2 hours lectures, one term.
Mathematics Service Courses

(not open to students registered in the Faculty of Mathematics)

Note
Course descriptions are given under the new course numbers introduced in 1976.

Math 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 endeavour 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 manner.

Math 101a Number Systems and Functions
Development of number systems: Natural to real; properties and operations therein. Analysis of polynomial, linear, rational, exponential, and trigonometric functions and their graphs.
2 hours lectures, Fall term

Math 101b Geometry and Calculus
Measurement and relationships of geometric figures in 2 and 3 dimensions. Infinite series, the limit concept. introduction to calculus including the derivative and its applications to graph sketching.
2 hours lectures, Winter term.

Note
Math 101a, 101b are specially designed for students enrolled in General Arts programmes and are normally not available to students with Grade 13 Mathematics or equivalent.

Math 102 Introduction to Algebra
2 hours lectures.

Math 103 Introductory Mathematics
This course is intended for students in the Faculty of Arts. 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); two terms.

Math 104 Algebra

Math 105 Mathematics for Environmental Studies
Quantitative analysis in environmental research. Elementary concepts in Algebra, notation, terminology, operations. Probability Theory. Permutations and Combinations, approaches to probability, dependent and independent events, conditional probability, distribution functions, including the Binomial, Poisson and Normal distributions, with applications to problems in Environmental Studies.
3 hours lectures, one term.

Math 110 Calculus 1
Differential and integral calculus of functions of one real variable. Transcendental functions. Integration techniques. Applications to rate, max./min., area, volume, moment, fluid pressure and work problems. Parametric and polar equations. Series of constants; power series; Taylor and Maclaurin series.
3 hours lectures, 3 hours tutorials, 2 hours labs.

Math 111a 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.

Note
For Science students only.

Math 111b Algebra and Solid Geometry
Determinants, Vector and Matrix notation, Elementary Solid Geometry, Linear transformations, Eigenvalues and Eigenvectors.
3 hours lectures.

Note
For Science students only.

Math 114 Algebra and Vector Geometry
3 hours lectures, 1 hour problems.
Math 210 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.

Math 211 Calculus 2 (For Electrical Engineers)
Differential calculus of functions of several variables. Differential equations. Multiple integrals.
Prerequisite: Math 110 or equivalent.

Math 212 Advanced Calculus (For Electrical Engineers)

Math 215 Differential Equations (For Chemistry Students)
See Math 216 for description.

Math 216 Differential Equations
3 hours lectures.

Math 414 Complex Variables
Cauchy-Riemann equations, the Cauchy integral theorems, conformal mapping, the Taylor and Laurent series, contour integration.
2 lectures, 1 hour problems; one term.
Department of Mechanical Engineering

Professor, Chairman of the Department
D. J. Burns, B.Sc., Ph.D. (Bristol), C.Eng., P.Eng.

Professor, Associate Chairman Graduate Studies
C. E. Hermance, B.E. (Yale), M.A., M.S.E., Ph.D. (Princeton)

Professor, Associate Chairman Undergraduate Studies
P. Niessen, B.Sc. (McMaster), M.A.Sc., Ph.D. (Toronto), P.Eng.

Professor, Vice President Academic

Professors
S. A. Alpay, Dipl.Ingr., Dr. Ing. (Berlin)
M. B. Danard, B.A.Sc. (British Columbia), M.A. (Toronto), Ph.D. (Chicago)
D. French, B.Sc., C.Eng., P.Eng.
E. L. Holmes, B.Sc. (Bristol), M.A.Sc., Ph.D. (Toronto), P.Eng.
J. H. G. Howard, B.Sc. (Queen’s), M.Sc., Ph.D. (Birmingham), P.Eng.
G. F. Pearce, B.A.Sc. (British Columbia), M.A.Sc. (Toronto), P.Eng.
J. A. Schey, Dipl.Ing., C.Sc. (Budapest)
M. M. Yovanovich, B.Sc. (Queen's), M.S. (Buff.), M.E. Sc.D. (M.I.T.)

Associate Professors
G. M. Bragg, B.A.Sc. (Toronto), Ph.D. (Cambridge), P.Eng.
R. N. Dubey, B.Sc. (Hons) (Patna), B.Sc. (Eng.) (Bihar), Ph.D. (Waterloo)
K. G. T. Hollands, B.A.Sc. (Toronto), Ph.D. (McGill), P.Eng.
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), P.Eng.
R. J. Pick, B.A.Sc. (British Columbia), M.Sc. (Imperial College), Ph.D. (Waterloo), P.Eng.

A. Plumtree, B.Sc., Ph.D. (Nottingham), P.Eng.
G. D. Raithby, B.E.Sc., M.E.Sc. (Western), Ph.D. (Minnesota), P.Eng.
P. R. Slawson, B.A.Sc., M.A.Sc., Ph.D. (Waterloo), P.Eng.

Assistant Professors
K. G. Adams, B.Sc. (Queen’s), M.A.Sc., Ph.D. (Waterloo), P.Eng.
G. A. Davidson, B.A.Sc. (Hons.) (Toronto), Ph.D. (Toronto)
S. R. Gollahalli, B.E., M.E. (Bangalore), M.A.Sc., Ph.D. (Waterloo)

Special Lecturer
R. G. R. Lawrence, Q.C.

Undergraduate Programmes

Details of the undergraduate programme in Mechanical Engineering are to be found in chapter 8. All courses extended 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 8. 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 streams, 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 or metals; soldering, brazing and welding; corrosion and oxidation; metal failure analysis.
40 Manufacturing Processes
The principles of manufacturing unit processes including casting, forming, machining and joining. Interactions between design, materials (metals, polymers, ceramics) and processes. Advantages and limitations relative costs and production rates of competitive processes.

44 Production Engineering

46 Polymer Processing
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 1
Organization for manufacture. Product design and development. Principles of processing for various production processes: unit, batch, and mass production. Line balancing. Economic decision models; concepts, break even and minimum cost analysis, allocation of resources, scheduling of resources, concepts of risk. Inventory control.

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.

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 and 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. Non-reacting mixtures, reacting mixtures, equilibrium considerations. Introduction to the kinetic theory of gases.

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
Selected topics in heat transfer fundamentals and applications. Topics to be covered include the fundamentals of convection with analytical solutions to simple laminar flow problems and approximate solutions to turbulent flow problems based on analogies between momentum and heat transfer. Also covered is radiant exchange in grey enclosures and in black enclosures containing emitting-absorbing gases. The remaining topics will be chosen from design of heat exchangers; condensation heat transfer; boiling heat transfer, and the treatment of problems in heat conduction.

58 Internal Combustion Engines
Reciprocating SI and CI engines, gas turbines, jets, rockets; principles of operation, modern developments (for pollution control and improvements in efficiency).
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. Economics 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

60 Introduction to Control Systems

62 Fluid Mechanics 2
Basic equations of two-dimensional flow, exact viscous solutions, introduction to lubrication, boundary layers, and introduction to turbulence. Turbomachinery fundamentals and applications. Selected advanced topics.

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 specified industrial application.
To be offered in Fall and Spring term

69 Introduction to the Environment 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 student's 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 Laws 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. The ME 100 Z section is restricted to senior Mechanical Engineering students.

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 specialties 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, photoelasticity, 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 crystallography of ionic and covalent compounds. The vitreous state. Important phase diagrams in oxide-ceramic systems. Production methods for glass, porcelain and graphite shapes. Properties and applications of special ceramics.

541 Deformation Processes

542 Mechanics of Machining Processes

543 Metal Casting Processes

544 Welding Processes
Static and dynamic design of welding details. Temperature distributions, distortion and residual stresses. Solidification in welding. Fracture modes and mechanical destructive tests.

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
Combustion thermodynamics; Introduction chemical kinetics of combustion; Combustion properties of fuels; Flammability of combustible mixtures, Flame propagation mechanisms, pre-mixed and diffusional; Stability of flames; Introduction to combustion aerodynamics, jet flames; Atomization; Droplet and spray combustion; Elementary ignition concepts and theory; Basic detonation theory.

560 Instrumentation
Choice of instrumentation systems, sensing devices and conversion devices. Examples and experiments of techniques used in the measurement of flow, pressure, temperature, position, velocity acceleration, strain, sound, surface finish and dimensions.
561 Fluid Power Control System

562 Introduction to Automation

563 Turbomachines

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 friction (Fanno) and heat transfer (Rayleigh). Imperfect gas effects, measurement of compressible flows, use of formulae, charts and tables, introduction to the methods of characteristics.

566 Fluid Mechanics 3
Reynolds stresses, intensity and scale of turbulence. The “law of the wall”, logarithmic velocity profile and velocity defect laws, effects of roughness. Pressure loss in pipes and conduits. Jets and wakes. Flow in Diffusers and Contractions, and Experimental measurement techniques. Prerequisite: ME 62

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 to 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 the 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.
School of Optometry

Professor, Director of School
M. E. Woodruff, O.D. (College of Optometry of Ontario), Ph.D. (Indiana)

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)
J. D. Moreland, B.Sc. (London), D.I.C., Ph.D. (Imperial College)
R. D. Pellowe, O.D. (College of Optometry of Ontario)
F. Van Nus, B.A., B.Sc. (Western Michigan), O.D., M.S. (Indiana)

Associate Professors
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)
G. C. S. Woo, O.D. (College of Optometry of Ontario), M.S. (Indiana)

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)
T. D. Williams, 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)
A. E. Chaet, M.Sc. Pharm.
J. H. Lamont, B.A. (Toronto), Q.C.
C. W. Schwengler, M.D., D.P.H. (Toronto)
G. W. Wyszecki, Dipl. Ing., Dr. Ing., (Tech. Univ., Berlin)

Visiting Professors (1974-1975)
L. F. Garner, B.App.Sc. (Melbourne), L.O.Sc. (Victorian College of Optometry), Ph.D. (City University of London)

Clinic Residents (1974-1975)
L. Banks, O.D., B.Sc. (Berkeley)
M. L. Cook, O.D. (Waterloo)
C. Dalziel, O.D. (Waterloo)
M. S. Desesienski, B.A. (Providence College, R.I.), O.D. (Mass. College of Optometry Boston)
D. J. Egan, O.D., B.Sc. (Pennsylvania)
J. Jantzi, O.D. (Waterloo)
H. Mayers, O.D. (Waterloo)
A. Nizza, B.S. (Loyola, L.A.), B.S., O.D. (S. California College of Optometry)
R. J. Pave, O.D., B.S. (Indiana)
J. Smibert, O.D. (Waterloo)
N. Wilson, O.D. (Waterloo)

Clinical Associates (1974-1975)
W. R. Andrews, O.D. (College of Optometry of Ontario)
J. G. Attridge, 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)
J. D. Capell, O.D. (Waterloo)
R. R. Chen, O.D. (College of Optometry of Ontario)
K. Chhatwal, O.D. (Waterloo)
R. D. Dugit, O.D. (Waterloo)
D. L. Forristal, O.D. (Waterloo)
A. N. Fruman, B.A. (Saskatchewan), O.D. (Waterloo)
G. A. Grant, O.D. (College of Optometry of Ontario)
Y. Grant, O.D. (College of Optometry of Ontario)
M. Gross, B.Sc. (Toronto), O.D. (Waterloo)
R. Haber, B.Sc. (Toronto), O.D. (Waterloo)
D. Hector, O.D. (Waterloo)
R. Kniaziew, O.D. (Waterloo)
A. J. MacKinnon, O.D. (College of Optometry of Ontario)
M. S. Munn, Dip. Opt. (College of Optometry of Ontario)
M. A. Oiffer, B.Sc. (York University), O.D. (Waterloo)
R. Pace, O.D. (Waterloo)
S. Peta, O.D. (Waterloo)
R. Pickard, O.D. (Waterloo)
J. M. Robertson, Dip. Opt. (College of Optometry of Ontario)
V. Russell, O.D. (College of Optometry of Ontario), B.A. (Toronto)
R. Sauri, O.D. (Waterloo)
C. Santone, O.D. (Waterloo)
R. Scheid, O.D. (Waterloo)
B. Wiseman, B.Sc. (McGill), O.D. (Waterloo)
H. L. Wismer, O.D. (College of Optometry of Ontario)
M. Wolf, B.Sc., O.D. (Waterloo)
S. Wood, O.D. (Waterloo)
Undergraduate 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 and the development of visual science; a consideration of legal and organizational development of optometry; the role of professional associations. The role and scope of optometry and its relationship to other professions and the community.
2 lect., Fall term

206* Geometrical Optics
3 lect., 3 hrs. lab., Fall term

211* Physiological Optics
The eye as an optical instrument. Ametropia and emmetropia. The refracting mechanism. The stimulus to accommodation. Ocular actuity and visual performance; stray light in the eye; analysis of the retinal stimulus pattern.
Prereq: Optom. 206*. 3 lect., 3 hr. lab., Fall term

224* Anatomy of the Eye and Associated Structures
The gross, microscopic and ultra structure of ocular tissues. The embryology and comparative anatomy of the eye will be emphasized. The relationship of the eye to the vascular supply of the head and the nervous system will be studies. This course is credited only upon completion of Optom 234.
Corequisite: Biol. 201. 3 lect., 3 h. lab., Fall term

234* Anatomy of the Eye and Associated Structures
A continuation of Optometry 224*
Prereq: Optom. 224*. 3 lect., 2 h. lab., Winter term

301* Physiological Optics
Ocular motility: description and analysis of eye movements, measurement of eye movements, the innervational systems of the extraocular and intraocular musculature.
Prereq: Optom. 211*. 3 lect., 3 hr. lab., Fall term

302* Clinical Optometry
Lectures and laboratories on clinical techniques for examination of the optical properties of the eye.
Prereq: Optom. 211*. 3 lect., 3 hr. lab., Fall term

305* General Pathology
Basic disease processes, including inflammation, degeneration, neoplasia; pathogenic microbiology and related diseases; immunity and hypersensitivity; disease caused by physical agents; diseases of the organ systems.
Prereq: Biol. 201, Optom. 244*-234*.
3 lect., 1 hour tutorial, Fall term

306* Optometrical Optics
The properties of ophthalmic glass and lenses, and the problems and solutions involved in fitting lenses to the eyes. Laboratory work involves processing prescriptions as well as experiments in optics.
Prereq: Optom. 206*. 3 lect., 4 h. lab., Fall term

311* Physiological Optics
The Visual Process: retinal structure; photopigments; photoreception; electrophysiology of the retina and higher centres. Psychophysics of Vision: light and dark adaptation; spatial and temporal light discrimination.
Prereq: Optom. 301*. 3 lect., Winter term

312* Clinical Optometry
Lectures and laboratories on clinical techniques for examination of the optical properties of the eye.
Prereq: Optom. 301*, 302*. 3 lect., 3 h. lab., Winter term

315* General Pathology
A continuation of 305*.
Prereq: Optom. 305*. 4 lect., 1 hour tutorial, Winter term

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 of ophthalmic use.
Prereq: Optom. 306*. 3 lect., 4 h. lab., Winter term

401* Physiological Optics
Prereq: Optom. 301*, 311*. 3 lect., 3 h. lab., Fall term

402* Clinical Optometry
Case analysis of the nonstrabismic patient: case history, testing the health and integrity of the visual system, refractive tests, binocular relations, analysis, diagnosis, prognosis and modes of therapy.
Prereq: Optom. 302*, 312*. 3 lect., 2 h. lab., Fall term

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.
Prereq: Optom. 224*. 2 lect., 2 h. lab., Fall term
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.
Prereq: Optom. 305*, 315*. 3 lect., 1 h. lab. bacteriology. Fall term

406* Optometrical Optics
The lecture course deals with problems involved in selecting, preparing and fitting ophthalmic materials. Optical, cosmetic and comfort requirements, and patient counselling are considered. The laboratory course provides experience in preparing and fitting materials to patients.
Prereq: Optom. 306*, 316*. 2 lect., 4 h. lab., Fall term

407* Optometric Specialties: Contact Lenses
A series of lectures and laboratories on the principles and procedures of prescribing and fitting contact lenses.
Prereq: Optom. 401*, 402*. 2 lect., 2 h. lab., Fall term

408* Optometry Clinic
The student is assigned to the Visual Analysis Clinic and under the direct supervision of optometrists of the clinic staff, carries out routine clinical investigations of patients who attend the public clinic.
No credit given until successful completion of Optometry 418*. Prereq: Permission of Clinic Director. 8 h. clinic, Winter term

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 lect., 2 h. lab., 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.
Prereq: Optom. 401*. 3 lect., 3 h. lab.

412* Clinical Optometry
Detection and evaluation of sensory and motor characteristics of vision in strabismus. Classifications, diagnosis, prognosis, modes of therapy for strabismus and amblyopia.
Prereq: Optom. 302*, 312*, 402*. 3 lect., 2 h. lab., Winter term

414* Physiology of the Visual Systems
The neural processing of colour, brightness, movement and form by the retina, lateral geniculate, cortex, superior colliculus and other brain centres. Neural mechanisms underlying binocular depth perception, the accommodative response and eye movement.
Prereq: Optom. 404*. 3 lect., 3 h. lab., Winter term

415* Ocular Pathology
A continuation of 405*.
Prereq: Optom. 405*. 3 lect., 3 h. lab., Winter term

418* Optometry Clinic
A continuation of 408*.
Prereq: Optom. 408*. 8 h. clinic, Winter term

427* Optometric Specialties: Aniseikonia and Low Vision Aids
A series of lectures and laboratories in examining low vision and aniseikonic patients with specific techniques described. Treatment and therapy will be included.
Prereq: Optom. 401*, 402*. 2 lect., 2 h. lab., Winter term

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.
Prereq: Successful completion of completed Year 4 programme

500* Optometrical Jurisprudence and Praxis
Lectures relating to legal aspects of practicing Optometry in Canada; the rights and responsibilities of the optometrist in practice; practice management: financial management, establishing a practice, interprofessional relations, office design, optometric assistants professional associations.
2 lect., Fall term

501* Physiological Optics
Students with an interest in research may arrange with a professor to undertake a research project of mutual interest. This course serves as an alternative to Psych. 357. Contact the course co-ordinator for details.
3 h., Fall term

502* Advanced Clinical Optometry
Special techniques for the examination of refractive and binocular properties of vision: binocular refraction; prism adaptation; etiology of refractive errors; changes in refraction with age; epidemiology; seminars and presentation of case reports.
Prereq: Optom. 302*, 312*, 402*, 412*. 3 lect., Fall term
504* Ocular Pharmacology
Neurohumoral theory, response to drugs, sterile techniques, disinfectants. Drugs used in contact lens practice, drugs used topically on the eye, drugs on the eye and vision.
Prereq: Optom. 404*, 405*, 415*. 4 lect., 1 h. lab., Fall term

508* Optometry Clinic
The clinical programme teaches the student how to provide optometrical services including pathology detection, strabismus evaluation and the application of spectacle therapy, contact lenses and vision training. The patients cared for extend from the pediatric to the geriatric, and include those with perceptual problems, or with low vision. No credit given until successful completion of Optom. 518*. Prereq: Permission of Clinic Director. 24 h. per week. Fall term

509* Community Health Optometry
Governmental and social aspects of health and vision care delivery, are discussed in relationship to the epidemiology of vision problems. The special aspects of management of vision problems of pediatric, geriatric and industrial population are discussed. 4 lect., Fall term

510* Optometrical Jurisprudence and Praxis
A continuation of 500*. Prereq: Optom. 500. 2 lect., Winter term

511* Physiological Optics
A continuation of 501*. This course serves as an alternative to Optom. 513. Prereq: Optom. 501. 3 h., Winter term

512* Advanced Clinical Optometry
A continuation of Optometry 502*. Prereq: Optom. 502*. 3 lect., Winter term

513* Optometric Communication
Verbal communication and counselling during the optometrical examination, alternatives to technical terminology, report and letter writing, preparing and delivering papers and talks for professional societies and public information. 2 lect., 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. Prereq: Optom. 405*, 415*. 2 lect., Winter term

518* Optometry Clinic
A continuation of 508*. Prereq: Optom. 508*. 24 h. clinic, Winter term

519* Community Health Optometry
A continuation of 509*. 4 lect., Winter term
Department of Philosophy

Associate Professor, Chairman of the Department
J. R. Horne, B.A., M.A. (Western Ontario), B.Th. (Huron), Ph.D. (Columbia)

Associate Professor, Associate Chairman
J. W. Van Evra, B.A. (Valparaiso), M.A., Ph.D. (Michigan State)

Professors
E. Jennifer Ashworth (Miss), B.A., M.A. (Cambridge), Ph.D. (Bryn Mawr)
T. L. Batke¹, B.A.Sc., M.A.Sc., Ph.D. (Toronto)
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)
J. W. Tucker², B.Sc., B.A., Ph.D. (London)

Professor Emeritus
P. Seligman, B.A., Ph.D. (London), (part-time)

Associate Professors
W. R. Abbott, B.A. (Kenyon), Ph.D. (Ohio State)
J. F. Centore, B.Sc. (Canisius), M.A. (Maryland), Ph.D. (St. John’s)
J. D. T. DeMarco, B.S. (Stonehill, Mass.), M.A., 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), (part-time)
A. C. Minas (Mrs.), B.A. (Radcliffe), M.A., Ph.D. (Harvard)

Assistant Professors
J. G. T. Campbell, B.A. (Western Ontario), Ph.L., Ph.D. (Laval)
M. F. McDonald, B.A. (Toronto), M.A., Ph.D. (Pittsburgh)
J. Wubnig (Miss), B.A. (Swarthmore), M.A., Ph.D. (Yale)

Faculty members holding cross appointments as shown
¹ Department of Chemical Engineering
² Department of Pure Mathematics

Note 1
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.

Note 2
Any full course of two half courses in Philosophy can be used to satisfy the group A(i) requirement.

Note 3
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 to General Philosophy Students

Five full course equivalents in Philosophy are required for the General Degree in Philosophy, including at least one of 140*, 240*, 241* or 340, 221* and one full-course equivalent from 280*/281*, 282*/283*, 390*/391*. (St. Jerome’s students: see p. 350 for further information.)

Minor
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 Course Descriptions

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? 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.
3 hours
111* Philosophy of Life
“Who am I?” “What can I hope for after death?” “How can I tell what to do?” “What can I know?” are questions that have led people to philosophize.
Approaches, such as those of the mystic, the scientist, the existentialist, the pleasure seeker, and the practical man, will be discussed.
No prerequisite. 3 hours

125* Fundamentals of Social and Political Philosophy
Introduction to basic value-questions about society. Theories about the meaning and basis of rights, justice, and government are examined. Both classical writers (Hobbes, Mill, Marx) and contemporary writers (Rawls) may be used. Sample issues: civil disobedience, racial and sexual discrimination, and socialism versus capitalism.
3 hours

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

140* Introduction to Formal Logic
Elementary sentence and predicate logic. Translation from the English into the formalism, decision methods and deductions. Application of Graphic Methods to Logic. This course is a preparation for courses in the foundations of mathematics, scientific methods, and more advanced logic courses.
No prerequisite. 3 hours

145* Critical Thinking
An analysis of basic types of reasoning, structure, of arguments, the critical assessment of information, common fallacies, problems of clarity and meaning.
No prerequisite. 3 hours

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.
3 hours

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.
3 hours

202* Philosophy of Women
A study of some of the issues raised by the Women’s Liberation movement, such as the nature of Women and her rights and liberties in various contexts—family, childbearing, economic, political, and social.
No prerequisite. 3 hours

210* Philosophical Literature
Certain works of literature will be studied for their relevance to philosophical problems. Those interested in this course may consult the Department regarding which works of literature are to be studied in any given year.
3 hours

211* Ethics I
This course is intended to be both a history of and an introduction to moral philosophy. Views on the foundations of ethics of the great philosophers from classical antiquity to about 1900 are systematically examined. Writers studied include: Plato, Aristotle, Aquinas, Kant, Mill and Nietzsche.
3 hours

222* Contemporary Ethical Theory
Continues the history and discussion of ethics begun in Philosophy 221* with writings from 1900 to the present. Theories such as intuitionism, emotivism, utilitarianism, and relativism are examined via the writings of such people as Moore, Hare, and Warnock. Philosophy 221* recommended. 3 hours

223 Moral and Social Philosophy
An investigation of what constitutes the good life and the good society. Such topics as the role of reason, the nature of the good, right and wrong, justice, individual rights, ecology, human nature and animal behavior are considered. Classical and contemporary readings. Prerequisite: Second year standing or consent of instructor. 3 hours

224* Mankind and Nature
An examination of some of the issues raised by recent discussions on ecology. Various theories of nature, the human being; and relations between the two will be explored. Possible foundations for duties of mankind toward nature will be examined.
3 hours

225* Social and Political Philosophy: Canadian Problems
This is philosophical study of various Canadian social and political problems such as foreign control, nationalism, the redistribution of wealth, native rights, and the War Measures Act. Canadian socialist, liberal, conservative, and anarchist approaches to such problems will be examined from a moral point of view. Prerequisite: Philosophy 125* or consent of instructor. 3 hours
226* Ethics and Human Engineering
An investigation of some critical ethical issues in human research and therapy. Includes discussion of the right to live and right to die, behavior control (e.g. psychosurgery, behavior modification and psychotherapy), human experimentation (including “informed consent” and fetal research) and human engineering.
Prerequisite: Phil. 125*, 221*, 222*, or consent of instructor. 3 hours

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.
2 hours

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 will lead us to discussions of such concepts as insanity, irrationality, the supernatural, and the miraculous.
2 hours

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

241* Intermediate Logic
The course begins with a brief review of the materials covered in Phil. 140*. Axiom systems of logic are developed and compared with natural deduction procedures. Then certain properties of these logical systems, such as consistency, completeness, compactness, will be investigated.
Prerequisite: Phil. 140* or familiarity with elementary sentence and predicate logic. 3 hours

242* Philosophical Logic
The course begins with a brief review of the materials covered in Phil. 140*. Then systems of modal logic will be developed and applied to such philosophical problems as obligation, belief and knowledge, essentialism, future contingencies, existence of God.
Prerequisite: Phil. 140* or familiarity with elementary sentence and predicate logic. 3 hours

243* Risk, Decision, Games, Amalgamation
Fundamentals of probability and game theory. Problems of decision making under conditions of certainty, risk and uncertainty. The definition and measurement of utility functions. Translation of decisions and preferences of members of a group into collective preference. Some applications to the Social Sciences.
Prerequisite: Phil. 140*, 145* or consent of instructor. 3 hours

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

258* Introduction to the Philosophy of Science
A discussion of the fundamental concepts on which science is based. Consideration is given to such topics as scientific explanation, the structure of scientific theories, the nature of law-likeness, the grounds for scientific confirmation, and the debate between rationalism and empiricism in science.
3 hours

265* The Existentialist Experience
An introduction to the existentialist view of man using both literary and philosophical texts from such authors as Kierkegaard, Unamuno, Nietzsche, Ortega y Gasset, Camus, Sartre, Heidegger and others.
3 hours

270* 271* Special Topics in Philosophy
Philosophic examination of areas of current or traditional social or conceptual interest. No special preparation in Philosophy. Topics dealt with may include Philosophical Anthropology, Philosophy and linguistic theory, Minds and Machines, The Concept of Deviance.
3 hours

280* History of Ancient Philosophy 1
From the beginnings to Plato
Prerequisite: Second year standing or above; or consent of instructor. 3 hours

281* History of Ancient Philosophy 2
From Aristotle to the close of classical antiquity.
Prerequisite: Philosophy 280*. 3 hours

282* History of Modern Philosophy 1
Earlier period beginning with Descartes.
Prerequisite: Second year standing or above, or consent of instructor. 3 hours

283* History of Modern Philosophy 2
Later period including Hume and Kant.
Prerequisite: Second year standing or above consent of instructor. Philosophy 282* recommended. 3 hours
284* 19th Century Philosophy
The 19th century. Philosophers covered may include Hegel, Mill, Schopenhauer, James, and Kierkegaard. 3 hours

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. 3 hours

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. 3 hours

301* Moral Issues
The aim of this course is to improve the student's understanding of ethical ideas and principles by careful discussion of selected concrete moral issues, such as abortion, euthanasia, capital punishment, and violence. Choice of issues largely determined by student interest. Prerequisite: At least second year standing or consent of instructor. 3 hours

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: At least second year standing or consent of instructor. 3 hours

312* Philosophy of Education 2
Critical evaluation of selected problems of education in an attempt to relate theory to practice. Recent Canadian studies will be among those considered. Prerequisite: Philosophy 311* or consent of instructor. 3 hours

311*/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

326* Political Philosophy 2
A detailed discussion of contemporary theories. Prerequisite: Philosophy 325*, or consent of instructor. 3 hours

327* Philosophy of Law
Besides considering some of the more prominent views of what law is (e.g., those of Aquinas, Kant, Austin, Kelsen, and Hart), we will also take up some other topics central to Jurisprudence, such as liability, right, and judicial reasoning. Prerequisite: One full or two half Philosophy courses or consent of instructor. 3 hours

328* The Philosophy of Karl Marx
A systematic, critical study of the Main philosophical ideas of Marx and Engels. Considerable reading from their original writings, early and late, with discussion and analysis, is the main work of the course; some recent interpretative and critical work is used. Prerequisite: One full or two half Philosophy courses, or consent of instructor. 3 hours

329* War, Peace and Justice
An intensive study of the morals issues involved in war and armed revolution. Critical evaluation of "just war" theories, and international rules of warfare is pursued as well as the moral arguments for and against pacifism and conscientious objection. Prerequisite: Phil. 125*, 221*222* or consent of instructor. 3 hours

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

335* Philosophy of Religion
A critical examination of the methods and substantive arguments found in selected major works of religious philosophy. The writings chosen for consideration will be announced in advance each year. Prerequisite: One full or two half Philosophy courses. 3 hours

340* Logical Theory
A rigorous and general development of the propositional and predicate calculus within which alternative calculi are examined. Study of such concepts as completeness, consistency, extensionality, and modality from both formal and philosophical points of view. Intended primarily for those interested in philosophical issues connected with logic. Prerequisite: Philosophy 140*, or (preferably) Philosophy 240, 241* or 242*, or consent of instructor. 3 hours
350 Epistemology
An analysis of human knowledge, its conditions and types. The first part concentrates on criteria of meaningfulness, the possibility of a priori knowledge, and the concept of knowledge. The second part deals with the character and possibility of our knowledge of the physical world and other minds.
Prerequisite: One full or two half courses in Philosophy. 3 hours

350A* Epistemology 1
The first part of Philosophy 350.
Prerequisite: one full or two half courses in Philosophy. 3 hours

350B* Epistemology 2
The second part of Philosophy 350.
Prerequisite: One full or two half courses in Philosophy. 3 hours

Note
Either 350A* or 350B* may be taken separately

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: At least second year standing or consent of instructor. 3 hours

362* Philosophy of Social Science
Problems about the fundamental methods and aims of the social sciences generally, and problems specific to Psychology, Sociology, Political Science, etc., and their relations to one another will be considered. (Cross-numbered as Sociology 371*)
3 hours

363 Philosophy of Language and Linguistic Analysis
The first part examines issues in the philosophy of language, such as synonymy, propositions, meaning, semantics, reference. The second part will consider ordinary language analysis as a method for solving philosophical problems as compared with structural linguistics.
Prerequisite: Consent of instructor, or honours status in Philosophy. 3 hours

363A* Philosophy of Language
The first part of Philosophy 363.
Prerequisite: Consent of instructor, or honours status in Philosophy. 3 hours

363B* Linguistic Analysis
The second part of Philosophy 363.
Prerequisite: Consent of instructor, or honours status in Philosophy. 3 hours

Note
Either 363A* or 363B* may be taken separately

365*-366* Oriental Philosophy
Studies of a selected area of non-western Philosophy (e.g. Indian or Chinese). Parallels will be drawn between modes of Eastern thinking and European conceptions with emphasis on essential differences as well as similarities.
Prerequisite: Consent of instructor. 3 hours

370*-372* Special Subjects
One or more half courses will be offered at different times as announced by the Department.
Prerequisite: Consent of instructor. 3 hours. 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 Abailard.
Prerequisite: Philosophy 280*281*. 3 hours

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

398(a-b)* Directed Reading in Special Areas
Prerequisite: Consent of instructor

399 Tutorial for Honours Students
Students wishing to enrol in 399 should consult the Department.

425* Philosophy of the City
Analysis and evaluation of the philosophical points of view that underlie current criticism of urban life and prevalent schemes for its reconstruction.
Prerequisite: One half Philosophy course. 3 hours

435*-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, 241* or 242* 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

455 Metaphysics
Theories of reality, historical and contemporary, with emphasis on metaphysical problems in the light of recent studies.
Prereq: Two full courses (or equivalent) in Phil. 3 hours

465 Existential Philosophy
An in depth study of the thought of some major existentialist figures such as Kierkegaard, Unamuno, Nietzsche, Heidegger, Sartre, Camus, Marcel, Jaspers, Ortega y Gasset.
Prerequisite: Consent of instructor. 3 hours

470 Phenomenology
A critical examination of the issues and methods of phenomenology, including the attempt to understand the uses and ramifications of phenomenological methods through the working out of a particular analyses. The basic writings of phenomenologists such as Husserl and Merleau-Ponty will be used.
Prerequisite: One full or two half courses in Philosophy, or consent of instructor. 3 hours

471*-473 Problems
One or more half courses will be offered at different times, as announced by the Department.
Prerequisite: Consent of instructor. 3 hours. 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

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 or 241* or 340, 218J* or 221*, two halves of 280*+1, 282*+3*, 390*+1, plus 2.5 or 3 other philosophy electives.
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.
Students in joint Honours Programmes, one half of which is Philosophy, may substitute the same St. Jerome's College courses in those programmes as others may substitute in the single Honours Programme.

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? 3 hours

120J* Philosophy of Life and Death
A study of what some of the great philosophers have said about the meaning of life in relation to death and the transition from life to death. Students are urged to raise their own questions and thereby help direct discussion.
Fall term. 3 hours

130J* Philosophy of Discontent
A study of what some of the great philosophers have said about the causes of personal and social discontent. The need for social disobedience, and the extent to which ethical principles can be altered to accommodate changing conditions are possible topics for discussion.
Winter term. 3 hours

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 . . .?" The course will cover the main common logical fallacies, term logic, propositional logic, and syllogistic logic. The difference between intentional logic and mathematical logic will be discussed.
Fall term. 3 hours

205J* Elements of the Philosophy of Science
Not offered 1976-77.

206J* Special Problems in the Philosophy of Science
Not offered 1976-77.
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? Is man an accident of evolution? What are the major views on man as a species? How are love and sex aspects of man’s life? These are some of the questions this course will attempt to answer.
Fall term, 3 hours

218J* Ethical Theory
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.
Fall term, 3 hours. Also offered in the Evening

219J* Practical Ethics
This course will discuss the applications of general ethics to the more specific areas of human endeavour. Among the topics discussed will be abortion, contraception, sex, obscenity, violence, drugs, egoism, dishonesty, various forms of human exploitation, genetic surgery, biological cloning and genetic pollution.
Winter term, 3 h. Also offered in the Evening

230J* God and Philosophy
Not offered 1976-77.

237J* Ethics and Society
This course examines the nature and purpose of community living as well as such traditionally controversial issues as private and public morality, the individual good and the common good, personal freedom and group responsibility. Topics for discussion may include: the government’s role in issues of life and death; the moral function of law; civil disobedience; and scientific, technological, and medical innovations.
Winter term, 3 hours

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.
Winter term, 3 hours

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.
Fall term, 3 hours. Prerequisite: Second year standing.

301J* The Western Philosophical Tradition
(1600-Present)
A continuation of 300J*.
Winter term, 3 h. Prerequisite: Second year standing.

321J* Canadian Philosophy
Not offered 1976-77.
Department of Physics

Professor, Chairman of the Department

Professor, Associate Dean Graduate Affairs, Faculty of Science
N. R. Isenor, B.Sc. (Acadia), M.Sc., Ph.D. (McMaster)

Professor, Dean of the Faculty of Science

Professors
R. A. Aziz, B.A., M.A., Ph.D. (Toronto)
G. A. Bakos, M.A. (Bratislava), M.A., Ph.D. (Toronto)
F. W. Boswell, B.A., M.A., Ph.D. (Toronto)
D. E. Brodie, B.Sc., M.Sc., Ph.D. (McMaster)
J. A. Cowan, B.Sc. (Manitoba), M.A., Ph.D. (Toronto)
I. R. Dagg, B.Sc. (Manitoba), M.S. (Penn State), Ph.D. (Toronto)
J. Grindlay, B.Sc. (Glasgow), D.Phil. (Oxon)
J. D. Leslie, B.A.Sc., (Toronto), M.S., Ph.D. (Illinois)
J. L. Ord, B.A.Sc. (Toronto), M.S., Ph.D. (Illinois)
R. K. Pathria, B.Sc., M.Sc. (Punjab), Ph.D. (Delhi)
M. M. Pintar, B.Sc., M.Sc., Ph.D. (Ljubljana)
G. E. Reesor, B.A., M.A. (McMaster), Ph.D. (Toronto)
G. Scoles, B.Sc., Ph.D. (Genova)
R. A. Snyder, B.Sc., Ph.D. (Western)
S. F. Wang, D.Sc. (Nagoya)

Adjunct Professors
J. A. Barker, D.Sc. (Melbourne), F.A.A.S.
P. A. Egelstaff, B.Sc., Ph.D. (London)
D. J. Henderson, B.A.(U.B.C.), Ph.D. (Utah), F.Inst.P.
J. D. Poli, Cand. Doc Leiden, Ph.D. (Toronto)

Research Associate
L. A. A. Read, B.A., M.Sc. (McMaster), Ph.D. (Waterloo)

Associate Professors
A. Anderson, M.A., D.Phil. (Oxon)
J. M. Corbett, B.A.Sc. (Toronto), M.Sc., Ph.D. (Waterloo)
A. E. Dixon, B.Sc. (Mt. Allison), M.Sc. (Dalhousie), Ph.D. (McMaster)
P. C. Eastman, B.Sc., M.Sc. (McMaster), Ph.D. (U.B.C.)
H. K. Ellenton, B.Sc. (Western), M.A. (Toronto)
M. P. FitzGerald, B.Sc., M.Sc. (Toronto), Ph.D. (Case)
D. Hemming, B.Sc., Ph.D. (Bristol)
J. Kruuv, B.A.Sc., M.Sc. (Waterloo), Ph.D. (Western)
C. C. Lim, B.A. (DePauw), M.A. (Nebraska), Ph.D. (Toronto)

R. A. Moore, B.Sc., M.Sc. (McMaster), Ph.D. (Alberta)
H. M. Morrison, B.Sc., Ph.D. (Edinburgh)
A. D. S. Nagi, B.A., B.Sc., (Punjab), Ph.D. (Delhi)
H. J. T. Smith, B.Sc., Ph.D. (London)
B. H. Torrie, B.A.Sc. (Toronto), Ph.D. (McMaster)
K. A. Woolner, B.Sc. (London)

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)
J. Vanderkooy, B.Eng., Ph.D. (McMaster)

Faculty Computer Resource Person
D. L. Roberts, A.B. (Bowdoin College), Ph.D. (Case)

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 13.

Note 2
All courses described are one-term courses unless otherwise designated. Such one-term courses are marked* and are 0.50 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
This course covers the topics in Ontario Year 3 to 5 essential for first year university physics. The course includes Mechanics, Gravitation, Vibrations and Waves. Heat, Electricity, Light and Optics. Successful completion of this course fulfills the University admission requirements where high school Physics is necessary. By correspondence only, one term. No University Credit

11* Mechanics
Brief review of kinematics and translation. Particle dynamics, work, energy, conservation of energy. Conservation of linear momentum, collisions. Rotational kinematics. Rotational dynamics, conservation of angular momentum. Equilibrium of rigid bodies. For students in Year 1 Engineering. 3 lect., 2 h. tut., Fall term
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 lect., 3 h. lab. alternate weeks, tut. to be arranged.

Note
Normally students who have completed Ont. Yr. 5 Phys. should select Phys. 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.
Prereq: Ont. Yr. 5 Phys. 3 lect., 3 h. lab. alternate weeks, tut. to be arranged.

111* General Physics
Mechanics, properties of matter, modern physics, heat flow and thermodynamics.
3 lect., and 1 tut. on alternate weeks, Fall term

111L* General Physics Laboratory 1
For students taking Phys. 111*.
3 h. lab. on alternate weeks, 0.25 course credit, Fall term

112* 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 lect., and tut. on alternate weeks, Winter term

112L* General Physics Laboratory 2
For students taking Phys. 112*.
3 h. lab. on alternate weeks, 0.25 course credit, Winter term

Note
The one-year sequence Phys. 111*-112* is primarily intended for students who plan to proceed in Biology, Biol. and Chem., or Earth Sc. Phys. 111L*-112L* is recommended for students who plan to proceed in the Optom. programme and for those students who want some practical 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 kinematics.
Prereq: Ont. Yr. 5 Math. – Functions and Relations, Calculus. Ont. Yr. 5 Physics recommended. 3 lect., and tut. on alternate weeks, Fall term. Science students must take 121L* with this course

121L* Introductory Physics 1 Laboratory
For students taking Phys. 121*.
3 h. lab. on alternate weeks, 0.25 course credit, Fall term

122* Introductory Physics 2
This course is a continuation of Physics 121*. Rotational dynamics, vibrations, waves, gravitation, heat and thermodynamics, properties of materials.
Prereq: Phys. 121*. 3 lect., and 1 tut. on alternate weeks, Winter and Spring terms. Sci. students must take 122L* with this course

122L* Introductory Physics 2 Laboratory
For students taking Phys. 122*.
3 h. lab. on alternate weeks, 0.25 course credit, Winter and Spring terms

Note
The one-year sequence Phys. 121*-122* is primarily intended for students who plan to proceed in Phys. and Math.

162* Introductory Physics A
Introduction to Newtonian mechanics including gravitation, collisions and conservation laws, conservative forces and motion under central forces.
Prereq: At least 75% average in Ont. Yr. 5 Phys., Math. – Functions and Relations, and Calculus. 3 lect., and 1 tut. on alternate weeks, Fall term. Sci. students must take 162L* with this course

162L* Introductory Physics A Laboratory
For students taking Phys. 162*.
3 h. lab. on alternate weeks, 0.25 course credit, Fall term

163* Introductory Physics B
This course is a continuation of Physics 162*. Rotational dynamics, vibrations of physical systems, resonance, coupled oscillators and normal modes, waves and interference.
Prereq: Phys. 162*. Sci. students must take 163L* with this course. Cooperative students wishing to take this sequence must have their IB term in the Winter. 3 lect., and 1 tut. on alternate weeks, Winter term

163L* Introductory Physics B Laboratory
For students taking Phys. 163*.
3 h. lab. on alternate weeks, 0.25 course credit, Winter term

Note
The one-year sequence Phys. 162*-163* is an enriched version of Phys. 121*-122* sequence intended for students in the Yr. 1 Sci. programme or the Yr. 1 Math. 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.
Prereq: First year phys. and calculus. 2 lect., 1 h. tut., Fall term. Not for Hons. Phys. Students. Phys. Majors must take 222L* with this course

222L* Electricity and Magnetism 1 Laboratory
For students taking Phys. 222*. 3 h. 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.

223L* Electricity and Magnetism 2 Laboratory
For students taking Phys. 223*. 3 h. alternate weeks, 0.25 course credit, Winter, Spring

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.

226L* Optics 1 Laboratory
For students taking Phys. 226*. 3 h. 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.

227L* Optics 2 Laboratory
For students taking Phys. 227*. 3 h. alternate weeks, 0.25 course credit, Winter term

243L* Electricity and Magnetism Laboratory
For students taking Phys. 243*. 3 h. alternate weeks, 0.25 course credit. Fall, Winter and Spring terms

244 Quantum Physics
Special relativity, Bohr atom, wave-particle properties, uncertainty and wavepackets, Schrodinger equation, correspondence principle, transitions and radiation processes, kinetic theory, basic statistical mechanics, Boltzmann distribution, elementary X-ray diffraction. (Not for General Students), 2 lect., for 2 terms

246* Physical Optics
Prereq: First yr. phys. and calculus. Corequisite: Phys. 246L*. This course is primarily intended for students registered in the Optom. programme. 3 lect., 1 h. tut., 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.
Prereq: First yr. phys. and math. 3 lect., 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.
Prereq: First yr. phys. and math. 3 lect., 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.
Phys. Majors must take Phys. 252L* with this course.
Prereq: First yr. phys. and calculus. 2 lect., 1 h. problems, Fall term. Recommended for students in Hons. 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 Phys. 252*. 3 h. alternate weeks, 0.25 course credit, Fall term
Course Descriptions

**Physics**

**253* Electricity and Magnetism 2**
Magnetic Fields, Ampere’s Law, Induced electromotive forces, magnetic properties of materials, magnetic devices, displacement currents, Maxwell’s equations, electromagnetic waves.

*Phys. Majors must take Phys. 253L* with this course.

Prereq: Phys. 252*, Math. 31*. 2 lect., 1 h. problems, Winter and Spring terms. Recommended for students in Hons. programmes. This course, with Phys. 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 Phys. 253*.

3 h., alternate weeks, 0.25 course credit, Winter and Spring terms.

**255* Quantum Physics**
Background to 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.

Prereq: First yr. phys. and calculus. 3 lect., Winter and Spring terms. Recommended for students in Hons. 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.

Prereq: First yr. phys. and calculus. 3 lect., Fall term. Phys. Majors must take Phys. 256L* with this course. Recommended for students in Hons. programmes.

**256L* Optics Laboratory**
For students taking Phys. 256*.

3 h., alternate weeks, 0.25 course credit, Fall term.

**259* Crystallography and X-Ray Diffraction**
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.


**259L* Crystallography and X-Ray Diffraction Laboratory**
For students taking Phys. 259*.

3 h., alternate weeks, 0.25 course credit, Winter and Spring terms.

**265* Introduction to Mathematical Physics**
Some mathematical techniques used 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.

Prereq: First yr. phys. and calculus. 3 lect., Fall, Winter and Spring terms.

**270* Laboratory**
Further experiments in optics for students taking Phys. 256L*.

3 h., alternate weeks, Fall term, 0.25 course credit.

**271* Laboratory**
Further experiments in electricity and magnetism for students taking Phys. 253L*.

3 h., alternate weeks. Winter and Spring terms, 0.25 course credit.

**301* Physical Instrumentation for Biologists 1**
Optics and microscopy; interference, phase contrast, polarizing, dark field and ultraviolet microscopes; polarimetry, spectra, spectroscopic techniques, luminescence.

Prereq: First year phys. and calculus. 2 lect., Fall term.

**302* Physical Instrumentation for Biologists 2**
Radioactivity and the use of radioactive tracers, nuclear magnetic resonance, mass spectrometry, the ultracentrifuge and other techniques.


**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.


**325* Atomic and Nuclear Physics 2**
Many electron atoms, atomic and X-ray spectra, nuclear structure, nuclear reactions, molecular and solid state physics.


**350* Astrophysics 1**

Prereq: none, however, familiarity with the contents of Phys. 250*–251* will be assumed. 3 lect., Fall term of odd-numbered yr. for third and fourth year students.
351* Astrophysics 2
Prereq: none, however, familiarity with the contents of Phys. 250*-251* will be assumed. 3 lect., Winter and Spring of even-numbered yr. for third and fourth year students.

Note

352* Electronics 1
Basic A.C. circuit theory. A survey of tubes, transistors and solid state devices, equivalent circuits, power supplies, amplifiers and feedback.

352L* Electronics 1 Laboratory
For students taking Phys. 352*.
3 h., alternate weeks, 0.25 course credit, in the same terms as Phys. 352*.

353* Electronics 2
Applications of feedback to oscillators, operational amplifiers, analogue computers and multi vibrators. Introduction to pulse techniques, FM and TV circuits.

353L* Electronics 2 Laboratory
For students taking Physics 353*.
3 h., alternate weeks, 0.25 course credit, Winter term.

354* Atomic and Molecular Physics
The Schrödinger equation applied to simple one-and three-dimension potentials. Hydrogen atoms, angular momentum and spin, molecular vibrations and rotations, many electron atoms, radiation processes.
Prereq: Phys. 255*. 2 lect., 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.

358* Thermodynamics
Thermodynamic systems, equation of state, the laws of thermodynamics with applications. Change of phase.
Prereq: Math. 237 and a first yr. phys. course. 3 lect., Fall and Spring terms.

359* Statistical Mechanics

360A* Intermediate Laboratory
Selected experiments in mechanics, atomic physics, solid state physics, optics and electronics.
18 hours of experiments, Fall and Spring terms. 0.25 course credit.

360B* Intermediate Laboratory
Continuation of 360A*.
18 hours of experiments, Winter term. 0.25 course credit.

362* Classical Mechanics 1

363* Classical Mechanics 2
Prereq: Phys. 362* or Math. 234. 3 lect., Winter term. This course is primarily intended for Hons. Phys. Students.

364* Mathematical Physics 1
Vector and tensor analysis with applications.
Prereq: Math. 237 and 31*. 3 lect., Fall and Spring terms. This course is primarily intended for Hons. Phys. Students.

365* Mathematical Physics 2

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*).
Prereq: First year Phys. and calculus. 2 lect., 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*).
Prereq: First yr. Phys. and Calculus.
371A* Intermediate Laboratory
Further experiments in atomic, nuclear and solid state physics, optics and electronics. For honours students who are taking Physics 360A*.
18 h. experiments, Fall and Spring terms. 0.25 course credit

371B* Intermediate Laboratory
Continuation of 371A*.
For honours students who are taking Physics 360B*.
18 h. experiments, 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.

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.
Prereq: Phys. 380*. 3 lect., 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.
Prereq: Phys. 362*, 363*, 364* and 365*. 3 lect., Fall term

432* Physics of 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.
Prereq: Phys. 435*. 3 lect., Winter term

433 Experimental Research Project
An experimental research project. This course is designed for students in the Honours Physics Programme and in the Cooperative Applied Physics Programme.
Students in the Regular Hons. Phys. Programme must take either Phys. 433 or Phys. 437*. Although students in the Co-operative Applied Phys. (Hons.) Programme are recommended to take one of these courses, enrolment may be limited. 6 h. per week, two terms, Fall and Winter, 1.00 course credits.

434A* Introductory Quantum Mechanics
Prereq: Phys. 354*. 2 lect. and 1 tut. h., Fall term

434B* Quantum Mechanics
Prereq: Phys. 434A*. 2 lect. and 1 tut. h., Winter term

Note
Phys. 434B* is strongly recommended for students intending to do graduate work.

435* Solid State Physics
Introductory concepts in crystal diffraction and the reciprocal lattice. Crystal bonding, lattice vibrations, thermal properties of insulators, free-electron theory of metals, band theory, semiconductors.
Prereq: Phys. 255*. 3 lect., Fall term

437* Theoretical Physics Project
Selected subjects for advanced study by theoretically inclined students, topics in relativistic, quantum, and statistical physics.
Students in the Regular Hons. Phys. Programme must take either Phys. 437* or Phys. 433. Although students in the Co-operative Applied Phys. (Hons.) Programme are recommended to take one of these courses, enrolment may be limited. 3 h. per week, Winter term

438 Geophysics 3

441 Electromagnetic Theory
A generalized treatment of the basic laws of electricity and magnetism, mathematical techniques for the problems of electrostatics, solution of Maxwell’s equation in free space and the study of plane waves, theory of waveguides and introduction to radiation.
Prereq: Phys. 222*-223* or Phys. 252*-253*. Phys. 364*-365*. 2 lect. and 1 h. tut. 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.
Prereq: Phys. 435*. 3 lect., 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.
Prereq: Phys. 364*-365*. 3 lect., Winter term

444* Nuclear Physics
Elements of nuclear structures and systematics. Alpha emission, beta decay, gamma emission, two-body systems and nuclear forces, nuclear reactions. Neutron physics. Sub-nuclear particles
Prereq: Phys. 355*. 3 lect., Winter term

445* Modern Optics
Prereq: Phys. 256*, Phys. 354*. 3 lect., Fall term

449* Radio Astronomy
Radio telescopes. Radio sources including the sun. H II regions, H I regions. The galactic centre, pulsars, quasars, other extra-galactic sources, cosmological implications.
Prereq: Phys. 223* or 253* and 250*-251*. 3 lect., Winter term of odd-numbered years to third and fourth years students, beginning Winter term 1977.

450* Astrophysics 3
Solar system astrophysics, (excluding the sun). The physical nature of planetary (and satellite) surfaces, atmosphere and interiors. Asteroids, meteorites and comets. The interplanetary medium (solar wind), Solar interactions with the interplanetary medium and earth’s magnetosphere.
Prereq: none, however, familiarity with the contents of Phys. 250*-251* will be assumed. 3 lect., Fall term of even-numbered yr. for third and fourth yr. 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.
Prereq: None, however, familiarity with the contents of Phys. 250*-251* will be assumed. 3 lect., Winter and Spring terms of odd-numbered yr. for third and fourth year students.

452* Digital Electronics
Fundamentals and advanced concepts of digital logic stressing practical uses of modern integrated circuit technology.
Prereq: Phys. 352*-353*. 2 lect., 18 h. experiments, Fall term

453* Analogue Circuits
A variety of topics in the operation of systems. Transistors, modern circuit techniques, noise, stability under feedback, information theory, and possible student motivated topics. Includes laboratory demonstrations.
Prereq: Phys. 352*-353*. 3 lect., Winter term

464* Mathematical Physics 3
Applications to Physics of the theory of functions of a complex variable.
Prereq: Phys 364*-365*. 2 lect., and 1 tut. h., Fall term

465* Mathematical Physics 4
Theory and applications of integral transforms (Fourier, Laplace), integral equations and Green’s functions
Prereq: Phys. 464*. 2 lect. and 1 tut. h. 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.
Prereq: Phys. 222*-223* and Math. 236. 3 lect., 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.
Prereq: Phys. 222*-223* and Math. 236. 3 lect., 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.
Prereq: Phys. 252* and Math 31*. 3 lect., Fall term. Recommended for third or fourth yr. students in Math. Eng. or Sci.
Department of Political Science

Professor, 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. (Oxford), Ph.D. (Leicester)
A. Kapur, B.A. (Panjab), M.A. (George Washington), Ph.D. (Carleton)
J. E. Surich, B.A., M.A. (Waterloo)
R. J. Williams, B.A., M.A. (McMaster), Ph.D. (Toronto)
R. P. Woolstencroft, B.A. (Alberta)

Lecturers
F. Miller, B.A. (U.B.C.), M.Phil. (Yale)
W. B. Moul, B.A., M.A. (U.B.C.)

Adjunct Professors
W. W. Johnson, B.A. (Memorial), J.J.B. (Queen's)
W. J. Morrison, B.A. (Western), LL.B. (Osgoode)

Undergraduate Programmes

While students in Arts do not choose a major until the end of the first year, many have some idea of the area in which they wish to study. Those students who intend to major in Political Science may wish some guidance in the selection of the first year courses. The Department would recommend the following programme for such students:

Political Science 101*/102*
Economics 101*/102*
Sociology 101*/205*
History – the equivalent of one full-year course
One other course, chosen from Group A

By no means should the above recommendations be considered mandatory: while these courses constitute, on the whole, the best overall background for the study of politics, students who wish to pursue interests in other disciplines are free to do so.

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:

1 – methodology
2 – normative theory
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 7) will normally complete, before graduation, the equivalent of five full courses in Political Science beyond the 100 level, of which there must be at least one-half course from each of four different fields of the discipline as defined above.
2 Honours Programme
Students choosing an Honours programme in Political Science (see Chapter 7) must complete, before graduation, the equivalent of nine full courses in Political Science beyond the 100 level, of which four must be 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 Sciences 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 7) with the requirements made by Anthropology, Economics, English, French Geography, History, Man-Environment, Philosophy, Psychology or Sociology. In a joint honours programme involving a Department in another Faculty, as in the Political Science and Man-Environment programme, students will fulfil the degree requirements of the Faculty in which they are registered. 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 there must be at least one-half course from each of four 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 Economics. Students in programmes in other Faculties, such as Planning, may follow a series of courses to obtain a minor designation in Political Science in their degree. Please consult the Department for assistance in planning such a programme. In addition, it is now possible for students in co-op studies in Arts, 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, or the equivalent of three full courses and a cognate essay. Highly personalized, flexible instruction is also offered in the form of reading courses. For more information, please consult the Graduate Calendar or the Political Science Department.

Undergraduate Course Descriptions

Note
Extensive descriptions of the content of Political Science courses are available in the Department at the time of pre-registration.

101* Introduction to Politics 1
An introduction to the nature of politics and to the conflict of modern political ideas. The course involves a common lecture series and faculty-led tutorials which focus on particular sets of political ideas and concepts. Fall and Spring terms

102* Introduction to Politics 2
A discussion of the processes and institutions which underlie modern political action. The course involves a common lecture series and faculty-led tutorials which focus on partial institutions and concepts. Prereq: Pol. Sc. 101*, or consent of instructor. Winter and Spring terms

Note
Descriptions of the specific subjects to be covered in the tutorials and the names of instructors will be available at preregistration each year.

214* Quantitative Analysis
Not offered 1976-77.

221* The History of Political Theory 1: The Classical Period
Not offered 1976-77.

222* The History of Political Theory 2: The Modern Period
Not offered 1976-77.

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 prereq. 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 prereq. for students in the second year and above. Winter term

231* Politics and the Administrator
A study of the various political factors involved in administrative decision-making in both the public and private sectors. Particular attention will be given to inputs from the general public, the media, special interests, and the institutions and agencies of government. No prerequisite but prior completion of Economics 193* would be helpful. Spring term

232* Policy-Making in Canada
Not offered 1976-77.

251* Comparative Politics 1
A survey of the principal historical and contemporary forces shaping politics in Western Europe with a view to evaluating who gets what, when and how, against whom the game is stacked and what potential exists for change. Specific focus on Britain, France, Germany and Italy. No prereq. for students in the second year and above. Fall term

252* Comparative Politics 2
A continuation of Political Science 251* with a narrowing of the theoretical focus to a specific concern with cleavage structures and conflict and a broadening of the empirical scope to take account of significant experiences of smaller nations such as Austria and non-European nations such as Chile. Prerequisite: Political Science 251*. Winter term

260 Canadian Government and Politics
An analysis of the structure of the Canadian political system dealing with such questions as the role of Quebec, the basis of federal-provincial conflict, the nature and operation of the leading institutions of decision-making, the character of the party system, and social bases of Canadian voting behaviour. No prereq. for students in the second year and above. Year

260A* Canadian Government and Politics 1
The first half of Political Science 260, for students in co-operative programmes only. No prerequisites for students in the second year and above. Fall and Spring terms

260B* Canadian Government and Politics 2
The second half of Political Science 260, for students in co-operative programmes only. Prereq: Political Science 260A* or consent of instructor. Winter term and from time to time in the Spring term.

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 prereq. 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 prereq. 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 prereq. for students in the second year and above. Winter term

271* Political Behaviour 1
An examination of the impact of behaviouralism upon the study of politics, focusing on the methodological assumptions and aspirations of behaviouralism. No prereq. for students in the second year and above. Fall term

272* Political Behaviour 2
An examination of the behavioural literature in the study of politics. Selected topics centering on both the micro and macro levels of political systems will be discussed. Prerequisite: Political Science 271* or consent of instructor. Winter term

281* International Politics 1
This course studies the transformation of the international system stressing East-West, Rich-Poor, and North-South perspectives and interactions. No prereq. for students in the second year and above. Fall term

282* International Politics 2
This course studies the roots of foreign policy behaviour of selected western and non-western (particularly Asian) states. Prerequisite: Political Science 281* or consent of instructor. Winter term
291* The Canadian Legal Process
An analysis of the manner in which the Common Law functions, together with an examination of the structure and jurisdiction of the Canadian court systems. Taught by a member of the legal profession.
Prerequisite: Open to all students in the second year and above. Fall term

292* Aspects of Canadian Law
A study of the way in which the law reflects and influences political ideas and attitudes in Canada in relation to a number of aspects of Canadian life. Taught by a member of the legal profession.
Prerequisite: Political Science 291* or consent of instructor. Winter term

293* Political Journalism
An account of the special factors affecting political reporting and commentary in the broadcast and print media, with a critical evaluation of contemporary practice in the field. Taught by a practising journalist.
No prereq. for students in the second year and above. Fall term

294* Women and Politics
An examination of the political roles, rights, and capacities of women and the relationship between the political roles which women choose and their other social, economic, sexual, and familial roles. Includes a review of the views of leading feminist critics, theorists, and activists.
No prereq. for students in the second year and above. Winter term

311* Methodology of Political Science: The Foundations
A selective examination of seminal works which have contributed to modern scientific methods of studying politics. The primary focus of interest will be on methodological considerations of major contributors, ranging in time from Bacon and Hobbes to such recent and contemporary writers as Weber, Mannheim, and Kuhn. It is not a survey course.
Prerequisite: Consent of the instructor. Fall term
Alternates with Political Science 327*.

321* Marxist Theory
An examination of the formation of Marx's method and of its significance for the proletariat.
No prereq. for students in the third year and above. Winter 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.
Prerequisite: Consent of the instructor. Fall term

324* Modern Political Philosophy
A selective examination of political philosophy in the modern period.
Prerequisite: Consent of instructor. Winter term

327* Political Science and Political Values
An examination of the relationship of "values" to a proper science of politics.
Prerequisite: Consent of instructor. Fall term.
Alternates with Political Science 311*.

331* Public Administration 1
An introduction to the principles of public administration illustrated by the study of Canadian institutions largely at the federal level, but including provincial and municipal examples.
Prereq: Pol. Sci. 260 or consent of instructor. Winter term

332* Public Administration 2
Analyses of problems and issues in the field applying the knowledge gained in Political Science 331*.
Prereq: Pol. Sci. 331* or consent of instructor. Winter term

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 exists in Canada.
Prerequisite: Political Science 260. Fall term

343* Canadian Municipal Government
A study of the assumptions, structures, and performance of municipal government in Canada with reference to metropolitan and regional structural innovations (particularly in Ontario).
Open to students in the third year and above with at least one previous course in Political Science. Winter term

344* The Politics of Local Government
A study of the political process in selected Canadian cities focusing on citizen participation, internal decision-making, leadership, and the allocation of power.
Prerequisite: Political Science 343* or consent of instructor. Winter term

350 The Politics of the Developing Areas
An examination of selected topics in the politics of developing areas. Emphasis will be placed upon the theoretical and empirical adequacy of explanations of both macro and micro political and economic change in Asian, African and Latin American states.
No prerequisites for students in third year and above. Year

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
Course Descriptions

Political Science

371* Political Culture
Not offered 1976-77.

372* The Political System
Not offered 1976-77.

373* Political Parties
An examination of the relationship of political parties and party systems to the dynamics of social change taking into account the imperatives of survival and adaptation and the dilemma of principles versus power.
Prerequisite: At least one of Political Science 251*, 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 251*, 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.
Prerequisite: Consent of the instructor. Fall term

380 World Politics
An examination of the structure or institutional arrangements of global society and their inter-relationships with interstate war and the allocation of misery. A wide range of theories of international violence and imperialism will be considered.
Open only to students in the third year and above. Year

390-398* 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 consult the Department's Undergraduate Officer.

411* Theories and Methods of Political Science
An examination of selected topics in political science research such as measurement, causal analysis and experimentation. Particular emphasis is placed upon the influence of images of science and scientific activity which are common in political science and are problematic in the history and philosophy of social science.
Prerequisite: Consent of the instructor. Fall term

424* Contemporary Socialist and Communist Thought
Not offered 1976-77.

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.
Prerequisite: Consent of the 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 331* or 332* 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.
Prereq: Pol. Sc. 431* or consent of instructor. Winter term

434* Canadian Foreign Policy
A seminar devoted to the course, factors and challenges of Canadian foreign policy. Some attention will be paid to how policy is made. The general patterns may, if students wish, be illustrated by case studies of major contemporary issues.
Prereq: Consent of the instructor. Winter term

442* Politics in Ontario
A critical examination of the distinctive elements of government and politics in the Province of Ontario.
Prereq: Pol. Sc. 260 or 341* or consent of the 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.
Prereq: Pol. Sc. 260 or 341* or consent of instructor. Fall term. Alternates with Political Science 445*
Course Descriptions
Political Science

444* Politics in Quebec
A sympathetic look at Quebec, its nationhood, its contradictions, its struggles and its political life.
Prerequisite: Pol. Sc. 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. Alternates with Political Science 443*

451* Comparative Parliamentary Systems
An analytical comparison of parliamentary institutions and processes as they have developed in various political systems influenced by Britain.
Prerequisite: Pol. Sc. 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 large scale and very diverse, they will be examined on a comparative basis.
Prerequisite: Pol. Sc. 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.
Prerequisite: Consent of the 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.
Prerequisite: Consent of the instructor. Fall term

473* Voting Behaviour
Prerequisite: Pol. Sc. 214*, 373* or consent of instructor. Fall term

478* Research Seminar in Political Socialization
Not offered 1976-77.
Department of Psychology

Professor, Chairman of the Department
R. K. Banks, B.A., M.A., Ph.D. (Toronto)

Associate Professor, Associate Chairman
Undergraduate Affairs
G. A. Griffin, B.A. (Colgate), M.A., Ph.D. (Wisconsin)

Associate Professor, Associate Chairman
Graduate Affairs
T. G. Waller, B.S., M.S. (Southern Mississippi), Ph.D. (Vanderbilt)

Professors
K. S. Bowers, B.A., Ph.D. (Illinois)
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)
M. Kinsbourne, B.A., M.A. (Oxford), B.M., B.Ch. (Guy's Hospital), D.M. (Oxford), (part-time)
H. M. Lefcourt, B.A. (Antioc), M.S., Ph.D. (Ohio State)
M. Lerner, B.A., M.A. (Ohio State University), Ph.D. (New York University)
D. Meichenbaum, A.B. (City College of New York), M.A., Ph.D. (Illinois)
S. Reinis, M.D., C.Sc. (Charles University)
D. A. Sprott, B.A., M.A., Ph.D. (Toronto), F.S.S.
R. A. Steffy, B.A. (Albright), M.A., Ph.D. (Illinois)
M. D. Vogel-Sprott, B.A. (McMaster), M.A., Ph.D. (Toronto)

Associate Professors
D. M. Amoroso, B.A., M.A. (Toronto), Ph.D. (Waterloo)
M. Breidenbaugh (Mrs.), B.A. (Wittenberg), Ph.D. (Vienna)
T. E. Cadell, B.A. (British Columbia), M.A. (Massachusetts), Ph.D. (Wisconsin)
J. A. Cheyne, B.A. (Waterloo Lutheran), M.A., Ph.D. (Waterloo)
J. M. Cornell, B.A., M.S., Ph.D. (Washington)
S. Z. Himunelfarb, A.B., Ph.D. (California, Los Angeles), (visiting)
G. E. MacKinnon, B.A. (Queen's), Ph.D. (John Hopkins)
P. M. Merckile, B.A. (Knox), M.A., Ph.D. (Virginia)
P. J. Nauss, B.A., Ph.D. (Nijmegen)
M. A. Ross, B.A. (Toronto), M.A., Ph.D. (North Carolina)
R. R. Ross, B.A., M.A., Ph.D. (Toronto), (part time)
P. M. Rowe, B.A. (Toronto), M.A. (Dalhousie), Ph.D. (McGill)
R. D. Seim, B.A. (Queen's), Ph.D. (Waterloo)
R. V. Thysell, B.A. (Montana), M.A., Ph.D. (Iowa)
D. L. Wahlsten, B.A. (Alma College), Ph.D. (California, Irvine)
E. E. Ware, B.A., M.A. (Richmond), Ph.D. (Illinois)
M. P. Zanna, B.A., Ph.D. (Yale)

Assistant Professors
R. J. Alapack, B.A. (Scranton), M.A., Ph.D. (Duquesne)
F. A. Allard, B.A., B.P.E., M.A., Ph.D. (Waterloo)
R. F. Asarnow, B.S. (Rutgers), M.A., Ph.D. (Illinois)
P. E. Bowers, (Mrs.), B.A. (Rosemount), M.A., Ph.D. (Illinois) (part-time)
A. J. Cohen, B.A. (McGill), M.A., Ph.D. (Queen's)
J. H. Davison, B.A. (York), Ph.D. (Waterloo), (part-time)
D. F. Hay, B.A. (Allegheny College), Ph.D. (North Carolina)
J. G. Holmes, B.A., M.A. (Carleton), Ph.D. (North Carolina at Chapel Hill)
R. H. Lahue, B.Sc. (Fordham), Ph.D. (Waterloo)
G. D. Logan, B.A., M.Sc. (Alberta), Ph.D. (McGill), (part-time)
T. J. Lottman, B.S., M.A. (Xavier), Ph.D. (Loyola of Chicago)
J. E. Orlando, B.A. (Western Ontario), M.A. (Detroit), M.A., Ph.D. (Michigan)
J. Psotka, B.A. (Toronto), A.M. (Harvard), Ph.D. (Yale)
H. Ross (Mrs.), B.A. (Toronto), Ph.D. (North Carolina)
K. H. Rubin, B.A. (McGill), M.A., Ph.D. (Penn State University)
D. M. Willows, B.A. (Manitoba), M.A., Ph.D. (Waterloo)

Adjunct Professors
J. R. Amdur, B.S. (Portland State College), M.A., Ph.D. (Denver)
J. R. Bambrick, B.A., M.A. (Guelph), Ph.D. (Windsor)
L. V. Cohn-Jones, B.A. (Winnipeg), M.A., Ph.D. (Waterloo)
R. E. Enfield, B.A. (Whistler College), M.A., Ph.D. (Arizona)
B. S. Francis, B.S. (Ursinus College), M.A., Ph.D. (Arizona)
D. E. Hill, B.S., M.D. (British Columbia)
R. A. Merrick, B.A. (Hiram College), M.A., Ph.D. (Kent State)
D. W. Proud, B.A. (Michigan State), M.A. (Bowling Green), Ph.D. (Ottawa)
P. L. Ritchie, B.A. (McGill), Ph.D. (Duke)
R. W. Robinson, B.A. (Rutgers), M.A., Ph.D. (Temple)
G. Sumner-Smith, M.R.C.V.S., B.V.Sc. (Liverpool), F.R.C.V.S., M.Sc. (Guelph)

Faculty members holding cross appointments as shown
1 Human Relations and Psychology
2 Kinesiology and Psychology
3 Renison and Psychology
4 Sociology and Anthropology, and Psychology
5 St. Jerome's and Psychology
6 Statistics 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* 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 498 or 499.

Honours Psychology with Early Childhood Education and Care Option
Students choosing the Honours Psychology Programme with Early Childhood Education and Care Option fulfill all the requirements listed under the Honours Programme above. In addition, students must be accepted into the option at the beginning of the third year and must have completed the following courses prior to the fourth year:

Psychology 101*, 203* or 207*, 211*, 241* 242*, 283*, 284*, 285*, 293* or 295*, 311*, 321*, 341*, 393*, Health Studies 140*, and Recreation 200*. In the fourth year students must complete Psychology 421, 453*, 498 or 499, Dance 364*, and Health Studies 345* and 440*. Before graduation each student must complete a minimum of twenty-two courses. Of these twenty-two courses a minimum of nine courses must be in Psychology with letters grades (Psychology 321 and 421 are offered on a Credit-Fail basis only). A recommended programme is outlined in Chapter 7.

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* 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 498 or 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 Office. All minor programmes must be approved by the Department.

Undergraduate Course Descriptions

Course Descriptions
Psychology

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.
Prerequisite: Psychology 101*. 3 hours

205* Sensory Processes
A consideration of data and theory concerning sensory processes. Topics will include psycho-physical methodology, sensory mechanism and the neuropsychological basis of perception.
Prerequisite: Psychology 101*. 3 hours
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Description</th>
<th>Prerequisite</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>206*</td>
<td>Perceptual Processes</td>
<td>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.</td>
<td>Psychology 101*</td>
<td>3 hours</td>
</tr>
<tr>
<td>207*</td>
<td>Cognitive Processes</td>
<td>An examination and evaluation of selected topics dealing with human learning, thinking, concept formation, memory and language.</td>
<td>Psychology 101*</td>
<td>3 hours</td>
</tr>
<tr>
<td>211*</td>
<td>Developmental Psychology</td>
<td>An examination of the process and factors of human development.</td>
<td>Psychology 101*</td>
<td>3 hours</td>
</tr>
<tr>
<td>214*</td>
<td>Psychology of Adolescence</td>
<td>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.</td>
<td>Psychology 101*</td>
<td>3 hours</td>
</tr>
<tr>
<td>218*</td>
<td>Aging, Dying and Death</td>
<td>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.</td>
<td>Psychology 101*</td>
<td>3 hours</td>
</tr>
<tr>
<td>241*</td>
<td>Educational Psychology: The Psychology of Classroom Learning</td>
<td>A consideration of the main variables affecting learning in the classroom with special focus upon the conditions essential to efficient learning.</td>
<td>Psychology 101*</td>
<td>3 hours</td>
</tr>
<tr>
<td>242*</td>
<td>Educational Psychology: Learning Disabilities</td>
<td>Analyses of learning disabilities associated with various categories of exceptionality including mental retardation, emotional problems, and receptive and expressive handicaps.</td>
<td>Psychology 101*</td>
<td>3 hours</td>
</tr>
<tr>
<td>253*</td>
<td>Social Psychology</td>
<td>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.</td>
<td>Psychology 101*</td>
<td>3 hours</td>
</tr>
<tr>
<td>254*</td>
<td>Interpersonal Relations</td>
<td>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.</td>
<td>Psychology 253*</td>
<td>3 hours</td>
</tr>
<tr>
<td>261*</td>
<td>Physiological Psychology</td>
<td>The structure and function of the nervous system and their relation to behaviour.</td>
<td>Psych. 101* or permission of instructor</td>
<td>3 hours</td>
</tr>
<tr>
<td>271*</td>
<td>Animal Behaviour</td>
<td>An in depth study of the behaviour of animals emphasizing both observational and experimental research.</td>
<td>Psych. 101* or permission of instructor</td>
<td>3 hours</td>
</tr>
<tr>
<td>275*</td>
<td>Statistics and Measurement</td>
<td>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.</td>
<td>2 hours lectures, 2 hours laboratory</td>
<td></td>
</tr>
<tr>
<td>283*</td>
<td>Statistical Methods in Psychology</td>
<td>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 the descriptive statistics, to sampling statistics and to an introduction to inferential statistics.</td>
<td>3 hours</td>
<td></td>
</tr>
<tr>
<td>284*</td>
<td>Experimental Design</td>
<td>An examination of the effective use and interpretation of statistics in design and understanding of experiments in the social sciences.</td>
<td>Psychology 283*</td>
<td>3 hours</td>
</tr>
<tr>
<td>285*</td>
<td>Tests and Measurements</td>
<td>An introduction to the theory and use of psychological tests. Special emphasis is placed on the assessment of personality, intelligence, aptitudes and interests.</td>
<td>Psychology 283*</td>
<td>3 hours</td>
</tr>
<tr>
<td>293*</td>
<td>Research in Learning and Motivation</td>
<td>Open only to students in a Psychology Programme (Honours, Joint Honours, General or Minor Programmes).</td>
<td>Psychology 283* and one of Psychology 203*, 207* or 271*</td>
<td>2 hours lecture, 2 hours laboratory</td>
</tr>
<tr>
<td>295*</td>
<td>Research in Perceptual and Cognitive Processes</td>
<td>Open only to students in a Psychology Programme (Honours, Joint Honours, General or Minor Programmes).</td>
<td>Psychology 283* and one of Psychology 205*, 206* or 207*</td>
<td>2 hours lecture, 2 hours laboratory</td>
</tr>
</tbody>
</table>
297* Research in Biopsychology
Open only to students in a Psychology Programme (Honours, Joint Honours, General or Minor Programmes). 
Prerequisite: Psychology 283* and Psychology 261*.
2 hours lectures, 2 hours laboratory

311* Behaviour and Development of Human Infants
An inquiry into the behaviour and development of human infants in the first two years of life, with emphasis on the implications of current research and theory for infant care. 
Prereq: Psych. 211* or permission of instructor. 3 hours

316* Moral Development
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. 
Prerequisite: Psychology 211*. 3 hours

321 Observation and Practicum Experience with Young Children
Directed observation of and supervised experience with young children in group or home settings. Graded on a Credit-Fail basis. 
Prerequisite: Acceptance into the Early Childhood Education and Care Option. 4 hours

331* Individual Differences
An analysis of individual and group differences in behaviour, with emphasis on studies of intelligence. 
Prerequisite: Psychology 285*

333* Industrial Psychology
An introduction to the methods and problems in Industrial Psychology. 
Prerequisite: Psychology 101*. 3 hours 
(Cross listed as Management Science 44)

334* Theories of Counselling Psychology
An introduction to the methods, theories and problems in Counselling Psychology. 
Prerequisite: Psychology 101*. 3 hours

340 Community Psychology
Theory and practice are integrated in an attempt to identify and to 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. 
Prerequisite: Psychology 253*. 3 hours

341* Psychology of Early Childhood Education
An introduction to the field of early childhood education. Topics to be considered include: (1) historical review of the area; (2) application of psychological theory to early childhood education; (3) the disadvantaged child and head start. 
Prerequisite: Psychology 211*. 3 hours

350 Group and Individual Counselling
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. 
Prerequisite: Psychology 355* and 334* or suitable alternative and permission of instructor. 3 hours

353* Aggression and Social Conflict
This course will examine the genetic, physiological, and social causes of aggression, with the emphasis on social-psychological causes. 
Prerequisite: Psychology 253*. Offered in alternate years. 3 hours

354* Interpersonal Processes in Critical Situations
Offered on alternate years. Not offered 1976-77.

355* Personality Theory
An examination and evaluation of some of the outstanding theories of personality. 
Prerequisite: Psychology 101*. 3 hours

357* Psychopathology
The nature and origin of deviant behaviour. 
Prerequisite: Psychology 101*. 3 hours

359* Personality and Adjustment
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. 
Prerequisite: Psychology 355*. 3 hours

363* (A-E)-366*(A-E) Special Subjects
One or more half courses will be offered at different times as announced by the Department. 
Prerequisite: Consent of instructor

393* Research in Development Psychology
Open only to students in a Psychology Programme (Honours, Joint Honours, General or Minor Programmes). 
Prereq: Psych. 283* and Psych. 211* or 331*. 
2 hours lecture, 2 hours laboratory

395* Research in Social Psychology
Open only to students in a Psychology Programme (Honours, Joint Honours, General or Minor Programmes). 
Prerequisite: Psychology 283* and 253*.
2 hours lecture, 2 hours laboratory

397* Research in Personality and Psychopathology
Open only to students in a Psychology Programme (Honours, Joint Honours, General or Minor Programmes). 
Prerequisite: Psychology 283* and one of Psychology 331*, 355* or 357*. 2 hours lecture, 2 hours laboratory
Course Descriptions
Psychology

410 History and Systems
An examination of current theoretical approaches to psychological problems present in a historical context.
2 hours

421 Senior Practicum in Preschool Groups
Laboratory experience for advanced students in guiding and supervising developmental experience for young children. Consideration of professional practical matters of organization and administration in early childhood education and care.
Prerequisite: Psychology 321.
Graded on a Credit-Fail basis. 4 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

498 Senior Honours Essay – Review Paper
Each student will work under the direction of a member of the department on a critical integrative review of an issue in the research literature. The result of this review will be presented in the form of a thesis, which will be critically examined by members of the department.

499 Senior Honours Essay – Experimental Study
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.

The following courses are administered by Renison College. Since these courses are intended primarily for students in the Social Development programme, students planning a General or Honours Psychology programme must consult their faculty advisor concerning Psychology major credit for these courses.

120R*/121R* Introductory Psychology

220R*/221R* Social Psychology

241*(R) Educational Psychology: The Psychology of Classroom Learning.

322R*/323R* Personality: Approaches to Individual Functioning.

334*(R) Theories of Counselling Psychology

367R*-369R* Special Topics in Psychology

367R* Cross-Cultural Psychology
Psychology 367R* Cross-Cultural Psychology

398R*-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 Development Studies Programme.
Department of Recreation

Professor, Chairman of the Department
W. F. Theobald, B.S. (Seton Hall), M.A., Ed.D. (Columbia)

Dean, Faculty of Human Kinetics and Leisure Studies
G. S. Kenyon, B.P.E. (British Columbia), M.S. (Indiana), Ph.D. (New York)

Associate Professor and Associate Chairman, Undergraduate Affairs
D. Ng, B.A. (Lingnan), M.A. (Carver), M.S., Re.D. (Indiana)

Professor, Associate Chairman, Graduate Affairs
E. 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)
J. Zuzanek, M.A. (Moscow), Ph.D. (Charles University, Prague)

Assistant Professors
K. R. Balmer, B.A. (Toronto), Ph.D. (Liverpool)
E. G. Carls, B.S., M.S., Ph.D. (Illinois)
R. Johnson, B.A., M.A. (Windsor), Ph.D. (Minnesota)
J. Levy, B.A. (Waterloo Lutheran), B.P.E. (Waterloo), M.S.W. (Waterloo Lutheran), Ph.D. (Waterloo)

Lecturer
C. R. Edginton, B.A. (San Jose), M.S. (Illinois)

Undergraduate 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. Prerequisite: Recreation students only. 1 two hour lecture and one hour discussion session, Fall and Winter terms

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. 3 lectures, Fall and Winter terms

204* Leisure and Recreation in Historical Perspective
Analysis of socio-cultural determinants which have influenced Canadian Leisure behavior. Prereq: Rec 100* or consent of instructor. 3 lectures, Fall

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, Winter and Spring terms

220* Recreation Programme Development
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. 2 lectures, 2 hours lab, Fall and Winter terms

230* Introduction to Outdoor 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. 3 lectures, Fall and Winter terms

240* Man, Leisure, and Society
See Kinesiology Departmental listing for course description.
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.
Prerequisite: Recreation 220*. 3 lectures, Winter term

250* Introduction to Recreation for Special Populations
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, Fall and Winter terms

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.
Prereq: Rec. 250*, Psych. 242*. 3 lect, Winter, 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.
Prereq: Rec. 250*, permission of instructor. 3 lect., Fall term

254* Recreation and Mental Health
A psycho-social analysis of the determinants and consequences of recreational behaviour as related to positive and negative mental health, discussing in detail, structure, semiotic factors and interaction patterns.
Prerequisite: Recreation 250*, 3 lectures, Fall term

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

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, Fall and Winter terms

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. 3 lectures, Fall and Winter 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, Winter term

303* Sport 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: Soc. 101* and one other Sociology course. 3 lectures, Winter and Spring terms

306* Psychodynamics of Leisure Behaviour
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*, 3 lectures, Winter term

311* School Recreation
(Not offered in 1976-77)

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.
Prerequisite: Recreation 210*. 3 lectures, Fall term

316* Principles of Recreation Planning (Planning 344*)
An exploration 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.
Prequisite: Recreation 220*. 3 lectures, Winter term

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.
Prequisite: Consent of instructor

331* Outdoor Education in 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.
Prereq: Recreation 250*. 2 lectures, 2 hours lab, Fall

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.
Prequisite: Recreation 230*, 241*. 2 lectures, 2 hours lab, (lab fee $25), Fall term

334* Park Management
Basic administrative procedures in park management. Operational techniques are examined together with general policies of acquisition, operation and development.
Prereq: Rec. 210*, Rec. 230*, or equiv. 3 lect., Fall

361* Aging and Leisure
Social parameters of the aging process with particular reference to the Leisure Service Industry.
Prequisite: Recreation 301*

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.
Prequisite: Faculty approval, Fall, Winter and Spring

371* 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.
Prereq: Rec. 270*, 3 lect., Fall, Winter and Spring

400* Seminar in Recreation and Leisure
An in depth analysis of the current major issues and trends. Fourth year Departmental students only. 3 hours. Fall, Winter and Spring terms

402* Colloquium on Religion and Leisure
Not offered in 1976-77.

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 to recreation areas and facilities.
Prequisite: Recreation 210*. 3 lectures, Fall term

432* Interpretation
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 and the community. The provincial and federal government relative to a systems approach toward an integrated design.
Prequisite: Recreation 332* or consent of the instructor. 3 lectures, Winter term

434* Advanced 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.
Prequisite: Recreation 334*. 3 lectures, Winter term

435* Recreation Resource Policy
A study of policies (both existing and emerging), policy development and policy gaps related to recreation resources in Canada. Based on a literature review and discussion of decision-making procedures, roles and tools used in the recreation field; students are required to research real and theoretical situations for seminar presentation.
Prequisites: Recreation 100* and Recreation 230* or consent of instructor. 3 hrs/week, 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, Fall, Winter and Spring terms

Recreation 471* requires the completion of the project begun in 470*.

**Prerequisite:** Recreation 470*. Fall, Winter and Spring terms

**580* The Dynamics of Tourism**

An examination of the behaviour factors which influence the tourist; the research methodologies employed to examine these factors; and the relationship between tourism and other aspects of leisure behaviour.

**Prereq.:** Rec. 302* or equivalent, and a course in statistics. Open to advanced undergraduate students and graduate students.
Religious Studies

Assistant Professor and Chairperson
B. J. Hubbard, B.A. (Seattle), M.A. (Marquette), Ph.D. (Iowa)

Professor
W. Klaassen, B.A. (McMaster), B.D. (McMaster Divinity School), D.Phil. (Oxford)

Associate Professors
A. M. McLachlin, M.A. (Toronto), B.D., Th.D. (Emmanuel)
D. Sahas, B.D. (Athens), S.T.M. (Christian Theological Seminar), Ph.D. (Hartford Seminar Foundation)
A. F. Thompson, B.A. (Toronto), B.Th. (Huron), M.A. (Western), S.T.M., Ph.D. (McGill)

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., Ph.D. (Iowa)
M. D. Bryant, B.A. (Concordia), S.T.B. (Harvard), M.A. (Toronto)
R. D. Legge, B.A. (Transylvania), S.T.B. (Harvard), Ph.D. (McMaster)
D. R. Newman, B.A. (Toronto), B.D. (Emmanuel), M.A., Ph.D. (Toronto)
L. L. Newmarch, B.A. (Toronto), B.R.E. (Victoria), M.A. (Columbia)
R. Sawatsky, B.A. (Bethel College), M.A. (Minnesota), M.A. (Princeton)
J. D. Whitehead, B.A. (Toronto), Ph.D. (Chicago)

Lecturers
W. G. Walker, B.F.A. (Cincinnati), M.Ed. (Xavier), M.A. (Marquette)
P. K. Hawkes, B.A. (Queen's), B.D. (Emmanuel), M.A. (Toronto) (part-time)

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
   B) History of the Christian Church
3) Theological - Philosophical Studies
   A) Theological
   B) Philosophical
   C) Ethics
4) Cultural Studies
   A) Religion and Culture
   B) Religion and the Social Sciences

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
   B) History of the Christian Church
3) Theological - Philosophical Studies
   A) Theological
   B) Philosophical
   C) Ethics
4) Cultural Studies
   A) Religion and Culture
   B) Religion and the Social Sciences

Note 3
The honours programme in Religious Studies can be found in Chapter 7 of this Calendar.

Note 4
Students at the University of Waterloo and Wilfrid Laurier University may, with the permission of their advisor, 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.
Course Descriptions
Religious Studies

Undergraduate Course Descriptions

103G*/103J* Introduction to Biblical Studies 1
A survey of the literature, history and religion of ancient Israel as seen in its cultural background in the Ancient Near East.
3 lectures, Fall term

104G*/104J* Introduction to Biblical Studies 2
A survey of the literature, history and religious thought of the Christian community during the New Testament period as seen in its cultural setting in the Greco-Roman world.
3 lectures, Winter term

105J Elementary Biblical 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 1976-77 at Wilfrid Laurier University and in alternate years at St. Jerome's College.
3 hours

106P* New Testament Greek
This course will consist of two parts:
a) An introduction to Greek grammar with appropriate grammatical exercises and development of vocabulary.
b) An exegetical study of the Greek text of the Synoptic Gospels, with Mark as the basis.
3 lectures

110* Religions of Mankind 1
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

111* Religions of Mankind 2
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

130P* Introduction to Theology
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

131P* Introduction to Theology
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

160R* Religion and Culture 1
An introductory exploration of the interrelationships of religion and culture through the medium of the arts. A consideration of the religious dimensions of man's artistic, personal and social quest in cultures East and West.
3 lectures, Fall term

161R* Religion and Culture 2
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

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

204G* Worship Life in Ancient Israel
Not offered in 1976-77.

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.
2 hours, Winter term, evenings, St. Jerome's College

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, Fall term

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

209G* The Apostle Paul: Life and Letters
An examination of the career and thought of Paul as seen in his letters and in the Acts of the Apostles.
3 hours, Fall term, (evenings)
212J* Ancient Near Eastern Religions
Not offered in 1976-77.

213* Hinduism
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

214* Buddhism in India, China and Japan
This course consists 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

215* Chinese Religions
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

216* Islam
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, Winter term

217* Judaism
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, Fall term

218* Christianity
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, Winter term

220G* Religious Styles in Recent Western History 1
The Fundamentalist Movement. A consideration of religious pluralism in recent Western society. This development will be examined by giving special consideration to the Fundamentalist movement and allied phenomena such as Pentecostalism, revivalism, reactionary political groups, the Jesus People, and the emphasis on the Second Coming.
3 lectures, Fall term

221* Religious Styles in Recent Western History 2
The Denominational Society. As above with special consideration given to certain denominations, sects and ethnic groups. The particular groups examined will vary according to the interests of the students and instructor, but might include Mormons, Methodists, Scientologists, Hutterites, the United Church of Canada and Reform Jews.
3 lectures, Winter term

227* (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.
3 lectures, Fall and Winter terms

231J The Evolution of Christian Thought: A Catholic Survey
An analysis of the major developments in Christian belief, practice and thought through the centuries.
3 hours

232J Christ and Contemporary Man
A systematic reflection on the revolution in contemporary consciousness, and its significance for the understanding of Jesus in a secular and pluralistic world.
2 lectures

233*P Contemporary Atheism & Christian Faith 1
The sources of atheism in western culture. The God of philosophical proof and the God of Christian faith. Christian responses to contributions to present day atheism made by Hegel, Feuerbach, Nietzsche, Marx and Lenin.
2 hours, lectures & seminars, Fall term

234*P Contemporary Atheism & Christian Faith 2
Prerequisite: R.S. 233*P or consent of instructor; 2 hours, lectures & seminars, Winter term

235J* Issues in Catholic Moral Theology 1
A study in moral theology of current social problems. Concrete possibilities for individual initiative toward needed social change will be stressed.
Prereq: 2nd year standing or consent of instructor; 2 lectures, Fall term

236J* Issues in Catholic Moral Theology 2
An investigation of the moral implications of an evolving sexual consciousness on the Christian tradition.
Prereq: 2nd year standing or consent of instructor; 2 lectures, Winter term
238J The Ecumenical Movement
Not offered 1976-77.

253G* History and Thought of Christian Pacifism 1
The Biblical Materials. An examination of the documents of the early church, notably the Bible, with reference to their teaching on war and peace.
3 lectures, Fall term

254G* History and Thought of Christian Pacifism 2
The Contemporary Discussion. A survey of Christian teaching on war and peace, focusing on the twentieth century discussion.
3 lectures, Winter term

255P* Christian Ethics 1
An introductory study of the relationship between Christian faith and moral decision as expressed in major ethical writings both historical and contemporary. Special reference will be made to such historical authors as Augustine, Aquinas, Luther and Calvin, and among more recent authors, Barth, Bonhoeffer, the Niebuhrs, Lehmann, Curran and Gustafson.
3 lectures, Fall term

256P* Christian Ethics 2
A continuation of the study of Christian ethical thinking. Such thematic considerations as the Christian view of human nature, the tension between freedom and law, principle vs. situation, love as an ethical norm and the individual and community, will be discussed with reference to the writers studied in R.S. 255P*.
3 lectures, Winter term

262R* Religion and Politics 1
An historical examination of the relationship between religion and politics from primitive to modern societies. Special focus will vary from year to year. (Fall 1976 focus will be the Quest for the City).
Prereq: 1 full course in RS or consent of instructor
3 lectures, Winter term

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

264P* Religion in Canada 1
An examination of religion in Canada with particular attention to topics such as the introduction of Christianity into Canada, Amerindian religion, religious life in colonial times, denominational differences and ecumenism, the impact of religion on social and political activity.
3 lectures, Fall term

265P* Religion in Canada 2
A continuation of the study of religion into the 20th Century, with special consideration of issues and motifs arising out of the Canadian experience, e.g., Social Gospel, immigration and national building, ecumenism, the open society and transcendence, and the post-Christian era.
Prerequisite: R.S. 264P*. 3 lectures, Winter term

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

267R* Religion and the Film 2
An exploration of selected themes – death, evil, guilt, fate, alienation, love redemption – in the films of several of today’s leading directors: Bunuel, Pasolina, Kurosawa, Fellini, Pintonioni, Polanski.
Film fee $5.00. 3 lectures, Winter term

268* Myths & Symbols of Indian Art & Civilization
An approach to understanding symbols and perennial themes of Indian religion through a study of representative art, architecture and folk-literature of Hinduism, Indian Buddhism and Jainism.
3 lectures, Winter term

270P* Psychology of Religion
A study of theories of the psychological nature of religious experience, the sources of religious belief and religious significance of psychological phenomena. Topics include faith, doubt, evangelism, conversion, faith healing, mysticism, drugs and religious experience, tongue-speaking.
3 lectures, Fall term

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

280G* The Parables of Jesus
Detailed examination of the stories Jesus told, their form, method, message, and significance for religious thought, past and present.
3 lectures, Fall term
281J* Foundations of Sacramental Theology
A study of the nature of Sacrament as an encounter between man and God in Christ. The mysterious, communal, symbolic and personalizing aspects of sacramentality will be discussed. The course will critically examine and evaluate the impact of social change, the secularization process and traditional forms on the sacramental life in the Roman Catholic experience.
Prereq: 2nd year standing or consent of instructor. 2 hours, Fall term (evening)

282J* New Perspectives in Sacramental Theology
A discussion of sacramental theology in the light of the ongoing renewal inaugurated by the Second Vatican Council through a study of the individual sacraments and their role as meaningful cultic signs in contemporary Roman Catholicism.
Prereq: 2nd year standing or consent of instructor. 2 hours, Winter term

301J* Palestinian Archeology
Not offered 1976-77.

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.
Prereq: RS 103G*, or RS 201J*, or consent of instructor. 2 hours. Fall term

303J* Palestinian Archaeology: Field Experience
Not offered 1976-77.

304J* Selected Topics in Israelite Religion
Studies in the development of Israelite religion.
Prerequisite: RS 103G* or previously (201J*) or consent of instructor. 2 hours. Seminar, Winter term

305P Intermediate New Testament Greek
Prerequisite: RS 106 or consent of the instructor. 3 hours

306J Intermediate Biblical Hebrew
Reading and grammatical analysis of selected prose and poetic portions of the Hebrew Bible.
Prerequisite: RS 105J or the equivalent

Note
This course is offered at St. Jerome's in 1976-77 through cross-registration and in alternate years at WL.

308J* The New Testament World
A study of the religio-cultural forces which influenced early Christianity. Jewish rabbinic and apocalyptic literature (including the Dead Sea Scrolls), Greek mystery religions and Gnosticism will receive special emphasis.
3 hours, Winter term

309G* New Testament Themes
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.
Prereq: RS 202J*, 104G* or consent of the instructor. Winter term

310J* 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.
Prereq: RS 110*, 213* or consent of the instructor.
3 lectures, Fall term

311* Zen Buddhism
Not offered 1976-77.

321G* (History 347G*) Radical Reformation 1
Not offered 1976-77.

322G* (History 348G*) Radical Reformation 2
Not offered 1976-77.

323J* (History 353*) 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

324J* (History 354*) 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

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, Fall term

329* The History and Methodology of the History of Religions
Not offered 1976-77.

331J The Church in the Modern World
Not offered 1976-77.

332K* Fantasy
Not offered 1976-77.
333J* Creativity: A Religious Perspective
An analysis of the concept of divine creation in the Judeo-Christian tradition as a basis for understanding man as a creative being. Emphasis will be given to a theological exploration of human creativity as it relates to work, art, leisure, and sexuality.
Prerequisite: 2nd year standing or consent of instructor.
2 hours, Winter term

334* Islamic Theology, Philosophy and Mysticism
Not offered 1976-77.

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

351J* Contemporary Western Mysticism
A theological interpretation of the 20th century search for self-meaning and expansion of consciousness with emphasis given to the following approaches: the psychedelic, the psychotherapeutic, the ecological, the sexual, the monastic, the revolutionary, and the scientific.
Prerequisite: 2nd year standing or consent of instructor.
2 hours, Fall term

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 consent of instructor.
Not offered in 1975-76

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 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

360R* Sacred and Profane in the Arts 1
A consideration of "the holy" and categories of sacred and profane in the arts. Thematic and methodological issues will be explored in the areas of painting, music, architecture, dance and cinema.
Prerequisite: Introductory RS course or consent of instructor.
3 lectures, Fall term

361R* Sacred and Profane in the Arts 2
A continuation of issues in 360R*.
Prerequisite: RS 360R* or consent of instructor.
3 lectures, Winter term

365* Religious Issues in Marxism
Not offered 1976-77.

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, Winter term

367R* Religion and Contemporary Literature 2
Not offered 1976-77.

373* Religion and Social Change in the Third World
Not offered 1976-77.

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

433J* The Problem of Authority in Contemporary Catholicism
Not offered 1976-77.

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.

490-499 Senior Seminars in Special Topics
Seminars are offered each year for senior honours R.S. students and senior students from other departments who have taken sufficient relevant survey and/or depth courses in R.S. or related disciplines. The instructors of and topics for the seminars are announced prior to the preregistration period. In all cases the instructor's permission is required.
Note
Every student in the Honour R.S. Programme is required to take at least one of these seminars.

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 programme.

100* Geological Foundations of the Environment
The materials of the earth: minerals and rocks. The Earth’s interior: heat and pressure. Volcanoes and earthquakes. The surface of the earth and how it changes. Mineral deposits. The history of the earth and life upon it. Application of geology to man’s use of environment. Field trips. 2 lect., per week, 2 h. lab. alternate weeks, Fall term. Not normally available to students in Regular Science programmes.

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 and Earth Science. A special course available to Math students who do not have a strong Science background. Not open to students registered in the Faculty of Science. No prerequisites. 3 lect., Fall term. A special division of this course may be offered to first yr. Eng. 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.
A special course available to students in the Mathematics Faculty who do not have a strong science background, especially at the Secondary School Year 5 level. Not open to students registered in the Faculty of Science. No prerequisites. 3 lectures, Winter term

120 The Physical Sciences
A survey of science specially designed for the needs of elementary school teachers. The lectures will provide a coherent background knowledge of astronomy, geology, physics and chemistry which will enable a teacher to answer questions presented by today’s enlightened students. Workshop and discussion sessions will stress communicating the ideas of science to students in all grades.
No specific prerequisites except an interest in teaching science. 3 lectures of discussion sessions per week for two terms (Fall and Winter), offered in the evening

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. Intended for first year Sci. students. Offered on a CR/NCR basis. No prereq., 3 lect. or discussion sessions per week, Fall term

200* Contemporary Science 1
An examination of some of the issues and development in contemporary science. The interaction between Science and society will also be discussed. Background knowledge in science not necessary. (Not for Science or Eng. students) No prereq., 3 lect. 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 lect. or discussion sessions per week, Fall, Winter

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. Prerequisite: Earth Sciences 130 or equivalent. Summer term only. 1.0 course credit

Science

Course Descriptions
Science
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.  
Prereq: at least one year of Secondary 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.)  
Prereq: at least one year of Secondary 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. (Not for Engr., Math. or Sci. students)  
No prereq., 3 lect., 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 prereq., 3 lect., Fall, Winter and Spring terms.  
A special division of this course may be offered in the Winter and/or Spring term primarily for Engr. students if sufficient demand exists.

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 Phys. 250* – The Solar System or Phys. 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.  
(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 water 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. (Students whose major field is Earth Sciences may not take this course for credit).

251* Human Genetics  
An examination of recent advances in human heredity including the genetic, cytological and biochemical aspects of individual inheritance. The principles of human population genetics will be discussed. The social implications of some of the modern discoveries will be stressed. (Students whose major field is Biology may not take this course for credit).  
No prereq., 2 lect. 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 prereq., 3 lect. 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 prereq., 2 lect. 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.  
Prereq: at least one year Secondary School Chemistry or Physics. 3 lect. per week, Winter term
312* Physics of Music  
A discussion of the nature of musical sounds. 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 lect., Fall term. Recommended for any student who understands logarithms and who is interested in both Music and Physics

313* Physics of Music  
Prereq: Sci. 312*, 3 lect., Winter term

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 Science may not take this course for credit). No prereq., 3 lect., 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*, 203*, 204* or 342. (Students whose major field is Biology may not take this course for credit).  
3 lect., Fall term

352* Human Biology 2  
Selected topics in human biology such as coordination 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*, 203*, 204*, or 342*. (Students who major field is Biology may not take this course for credit).  
3 lect., Winter term

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 world Grading system will be used and will range from Excellent to Un satisfactory. 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.

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. (Students whose major field is Biology may not take this course for credit).  
No prereq., 3 lectures, Winter term

462* Biology of Food Production  
A survey of world food production from the biologist’s viewpoint. Topics: Nutrition; food chains; origins of agriculture; basic plant and animal food crops; primitive and modern scientific agricultural practices and the environmental implications of each. (Students whose major field is Biology may not take this course for credit).  
No prereq., 3 lect., Fall term

400 The History of Science
Social Development Studies

Professor, Dean of Academic Programmes

Professor
J. O. Towler, B.A. (Toronto), M.Ed. (Alberta), Ph.D. (Alberta) R

Assistant Professors
R. Lahue, B.Sc. (Fordham), Ph.D. (Waterloo)
M. Smyth, B.A. (Toronto), M.A., Ph.D. (York)
M. Webber, B.A., M.S.W. (Dalhousie) R
M. Zentner, B.A. (Temple), M.S.W. (Kansas) R

Lecturer
C. Irizarry, B.A. (Wm. Smith College), M.S.W. (Columbia) (part-time) R

Associated Faculty

Assistant Professor, Religious studies
M. Bird, B.A., M.A., Ph.D. (Iowa)

Assistant Professor, Religious Studies
D. Bryant, B.A. (Concordia College), S.T.B. (Harvard), M.A. (Toronto) R

Assistant Professor, Geography
B. Hyma, B.Sc., M.Sc. (Madras), M.A. (Sheffield), Ph.D. (Pittsburgh)

Assistant Professor, History
W. Packull, B.A. (Guelph), M.A. (Waterloo), Ph.D. (Queen's) R

Associate Professor, English
H. Tuyn, M.A. (Utrecht & Oxon), Docteur de L'Universite de Paris R.

Social Development Studies Programme

The Social Development Studies Programme at Renison College currently offers an interdisciplinary curriculum leading either to an honours or a general B.A.

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 Development Studies 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.

The Honours Programme

The honours programme consists of 8 academic terms in a period of 4 years. Courses are normally offered in the Fall or Winter terms. Requirements for the programme are 21 full credits including Faculty of Arts Group A and B requirements with an overall cumulative average of at least C- and a cumulative average of B in core area courses taken at Renison. These 21 credits should include a minimum of 9 full credits within the core areas of the programme and a minimum of 4 full credits related to one of the multidisciplinary theme areas.

The General Programme

The General programme consists of 6 academic terms in a period of 3 years. Courses are normally offered in the Fall or Winter terms. 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;
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 must register in the fall term for the introductory courses (120 level) in sociology, psychology, social work and interdisciplinary social science. In the Winter term which follows it is recommended that the student completes follow-up courses (121 level) in at least 2 areas.
   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.
4) After meeting these minimum requirements, the student may elect his/her remaining courses from the general arts offering 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 Dean of Academic Programmes.

6) For further information consult the Registrar, Renison College, Waterloo, Ontario N2L 3G4.

Undergraduate Course Descriptions

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. Under 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.

Fall/Winter term. (Cross-listed with Arts 120G*/121G*)

ISS 220R* The History of Development of Modern Day Social Problems
A study and examination of the development of selected trends within modern society in both their historical and contemporary aspects.

Prerequisite: ISS 120R* or consent of instructor.
Fall term

ISS 221R* Community Issues
An examination of political, social, and ethical issues in selected social problems with particular emphasis on the Kitchener-Waterloo community. Consideration will be given to various strategies for maximizing social concern and response. Emphasis on social research as a vehicle for examination and analysis.

Prereq: Social research course or consent of instructor.
Winter term

ISS 250R*/251R* Social Research
Introduction to the philosophy and methods of applied social science, the problems and strategies of research design and analysis. Emphasis on collection, statistical analysis, and descriptive presentation of research data using a variety of qualitative and quantitative methods.

Prereq: 2nd year standing or consent of instructor.
Fall/Winter term

ISS 320R*/321R* 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 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.

Prerequisite: Courses in at least two of the social sciences or consent of instructor. Fall/Winter terms

Core Area Courses

<table>
<thead>
<tr>
<th>Interdisciplinary Social Science</th>
<th>Social Work</th>
<th>Sociology</th>
<th>Psychology</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS 120R*/121R*</td>
<td>SOC WK</td>
<td>SOC 120R*</td>
<td>PSYCH</td>
</tr>
<tr>
<td>120R*</td>
<td>120R*</td>
<td>120R*</td>
<td></td>
</tr>
<tr>
<td>SOC WK</td>
<td>121R*</td>
<td>121R*</td>
<td></td>
</tr>
<tr>
<td>ISS 220R*</td>
<td>SOC WK</td>
<td>SOC 220R*</td>
<td>PSYCH</td>
</tr>
<tr>
<td>220R*</td>
<td>220R*</td>
<td>221R*</td>
<td></td>
</tr>
<tr>
<td>ISS 221R*</td>
<td>SOC WK</td>
<td>SOC 221R*</td>
<td></td>
</tr>
<tr>
<td>221R*</td>
<td>221R*</td>
<td>221R*</td>
<td></td>
</tr>
<tr>
<td>ISS 250R*/251R*</td>
<td>SOC WK</td>
<td>SOC 250R*</td>
<td></td>
</tr>
<tr>
<td>250R*</td>
<td>250R*</td>
<td>250R*</td>
<td></td>
</tr>
<tr>
<td>ISS 320R*/321R*</td>
<td>SOC WK</td>
<td>SOC 320R*</td>
<td>PSYCH</td>
</tr>
<tr>
<td>320R*</td>
<td>320R*</td>
<td>320R*</td>
<td>PSYCH</td>
</tr>
<tr>
<td>ISS 350* (a-f)</td>
<td>SOC WK</td>
<td>SOC 350*</td>
<td>PSYCH</td>
</tr>
<tr>
<td>350* (a-f)</td>
<td>350* (a-f)</td>
<td>350* (a-f)</td>
<td>PSYCH</td>
</tr>
<tr>
<td>ISS 398R*/399R*</td>
<td>SOC WK</td>
<td>SOC 398R*</td>
<td>PSYCH</td>
</tr>
<tr>
<td>398R*</td>
<td>398R*</td>
<td>398R*</td>
<td>PSYCH</td>
</tr>
<tr>
<td>ISS 469R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISS 499R</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ISS 330R* Education as a Social Problem
An examination of the relationship between education and the place of the individual within society, and how educational institutions are reflective of social goals. A consideration of the significance of education within the social process for the study of selected issues in social work.
Prereq: 2nd year standing or consent of instructor. Fall term

ISS 341R* Males in Society
An interdisciplinary exploration of the psychological, sociological, cultural and biological influences upon the development of individuals in society with an emphasis on males. Discussion will include socialization and development, affiliation and emotional expressiveness, power, violence, fatherhood, work, sexuality and marriage.
Prereq: Introductory psychology recommended. Winter term

ISS 343R* Interdisciplinary Investigation of Human Sexuality
Focus on the sex research of Kinsey, Masters and Johnson, and areas of import for human sexuality theory and therapy. Current sexual myths and supporting literature will be explored. The clinician's role in changing individual and societal attitudes and sanctions regarding sexual behaviour will be examined.
Winter term

ISS 346R* Women's Problems in Contemporary Society
An examination of the evolution of women's problems in contemporary society emphasizing the implications for social welfare. Attention given to those women who are frequent recipients of social service: poor women, single mothers, welfare recipients, women prisoners, and to the role of women in the helping professions.
Prereq: Soc. Wk. 120R* or consent of instructor. Fall term

ISS 350* (a-f) Special Topics in Interdisciplinary Social Science
One or more half courses of an interdisciplinary nature will be offered from time to time as announced by the Social Development Studies 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 on 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 Development Studies Programme.

ISS 469R Senior Seminar Workshop
Social and human phenomena will be examined holistically. Students will be encouraged to synthesize knowledge learned in other social science courses in an intensive study of specific social issues and human concerns. The issues examined will vary from year to year reflecting social change, immediate community concerns, developments in the social sciences and the interests of students and instructors. Students will be required to engage in field projects, including community based learning experiences.
Prequisite: Open to senior honours students only. Year course

ISS 499R Senior Honours Essay
The essay will normally be related to the student’s chosen theme area. Although the work will be supervised by only one faculty member, the final product will be critically examined by faculty from all areas of the programme.
Prequisite: Open to senior honours students only. Year course
Psychology

Psych 120R*/121R* Introductory Psychology
Basic concepts and techniques of modern psychology as a behavioural science. 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.
*Fall/Winter terms

Psych 220R*/221R* Social Psychology
An examination of psychological principles involved in the interaction of the individual and society. Emphasis on social attraction, socialization of the child, language and social communication, interpersonal perception, attitude formation, social control, group dynamics, leadership, and aggression.
Prerequisite: An introductory psychology course.
*Fall/Winter terms

Psych 322R*/323R* Personality: Approaches to Individual Functioning
An examination of the major theories of personality, including consideration of the psychoanalytic, dispositional, humanistic and behaviouristic models. Attention is also given to the interaction approaches to individual functioning. Both normal and deviant behaviour patterns are considered.
Prerequisite: An introductory psychology course. (Psych 322R* is prerequisite for Psych 323R*).
*Fall/Winter terms

Psych 334*(R) Theories of Counselling Psychology
An introduction to the theories, methods and problems in Counselling Psychology.
Prerequisite: Introductory psychology course.
*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 Development Studies Programme. Subjects will be dependent upon special research and/or instructional interests of faculty.
*Fall/Winter terms

Psych 367R* Cross-Cultural Psychology
An examination of the findings in several areas of psychological interest in a diversity of cultural settings will provide students in psychology and other disciplines with an appreciation for the cultural relativity of psychological data and concepts.
Prerequisite: An introductory psychology course.
*Fall term

Psych 398R*/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 Development Studies Programme.

Sociology

Soc 120R*/121R* 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.
*Fall/Winter terms

Soc 220R* The Individual, Society and Religion
An application of sociological analysis to the study of religion. Development of an approach or methodological perspective which can be applied to the study of other social institutions.
Prereq: An introductory Sociology course.
*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.
Prerequisite: Introductory sociology course.
*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.
Prerequisite: Introductory sociology course or consent of instructor.
*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.
Prerequisite: Soc. 225R* or consent of instructor.
*Winter term

Soc 325R*/326R* Issues in Third World Development
The course will examine the impact of modernization on the value systems and social structures of selected South African societies. The course will in particular investigate the functioning of the new elite including some analysis of its new habitat, the city.
Prereq: Introductory sociology or consent of instructor.
*Fall/Winter terms

Soc 327R*/328R* Canadian Ethnic and Cultural Minorities
A detailed examination of various minorities in Canadian society. The course will stress the fundamental concepts and issues of race and ethnic relations and the application of these fundamentals to the various groups in Canadian mosaic.
Prerequisite: Introductory sociology.
*Fall/Winter terms
Course Descriptions
Social Development Studies

Social Work

Soc Wk 120R* Introduction to Social Work
An introduction to the methods, values and concepts of social work. A broad survey of methods of social work practice: casework, group work, community organization, family therapy, etc. An overview and development of social work settings; public assistance, mental health services, welfare services, etc.
Fall term

Soc Wk 121R* 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 220R* Social Casework 1
A presentation of some of the theoretical constructs necessary for the understanding of the individual in the casework relationship, as well as an introduction to some appropriate casework interventions. Emphasis in the course will be theoretical.
Prerequisite: Soc Wk 120R* or consent of instructor.
Fall term

Soc Wk 221R* Social Group Work and Family Therapy 1
Presentation of some of the theoretical constructs necessary for the understanding of the family and the group in the social work relationship, as well as an introduction to some appropriate social group work and family therapy interventions. Emphasis will be theoretical.
Prerequisite: Soc Wk 120R* or consent of instructor.
Fall term

Soc Wk 222R* Community Organization
An examination of social work practice as it relates to functional and geographical communities. The course will explore the theoretical foundations of organization practice as well as a variety of models.
Prerequisite: Soc Wk 120R* or consent of instructor.
Fall term

Soc Wk 320R* Social Casework 2
A methodological examination of some of the more complex intellectual components of the social work skills necessary to work with individuals in casework. Social work theories of the individual will be examined in order for the students to learn some clinical casework applications.
Prerequisite: Soc Wk 222R*, or consent of instructor.
Winter term
Course Descriptions
Social Development Studies

Soc Wk 321R* Social Work and Family Therapy 2
A methodological examination of some of the more complex intellectual components of some of the social work skills necessary to work with families and groups. Social work theories of the family and of the group will be concretized in order for the student to learn some clinical applications. 
Prerequisite: Soc Wk 221R*, or consent of instructor. 
Winter term

Soc Wk 322R* Community Organization 2
An examination of social change tactics as they have been operationalized by individuals and groups committed to the social work ethos. This course will concentrate on the Canadian scene and such diverse formations as social work unions, collective action by welfare recipients, political parties, etc.
Prerequisite: Soc Wk 222R*, or consent of instructor. 
Winter term

Soc Wk 326R* History of Social Welfare
The historical development of the religious, philosophical, technological and cultural bases of social welfare services from early civilization to the modern welfare state.
Prerequisite: Soc Wk 120R*, or consent of instructor. 
Winter term

Soc Wk 350* (a-f) Special Topics in Social Work
One or more half courses will be offered from time to time as announced by the Social Development Studies Programme. Subjects will be dependent upon special research and/or instructional interests of faculty.

Soc Wk 355R* Child Abuse: Identification and Treatment
The objectives of this course are to provide an understanding of the dimensions and causes of child abuse, to develop skills in identifying cases of this social problem and to explore current methods of management and treatment of persons involved in child abuse situations.
Winter term

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 Development Studies Programme.

Elective Courses
The following elective courses are administered by Kenoson College. For fuller descriptions, see appropriate departments.

Arts
220R* Chinese Thought and Culture 1
221R* Chinese Thought and Culture 2
250R Art and Society
320R-325R* Special Topics in Chinese Thought and Culture

English
109Z*(R) Basic Writing Skills
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
348R* The Films of Chaplin

Geography
125R* Introduction to the Development World
226R* 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
364R* The Enlightenment 1, Europe in Ferment
365R* The Enlightenment 2, Europe in the 18th Century

Philosophy
100R Introduction to Philosophy

Psychology
241*R Educational Psychology: The Psychology of Classroom Learning

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
332R* Fantasy
360R*/363R* Sacred and Profane in the Arts, 1 and 2
366R*/367R* Religion and Contemporary Literature, 1 and 2
460R*-463R* Special Topics in Religion and Culture
Department of Sociology and Anthropology

Sociology

Associate Professor, Chairman
K. Westhues, B.A. (Conception), M.A., Ph.D. (Vanderbilt)

Professors
G. L. DeGré, 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)
H. D. Kirk, B.S. (City College, N.Y.), M.A., Ph.D. (Cornell)
D. G. S. M'Timkulu, M.A. (S.Africa), M.A. (Yale), Ph.D. (Natal) R

Associate Professors
M. A. Beauchamp, B.A., M.A. (Buffalo)
J. Curtis, B.A. (Sir George Williams), M.A. (Central Michigan), M.A. (Cornell)
L. Driedger, M.A. (Chicago), Ph.D. (Michigan State), Visiting 1976
F. A. Fasick, B.A. (Penn. State), M.A., Ph.D. (Columbia)
A. A. Hunter, B. A. (U.B.C.), M.A., Ph.D. (Wisconsin)
L. A. Johnson, B.A. (Waterloo), M.A., M.Phil. (Toronto)
D. Kubat, M.A. (Kansas), Ph.D. (L. Maximillan, Munich)
R. D. Lambert, B.A., M.A. (McMaster), Ph.D. (Michigan)
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. (Cal., Berkeley)

Assistant Professors
L. Fischer, B.A. (Rutgers), M.A. (Northwestern), Ph.D. (Duke)
J. Goyder, B.A. (Bishop's), M.A., Ph.D. (McMaster)
A. Q. Lodhi, M.A. (Punjab), M.A., Ph.D. (Toronto)

Lecturer
B. Leathers, B.A., M.A. (Carleton)

Course Descriptions
Sociology and Anthropology

Associated Faculty

Professors
W. F. Forbes, Ph.D., D.Sc. (London), D.I.C., Statistics
M. Lerner, B.A., M.A. (Ohio State), Ph.D. (N.Y.U.), Psychology
D. Smucker, B.A. (Bluffton), B.D. (Princeton), M.A., Ph.D. (Chicago), Social Sciences, Conrad Grebel
P. J. Wooldridge, B.A. (Chicago), B.S., M.A. (Florida), Ph.D. (Yale), Nursing and Sociology, Rochester, Adjunct

Associate Professors
G. M. Anderson, B.A., M.A. (McMaster), Ph.D. (Toronto), Sociology and Anthropology, Wilfrid Laurier, Adjunct
M. Eichler, M.A., Ph.D. (Duke), Sociology in Education, O.I.S.E., Adjunct
B. McPherson, B.A., M.A. (Western Ontario), Ph.D. (Wisconsin), Kinesiology
J. Zuzanek, M.A. (Moscow State Univ.), C.Sc., Ph.D. (Charles Univ., Prague), Recreation

Assistant Professor
J. M. Alleyne, B.A. (Sir George Williams), Ph.D. (Johannes Gutenburg), Sociology and Anthropology, St. Jerome's

Undergraduate Course Descriptions

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 preprofessional 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.

216* 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.
Pre-requisite: Soc. 101* or Psych. 101*. 3 hours, Spring, Fall and Winter terms

Note 4
First year students who are interested in Sociology as a major are encouraged to take courses in other Social Science such as Anthropology 101*, 102*, Political Science 115*, and Psychology 101*.

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. 141*, 101(f)* or 101(m)*. 101(m)* is an introductory course intended as an elective for mathematics students or as a basis for a combined honours in Mathematics and sociology. 101(u)* is especially designed for Planning students. 2 hours lecture, Spring, Fall, Winter.

202* Sociological Statistics
A first course in sociological statistics; sampling, central tendency, probability, co-variance, as illustrated in specifically sociological data.
Pre-requisite: Soc. 101*, or equivalent other introductory social science course. 2 hours lecture, 2 hours lab, Fall and Winter terms

203* Introduction to Comparative Social Thought
Selected original sources, 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. Including the mythological world-view, ordered social cosmos, Eastern thought and social thought of Europe.
2 hours, Winter term

211* Social Structure and Character
In the context of comparative studies of slavery in the Americas this course examines the relationship between social institutions and types of human personality or "Social Identity".
Pre-requisite: Sociology 101*, 2 hours, Winter term

213* Sociology of Death and Dying
The course deals with the current literature on death and dying; also, with the sociological implications of institutional housing of the terminal patients. Patterns of mortality as affecting different social groups and as reflecting differential life changes of individuals in society are described. North American issues of death and dying are considered against a historical background.

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 men's and women's liberation movement is included.
Pre-requisite: Soc. 101*. 2 hours of lecture, Fall, Winter terms

216* An Introduction to the Sociology of Marriage and the Family
A survey of sociological perspectives on marriage and the family in urban-industrial societies. Special attention is given to marriage and the family in Canada. Comparisons with the U.S. and Britain will be undertaken.
Pre-requisite: Soc. 101*. 2 hours, Fall and Winter terms

218* Sociology of Adolescence
The social definitions of adolescence in cross-cultural and historic 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 adolescent's social roles to processes of social change and stability.
Pre-requisite: Soc. 101*. 2 lectures, Spring and Fall terms

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.
Pre-requisite: Soc. 101*. 2 lectures, Fall term
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Prerequisite</th>
<th>Credits</th>
<th>Term(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>241*</td>
<td>Social Movements</td>
<td>The sociological analysis of varieties of social movements and their relationships to social organization and social change.</td>
<td>Soc. 101*</td>
<td>2</td>
<td>Winter term</td>
</tr>
<tr>
<td>250*</td>
<td>Crime and Society</td>
<td>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.</td>
<td>Soc. 101*</td>
<td>2</td>
<td>Winter term</td>
</tr>
<tr>
<td>251*</td>
<td>Ethnic and Racial Relations</td>
<td>Relations between different racial and cultural groups; analysis of majority-minority group status with special reference to Canada.</td>
<td>Soc. 101*</td>
<td>2</td>
<td>Winter term</td>
</tr>
<tr>
<td>252*</td>
<td>Juvenile Delinquency</td>
<td>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.</td>
<td>Soc. 101*</td>
<td>3</td>
<td>Fall term</td>
</tr>
<tr>
<td>262*</td>
<td>Canadian Population</td>
<td>Study of the basic demographic processes in the population of Canada. Demographic implications for selected social institutions. Use of Canadian enumeration and registration data.</td>
<td></td>
<td>2</td>
<td>Fall term</td>
</tr>
<tr>
<td>270*</td>
<td>Communication</td>
<td>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.</td>
<td>Soc. 101*</td>
<td>2</td>
<td>Spring and Fall terms</td>
</tr>
<tr>
<td>280*</td>
<td>Social Organization of Animal Societies</td>
<td>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.</td>
<td>Soc. 101*</td>
<td>2</td>
<td>Fall term</td>
</tr>
<tr>
<td>290*</td>
<td>Introductory Sociological Theory</td>
<td>An examination of the object and function of sociological theory in social research. Types of sociological theories. Discussion of selective classics of sociological theory.</td>
<td>Soc. 101*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300*</td>
<td>Canadian Social Institutions</td>
<td>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.</td>
<td>Soc. 101*</td>
<td>2</td>
<td>Winter term</td>
</tr>
<tr>
<td>301*</td>
<td>Urban Sociology</td>
<td>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 cities of Western societies.</td>
<td>Soc. 101*</td>
<td>2</td>
<td>Winter term</td>
</tr>
<tr>
<td>302*</td>
<td>Crises in Social Structure and Character</td>
<td>This course proposes a frame of reference for the systematic study of human predicaments, ranging in scope from illness and dying to natural disasters and socially induced calamities like forced migration, total war, and genocide.</td>
<td>Sociology 101*</td>
<td>2</td>
<td>Fall term</td>
</tr>
<tr>
<td>303*</td>
<td>Crisis Management</td>
<td>Some crises of social structure, such as disease, death, and poverty, are so pervasive as to call forth universally equivalent mechanisms of coping. This course explores such institutionalized mechanisms as medical and welfare services in the context of Weber's types of authority and of rationality.</td>
<td>Soc. 303* or consent of the instructor.</td>
<td>2</td>
<td>Winter term</td>
</tr>
<tr>
<td>305*</td>
<td>Pariah Peoples: Gypsies and Jews</td>
<td>Not offered 1976-77.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>306*</td>
<td>Nazi Holocaust: The Destruction of Europe's Pariah People</td>
<td>Not offered 1976-77.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>310*</td>
<td>Seminar in Group Dynamics</td>
<td>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.</td>
<td>3rd or 4th year standing in a social science or by permission.</td>
<td>2</td>
<td>Fall term</td>
</tr>
</tbody>
</table>
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.

316* Family Structures in Comparative Perspective
Family structures in a number of different societies will be compared. The impact of specific structures on individual family members and the relationships between the structures and other social institutions will be analyzed. Change occurring in the predominant family structure in North America will be considered.
Prerequisite: Soc. 101*. 2 lectures, Winter term.

321* Research Methods 1
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.
Prerequisite: Soc. 101* or equivalent. 2 lectures, 1 h. lab., Fall and Winter 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.
Prerequisite: Soc. 101*. 2 hours seminar, Winter term.

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).
*(offered in Spring 1976 in Haiti by Conrad Grebel; for information, contact the College).

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.
Prerequisite: Soc. 101*. 2 lectures, Winter term.

333* The Sociology of Regional Planning
This course explores the social manifestations of marginality - with marginality begin interpreted as due to race, ethnicity, poverty or geographical remoteness from metropolitan centres. Geographically, it deals with the "underdeveloped" areas of Canada, Atlantic provinces, Sub-Arctic and Arctic. Other areas of Canada will be touched on, but will not receive major attention.
Fall term.

335* Sociology of Science
Not offered 1976-77.

338* Sociology of Literature
Not offered 1976-77.

339* Industrial Sociology
Sociological analysis of industry, including relationships between labour and management and industry and society.
Prerequisite: Soc. 101*.

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.
Prerequisite: Soc. 101*.

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.

342* Social Structure of the Canadian Labour Force
Not offered 1976-77.

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.
Prerequisite: Soc. 101*. 2 lectures, Fall term.
Course Descriptions
Sociology and Anthropology

360* Political Sociology
Not offered 1976-77.

361* Conflict Simulation Workshop
Comparative studies in social and political conflict: war, colonialism, insurgency, class struggles etc., utilizing conflict simulation games for testing basic concepts. Readings in sociology of conflict, as well as case studies in the application of game concepts will supplement the practicum.
Prerequisite: Soc. 101*. 2 hours, Fall term

361* Political Sociology
Not offered 1976-77.

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*). Prerequisite: Some previous work in a Social Science or in Philosophy. 3 hours

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.
Prerequisite: Soc. 101*

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 are analysed. Special emphasis will be given to the problem of leisure time in the later years of life.
(Same as Kinesiology 352*). Prereq: Soc. 101* and one other Soc. course. 3 lectures, Fall term (offered every other year i.e., 1976, 1978, 1980)

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*). Prereq: Soc. 101* and one other Soc. 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 organization 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
Not offered 1976-77.

398* Seminar in Nationalism and Ideology in Canada and Québec
A research oriented seminar dealing with varieties of nationalism, national identity, separatism, independence and political/economic ideology and values in Canada and Québec.
Prerequisite: Registration in 3rd or 4th year of an honours programme. 3 hours seminar, Winter term

399* Research Seminar in Canadian Society
Not offered 1976-77.

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

410* Seminar: Self and Social Interaction
Not offered 1976-77.

415* Seminar: The Impact of Sex Factors on Sociological Theory and Research
Not offered 1976-77.

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. 2 hours, Fall term

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
Not offered 1976-77.
451* Seminar: Problems in Contemporary Theory and Research
Not offered 1976-77.

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

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. Fall 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

The following courses are administered by Conrad Grebel College

207G* Sociology of Education
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, adaptation 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 international 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. It emphasizes the changing roles of the learners and instructors and social dimensions of newer learning theories and programmes. 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
Special attention will be paid to the growing public awareness of the failure of law to provide justice or social control in a growing number of situations. Local judges, lawyers and police officials are invited to discuss such issues as the jury system, police and violence, civil rights and mass media.
Prerequisite: Third year standing in a social science course or by permission. 3 hours, Fall term

377G* Seminar: Studies in Sociology of the Mennonites
This seminar will devote attention to research methods, sociological theory and interdisciplinary approaches to the study of Mennonite communities and culture.
Prerequisite: Permission of the instructor
The following courses are administered by Renison College

Soc 120R*/121R* Fundamentals of Sociology
See page 384 for descriptions of these courses.

Soc 220R* The Individual Society and Religion

Soc 221R* Master Trends in Modern Society

Soc 225R* Race and Culture in the Third World 1

Soc 226R* Race and Culture in the Third World 2

Soc 325R*/326R* Issues in Third World Development

Soc 327R*/328R* Canadian Ethnic and Cultural Minorities

Soc 367R*/369R* Special Topics in Sociology

Soc 398R*-399R* Independent Study

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.
Prerequisite: Sociology 101* or permission of the instructor. 3 hours, lectures and tutorial
Anthropology

Associate Professor
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)
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
C. E. De'ath, B.A. (Auckland), ASOPA Cert. (Sydney), M.Ed., Ph.D. (Pittsburgh)
S. Gabow, B.A. (California – Berkeley), Ph.D. (Toronto)
J. Rogers, B.A. (Radcliffe), M.A. (New Mexico), Ph.D. (Toronto)
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 Course Descriptions

Note
Many of the listed courses are given irregularly. Students should consult the course offerings list issued at preregistration.

101* Human and Cultural Evolution
An overview of 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.

102* Introduction to Social and Cultural Anthropology
The dynamic nature of socio-cultural systems is examined. Topics include language, technology, social organization, economics, politics, and religion. Data are drawn from a broad ethnographic base, including both "primitive" cultures and modern developed societies.

103* The Nature of Language
A general introduction to the scientific study of language. Lectures on the nature of human language as compared with animal communication, some of the basic methods of historical and descriptive linguistics, and the importance of language in culture and society.

202* Principles of Social Organization
An introduction to basic concepts used by social anthropologists for the analysis of social, economic, political and ideational systems.
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.

212* Western Technology and Culture Change
Not offered 1976-77.

214* Conflict, Feud, and Warfare
The manner in which varying degrees of violence are used in the settlement of dispute is explored. Discussed are the rules which control violent behaviour, the effects of violence on the societies and populations involved, and the adaptive (or maladaptive) aspects of such phenomena as feud and warfare. Data are drawn from a broad spectrum of societies.
Prerequisite: 102* or permission of the instructor.
Course Descriptions
Sociology and Anthropology

218* A Survey of Great Lakes Archaeology – Paleo Indian and Archaic
A general survey of the archaeological remains of the earliest known cultures in the Great Lakes area (mostly prior to 1000 B.C.).
Prerequisites: 101* or permission of the instructor.
Not acceptable for Honours Anthropology 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.
Not acceptable for Honours Anthropology credit

221* Old World Prehistory. The Food Producing Phases
Not offered 1976-77.

224* A Survey of Southwestern Archaeology
Not offered 1976-77.

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.
Not acceptable for Honours Anthropology credit

227* Peoples of Africa
A survey of the cultures and societies of the 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.
Prerequisites: 102 or permission of the instructor

229* Cultures of West Africa
Not offered 1976-77.

231* North American Indian Hunting and Gathering Societies
The society and culture of North American Indian hunters and gatherers (excluding big game hunters dependant upon the horse) is surveyed. The course concentrates on the adaptation exhibited by these peoples at the time they were first contacted by Europeans.
Prerequisite: 102* or permission of the instructor

232* North American Indian Pastoral and Horticultural Societies
Pastoral (big game hunting dependant upon the horse) and horticultural (farming) societies north of the high civilizations of Mexico are described as they existed when initially contacted by Europeans.
Prerequisite: 231* or permission of the instructor

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.
Prerequisite: 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.
Prerequisite: Sociology 101* or Anthropology 101*, 102*

237* Circumpolar Peoples
Not offered 1976-77.

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.
Prereq: Anthro. 102* or permission of instructor

240* Canadian Indian-White Relations 1830-1950
Not offered 1976-77.

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.
Prereq: Anthro. 240* or permission of instructor

247* Urban Anthropology
Not offered 1976-77.

248* Peasant Society
Not offered 1976-77.

249* Band and Tribal Societies
An analytical survey of egalitarian societies, including hunting and foraging bands and agricultural pastoral chiefdoms and tribes. Topics include typology of bands, tribes, and chiefdoms; environmental adaptations; social structures; economics; and religion; and are illustrated by selected societies from Africa, the Americas, and Asia.
Prerequisite: 102* or permission of the instructor.
258* Anthropology and the Future of Man
Various anthropological theories pertaining to culture change and cultural evolution are examined in the context of the modern world. Long and short term trends in technology and other aspects of culture are examined in the light of the above ideas. Data from Archaeology, Ethnography, History, modern Science, and Technology will be utilized.
Prerequisites: 101* and 102* or permission of the instructor

261* Primate Behaviour
Not offered 1976-77.

262* Introduction to Primatology
Not offered 1976-77.

263* Evolution of Human Behaviour
Changes in behaviour and social organization during the course of human evolution will be discussed. Topics will include the evolution of human sexual behaviour, altruism, and communication systems.
Prerequisite: 260* or 261* or permission.

275* Principles of Archaeology
An introduction to the working assumptions, analytic approaches, and integrative and descriptive methods of archaeological anthropology.
Recommended to Honours Anthropology students.

283* Phonology for Non-Linguists
Not offered 1976-77.

285* Descriptive Grammar 1 – Morphology
A survey of word formation in different languages. Linguistic approaches to the analysis and description of words, with examples and class problems based upon a number of actual languages. Consideration will be given not only to languages with a relatively simple morphology, such as Chinese and English, but also to languages like Turkish and Ojibwa.

286* Descriptive Grammar 2 – Syntax
How composite utterances are formed in various languages. The syntactic mechanisms used in different languages will be examined in relation to the transformationalist theory that all languages work along basically similar lines. Examples from Eskimo, Latin, Swahili, Ojibwa, English, and Japanese will be examined in some detail.
Prerequisite: 285*

310* Indians of the Canadian Subarctic
An analysis of the adaptations of the Northern Athapaskans and Algonkians from time of earliest European contact to the present. Emphasis will be on social and cultural change resulting from the several phases of the fur trade. Consideration will also be given to current adaptations and problems.
Prerequisite: 102* or permission of the instructor

318* Great Lakes Archaeology – Paleo Indian and Archaic
This course deals in depth with the archaeological evidence for the earliest known cultures in the Great Lakes area (mostly prior to 1000 B.C.).
Prerequisite: Permission of the 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.
Primarily for Honours Anthropology students.
Prereq: Anthro. 20/* or permission of instructor

321* Recent Prehistory in the Old World
Not offered 1976-77.

324* Southwestern Archaeology
Not offered 1976-77.

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.
Permission of instructor. Primarily for Honours Anthropology students.

330* Cultural Ecology
An examination of the relationships among environment, technology, society, and culture. The increasing levels of complexity will be considered in the context of hunting and foraging bands, horticultural tribes and chiefdoms, pastoral tribes, and agricultural peasantry.
Prereq: 101* and 102* or consent of instructor

333* Community Studies and Planned Change
The nature of planned programs and their implications for the communities involved are examined through ethnological studies of small communities in Canada and abroad. Reasons for the success or failure of programs of change are sought in relation to community structure.
335* Anthropology and Education
A seminar on certain theories of socialization, acculturation, and enculturation. These theories will be related to what in the west is usually categorized as “education”. There will also be some emphasis on understanding how field work should be done in educational settings. Students should be prepared to do some field work themselves.
Prerequisite: 102* or permission of the instructor.
Cross listed as Mun Env. 335 also.

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.
3 hours lecture. Prereq: Anthro. 101*, 102* or consent of instructor.

345*, 346*, 347*, 349* Special Problems in Anthropology
Lecture or seminar in special problems in anthropology. Topics may include problems in archaeology, physical anthropology, linguistics, social/cultural anthropology and will vary by term and 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.
Prerequisite: Consent of 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.
Prereq: Anthro. 101*, 102* or consent of instructor.

356* Comparative Economic Organization
A discussion of the alternative means of organizing economic activity, focused primarily on non-market societies.
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.
Prerequisites: 102 or permission of instructor

365* Fossil Man
A detailed examination of the fossil evidence for human evolution with particular emphasis on interpretation and reconstruction.
Prerequisite: 260* 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.
Prerequisites: 102* or permission of the instructor

371* Archaeological Field Methods
Not offered 1976-77.
Lecture plus excavation and laboratory experience. Offered irregularly in Spring and Summer sessions.
Prerequisite: Permission of the instructor

372* Archaeological Techniques
Various archaeological techniques will be discussed and demonstrated. Major emphasis will be on working with artifacts in the lab. The relationship to other disciplines such as Pleistocene Geology, Palynology, Paleontology, and Soils Analysis to archaeology will also be dealt with.
Prerequisite: Permission of the instructor. Primarily for Honours Anthropology students

373* Archaeological Reporting
Various ways of processing archaeological data will be demonstrated and discussed. The major emphasis will be on writing up archaeological reports.
Prerequisite: 372* or permission of the instructor.

375* Genetics and Variability in Human Populations
The study of variation and its causes in contemporary human populations. The questions of race and various adaptations of modern human populations will be considered.
Prerequisite: 260* or permission of the instructor

376* Human Population Genetics
An introduction to the theory of population genetics as it applies to modern man. Techniques for measurement of selection pressures, inbreeding, genetic drift, and mutation rates will be considered.
Prerequisite: 375* or permission of the instructor.
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.
3 hours lecture. Prerequisite: At least one previous half-course in linguistic 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.
3 hours lecture. Prerequisites: Anthropology 283* or 285*

388* Applied Anthropology
The technical and ethical aspects of directed culture change will be examined.
3 hours lecture. Prereq: 102* or permission of instructor

390, 391*, 392, 393*, 395*, 397* Reading in Anthropology
Guided reading in a selected portion of the anthropological literature.
Prereq: Anthro. major and permission of instructor

401*/402* 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, nativist reactions, general and specific evolution.
Seminar. Prereq: Anthro. 102* or permission of 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.
3 hours lecture. Prerequisites: Anthropology 101*, 102*

452* Contemporary Cultural Theory
Not offered 1976-77.
Department of Systems Design

Professor, Chairman

Professor, Associate Dean, Undergraduate Studies
G. N. Soulis, B.A.Sc. (Toronto), P.Eng.

Professor, Associate Chairman
K. Huseyin, M.Sc. (Istanbul), Ph.D. (London)

Professors

Associate Professors
M. L. Constant, B.A.Sc. (Toronto)
P. H. Meincke, B.Sc. (Manitoba), P.Eng.
G. F. Radibeau, B.A. (Wisconsin), M.A. (Wisconsin), Ph.D. (Purdue)
P. L. Secley, B.A.Sc. (Toronto)
B. L. Wills, B.A.Sc., M.A.Sc., Ph.D. (Waterloo), P.Eng.
D. A. Winter¹, B.Sc., M.Sc. (Queen’s), Ph.D. (Dalhousie), P.Eng.

Assistant Professors
C. K. G. Hahn, M.A.Sc. (Waterloo)
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
K. W. Hipel, B.A.Sc., M.A.Sc., Ph.D. (Waterloo)
Y. S. Ho, B.Sc. (Taiwan), M.Sc. (Toronto), Ph.D. (Waterloo)
G. J. Savage, B.A.Sc., M.A.Sc. (Waterloo)

Visiting Associate Professor

Faculty members holding across appointments as shown

¹ Kinesiology and Systems Design

Undergraduate Course Descriptions

101 Tutorial 102 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.

Non-credit courses

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: container handling, air traffic control, telephone systems, etc.

162 Engineering Design Methodology
The principles of engineering design culminating in a project. Specific topics introduced are: The systems approach, principles of planning, 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, etc.

211 Applicable Mathematics for Systems Design 1
(Also listed as Mathematics 61)

212 Applicable Mathematics for Systems Design 2
(Also listed as Mathematics 62)

213 Theory and Applications of Statistics
(formerly SD 211)

221 Numerical Analysis and Computation
(formerly SD 222)
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

262 Systems Design Workshop 2
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. Both the problems and the student's work are expected to increase in sophistication through the course.

281 Mechanics of Deformable Solids (formerly SD 282)
Statics and resistance of materials, Equilibrium of particles, rigid bodies and deformable bodies. Vector fields, Bay streams. Stress-strain relationships. Elastic and inelastic behaviour of prismatic members subjected to axial, shearing, torsional and flexural deformations.
282 Thermodynamics (formerly SD 384)
An introductory course in engineering Thermodynamics structured for students in Systems Design. Classical Thermodynamics is presented as the systematic study of energy: its use, degradation, and waste. Applications focus on problems of energy and environment. The concepts of statistical thermodynamics are introduced briefly and their connection with information theory are described.

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 Lab 2
A continuation of 192 for second year students. The first part of the course will cover the general concept of transducers and specifically the use of some sensors used in the human systems experimental environment. The second part will emphasize the conduct of experiments using human subjects.
1 hr. seminar, 2 hrs. lab per week

292 Systems Design Lab 3
A continuation of 291 for second year students. The first part will cover signal-conditioning, noise and recording techniques and physical systems sensors. The second part will cover digital logic with the emphasis on the use and characteristics of integrated circuits and the design of sub-systems using digital components.
1 hr. seminar, 2 hrs. lab per week

301 Tutorial 302 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.
Non-credit courses

311 Systems Operations 1
"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.

322 Computer Simulation of Systems
System modelling, system simulation techniques, digital computer methods, fundamentals of analog computation, digital simulation of analog computers; block-oriented languages; introduction to system simulation using hybrid computers.

324 Principles of Digital Computers
Boolean algebra, number systems and data representation; flip flop and registers; computer operation, control unit, instruction sequencing, arithmetic unit; storage organization; operating systems, compilers, assemblers, multiprogramming, multiprocessing and time-sharing.

325 Mathematical Programming (formerly SD 513)
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.

333 Experimental Design
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.

341 Ergonomics of Special Environments (formerly SD 541)
Neuroendocrine system and the human response to stress (Adaptation); sustained acceleration, weightlessness and restrictive confinement; hypobarism, hypoxia, and high altitude: hyperbarism and underwater environments; impact acceleration and automotive safety; toxic atmospheric contamination.

351 Physical Systems 2
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 Systems Analysis
(formerly SD 354)
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 computers. 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

364 Manufacturing Science

366 Aesthetic and Perceptual Aspects (formerly SD 563)
Presentation and discussion of appropriate and possible methods for the design of systems of artifacts in which aesthetic characteristics and visual form are primary requirements of the design.

381 Material Engineering
A general introduction to the science of materials; 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 everyday use.

382 Applied Electronics
Component models of various electronic devices, oscillation, amplification, modulation, detection, application to instrumentation.

390 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.

392 Systems Design Lab 4
This course serves as a focus for the complete lab programme sequence. The emphasis is on the design of major experiments which are themselves complete systems requiring the application of previously acquired knowledge in the areas of sensing, synthesis, control, measurement and evaluation. At least one experiment will be drawn from the digital control of computer control environment and one from the analog control environment. 2 hrs. lab per week.

401 Tutorial 402 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 SD 312)
A continuation of SD311, with emphasis on Stochastic Operations Research Models. Topics will include; Decision making under uncertainty, queuing models and related probabilistic techniques, feedback control, probabilistic inventory, competitive strategies and related topics.

412 Topics in Operations Research (formerly SD 411)
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
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
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 SD 331)
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 SD 242)
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, biological variation. Introductory concepts in molecular biology and genetics; the cell as a micro-system; the role of water transport; man as a complex system.
443 Human Engineering and Relational Design
(formerly SD 342)
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 SD 453)
Application of systems theory to large power distribution
networks and electromechanical energy conversion
systems.

461 Systems Design Workshop 5

462 Systems Design Workshop 6
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.

463 Structures and Design
Structural forms. Structural requirements. Statically
determinate and indeterminate structures. Basic theorems
of linear elastic structures. Methods of analysis:
Slope-deflection, moment distribution, etc. Application of
Graph Theory to the analysis of structural systems.
Principles of Design.

464 Theory and Application of Photographic Methods to
Measurement and Design
Photo-instrumentation; 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.

472 Man-Machine Communications (formerly SD 475)
The nature and design of machine-mediated human
communication systems. Displays, computer graphics,
computer-aided instruction and mass communication
media (Film, T.V., radio, print). A system approach will be
adopted with special attention to the socio-economic
effects of such systems.

511 Linear Graph Theory
Fundamental definitions, properties of circuits, paths a
graph, and Euler graphs. Properties of cutsets. Matrix
representation of linear graphs and trees. Planar graphs
and their duals. Nonplanar graphs, pseudo cuts and duals.
Oriented graphs.

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.

534 Planning of Facilities
Industrial and Non-Industrial facilities. Networks,
locational analysis, physical layout and spatial analysis,
allocation of facilities, criteria for optimality, utilization
and occupation, various operations research techniques
for the analysis and synthesis of networks of facilities,
n-job, m-machine problem.

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.

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,
ilumination, 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.
School of Urban and Regional Planning

Professor, Director

Associate Professor, Associate Director, Graduate Officer
L. R. G. Martin, B.A. (Queen's), M.A., M.R.P., Ph.D. (Syracuse), M.C.I.P.

Professor, Undergraduate Officer
R. S. Dorney, B.Sc., M.Sc., Ph.D. (Wisconsin), M.C.I.P.

Professional Liaison Officer, Adjunct Lecturer
H. T. Lemon, M.C.I.P.

Professors
L. O. Gerlter, B.A. (Queen's), M.A. (Toronto), M.C.I.P., (Sabbatical 1976-77)

Associate Professors
J. T. Horton, B.A. (Wheaton), M.A. (North Western)
E. McBean, B.Sc. (U.B.C.), S.M., C.E., Ph.D. (M.I.T.)
G. G. Mulamoottil, B.Sc. (Mysore), M.Sc. (Bombay), Ph.D. (Delhi)

Adjunct Professors
W. R. Code, B.A. Hons. (Queen's), Ph.D. (California, Berkley)
A. de Vos, M.Sc., Ph.D. (Wisconsin)
M. K. Foster, B.A., M.A. (Toronto), M.Phil., Ph.D. (Columbia)
M. R. Mathews, B.A., M.Sc. (Toronto), M.C.I.P.
D. H. Wood, B.Com., LL.B. (Toronto)

Adjunct Lecturers
G. Davidson, B.A. (Toronto), M.A., (Waterloo), M.C.I.P.
C. C. Kibbe, B.E.S. (Waterloo), Planning Graphics
D. Peltz, B.A. Hons. (Waterloo)

Faculty members holding joint and/or cross appointments
1Planning, Geography and Biology
2Geography and Planning
3Planning and Man-Environment Studies
4Anthropology and Planning
5Planning, Man-Environment Studies and Biology
6Sociology and Planning
7Civil Engineering and Planning

Undergraduate 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. 3 hours lectures, 1 hour discussion, Year

ES 111* Introduction to the Study of the Future
See Environmental Studies course description, page 261.
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). 2 hrs. lect. and 1 hr. disc., Fall and Winter terms

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 or consent of instructor. 2 hours studio, Fall and Winter terms. Estimated cost to student: $30

ES 195* Introduction to Environmental Problems
See Environmental Studies course descriptions, page 261.

ES 200* Field Ecology
See Environmental Studies course descriptions, page 261.

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.
Prerequisite: None. 2 hours lectures, 1 hour discussion. Winter term

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 relationships will be examined and related to planning.
Prerequisite: Sociology 101, or consent of instructor. 3 hours lectures, Winter term

ES 252* Media Tools for Environmental Studies
See Environmental Studies course descriptions, page 261.

ES 253* Media Tools for Environmental Studies – Advanced Level
See Environmental Studies course descriptions, page 261.

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. 2 hours lectures, 2 hours workshop, Winter term

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: 2nd year Planning, or Environmental Studies students with consent of instructor. 2 hours lectures, 2 hours studio, Year

258* Readings and Research in Planning
Special readings and research on planning topics chosen in consultation with an 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. Prior to registering for this course students must arrange with a faculty member to serve as advisor. 3 hours seminar and/or tutorial, Fall or Winter terms

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 Year 5 Maths, take Math 85.
Prereq: Students in Environmental Studies. 2 hours lectures, 1 hour lab, Fall and Winter terms

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. 3 hours, Winter term
300 Seminar/Workshop Project in Urban and Regional Planning
An integrated approach to the comprehensive analysis and design of communities; identification and synthesis of factors relating to function; structure, environmental context, regional framework, etc., in the preparation of comprehensive development programmes. A major project undertaken in small project groups.
Prerequisite: 3rd Year Planning students only. 3 hours workshop, Year

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: Planning students or consent of instructor. 3 hours, studio/workshop, Fall and Winter terms

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. 2 hours lectures, 1 hour practical or discussion, term to be arranged.

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. 3 hours seminar and/or tutorial, Fall term

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. 2 hours lectures, 1 hour practical, Winter term

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. 3 hours lectures, Winter term

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 instructor's consent. 3 hours seminar and/or tutorial, Fall term

330* 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: Sociology 101*, or consent of instructor. 3 hours lectures, Winter term

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. 3 hours lectures, Full term

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 natural resources in Canada and abroad.
Prerequisite: Sociology 101*, or consent of instructor. 3 hours lectures, Winter term

342* Urban and Regional Planning: (Part 1)
Urban planning as a method of obtaining command over the major tools for problem identification, analysis and resolution. Planning types and practice; process and achievements, determinants of physical urban structure and supporting systems, case studies and examples. Emphasis on urban development and responses to dilemmas of the built environment.
Prerequisite: None. (Not available for credit to Planning students). 3 hours lectures, Fall term

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). 3 hours lectures, Winter term
Course Descriptions
Urban and Regional Planning

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. 3 hours lectures, Fall and Winter terms. (Winter-term – Planning students only)

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. 3 hours lectures, Winter term

ES 358* Environmental Pollution and its Control
See Environmental Studies course descriptions, page 262.

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 policies in other nations.
Prerequisite: One of Planning 100, 156*, 343*, or consent of instructor. 2 hours lectures, 2 hours workshop, Winter term

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. 3 hours lectures, terms to be arranged

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. 3 hours lectures, terms to be arranged

ES 380*/381* Environmental Studies Workshop
See Environmental Studies course descriptions, page 262.

391* Field Research Methods and Projects
Selected field trip experiences directly related to the theme content of Planning 300, including assignments, follow-up discussion, and presentation of research papers. The School covers the cost of travel 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

ES 400 Environmental Law
See Environmental Studies course descriptions, page 262.

ES 411* Alternative Future Environments 1
See Environmental Studies course descriptions, page 262.

ES 412* Alternative Future Environments 2
See Environmental Studies course descriptions, page 262.

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. 3 hours lecture, Fall term

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.
Prerequisite: Planning 330* or consent of instructor. 3 hours lectures, term to be arranged

449 Canadian Urban and Regional Planning: (Part 1)
An overview of the evaluation of Canadian urban and regional planning covering the Canadian Planner's heritage, colonial planning, growth stages of post colonial planning, planning principles with an indepth examination of comprehensive planning and zoning, and the scope of planning education especially in our School.
Prerequisite: Consent of School

450 Canadian Urban and Regional Planning: (Part 2)
A review of Canadian urban literature focusing on major themes. The literature will be examined through subject areas such as housing, land policy, redevelopment and urban politics.
Prerequisite: Consent of School.
Course Descriptions
Urban and Regional Planning

470* Concepts and Ideas in Contemporary Urban Planning
An overview of the modern movements and philosophical roots underlying urban planning and civic design. Philosophies and contributions of those who have significantly influenced modern historical thought. Development of planning trends and ideas in North America and abroad emphasizing relevance to contemporary concerns.
Prerequisite: 3rd or 4th year Planning students, or consent of instructor. 2 one hour lectures/seminars, Winter term

475* Projects, Problems and Readings in Planning
Special planning projects and problems chosen in consultation with instructor.
Prerequisite: Consent of instructor. A student must arrange with a faculty member to serve as advisor prior to registering for this course. 3 hour seminar and/or tutorial, Fall and Winter term

476 Projects, Problems and Readings in Planning
Special planning projects and problems, chosen in consultation with instructor.
Prerequisite: Consent of instructor. A student must arrange with a faculty member to serve as advisor prior to registering for this course. 3 hours seminar and/or tutorial, Year

480 The Philosophy and Methodology of Urban and Regional Planning
A seminar course on some current and changing social philosophies, the image of man, the notions of ethics, morality, authority, equity, etc., and the related perceptions and perspectives and conceptions of social and environmental realities and their relevance to planning, its human information base, processes and procedures.
Prerequisite: 4th year Planning students only. 3 hours seminar/workshop, Year

490 Senior Honours Essay
Practical experience in the identification of a problem in the planning field. Conduct of individual research into this problem and presentation of the results of this research in a form that meets both professional and academic standards. As further elaborated in a policy statement available from the undergraduate officer.
(2 course credits). Prerequisite: 4th year Planning students only
Women's Studies

Women's Studies started at the University of Waterloo in 1971, when the first course on women was taught. Since that time this subject has developed so rapidly that by now the University has eleven undergraduate and several graduate courses on women and sex roles on its books. To the best of our knowledge, this constitutes the strongest combination of offerings on women or sex roles at any University in Ontario and probably in Canada.

All courses that are offered, both at the undergraduate and graduate level, are regular credit courses, counting like any other course toward the fulfillment of requirements for majors and honours in their respective disciplines. Courses on women or sex roles are offered in the Departments of Anthropology, English, History, Human Relations, Philosophy, Political Science, Psychology, Sociology and Social Work. The Arts Library has a special collection on women which has been constantly expanded and which presently comprises more than 10,000 items on women. This makes it probably the largest collection on women in Canada. The Canadian Newsletter of Research on Women was started at this University. It appears three times a year and abstracts recent research on women in Canada and abroad.

Library, Newsletter, a relatively large number of courses and people who are actively concerned with research and teaching on women make women's studies an important and well developed topic at the University.

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

English 108E*
- Women in Literature

English 208E*
- Women Writers of the Twentieth Century

History 203H*
- The individual and the Family in History

Political Science 116*
- Political Participation: The Case of Canadian Women

Political Science 294*
- Women and Politics

Psychology 365*
- The Behavioural Development of Women

Sociology 215*
- Sociology of Sex Roles

Sociology 415*
- Seminar on the Impact of Sex Factors on Sociological Theory and Research

Social Work 369R*
- Women and Social Work
Governing Bodies and Staff

Convocation
The Board of Governors

Officers
Chairman – W. M. Rankin
Vice-Chairman – To be appointed
Secretary – The University Secretary

Ex Officio
The Chancellor – C. A. Pollock
The President – B. C. Matthews
The Mayor of the City of Kitchener – E. I. MacIntosh
The Mayor of the City of Waterloo – H. Epp
The Regional Chairman – J. Young

From the Community At Large
E. F. Attridge, Toronto
J. Bergsma, St. Catharines
G. Chapman, Kitchener
J. C. Davidson, Toronto
D. W. Maguire, Sault Ste. Marie
G. A. Mitchell, Kitchener
W. M. Rankin, Toronto
K. A. Reichert, Milton
A. P. Schendel, Waterloo
Vacancy

Appointed by the Lieutenant-Governor in Council
E. Dreger, Breslau
R. A. Edwards, Q.C., Cambridge
P. J. Ivey, London
D. N. Morris, Cambridge
G. Pattinson, Bramford
J. P. R. Wadsworth, Toronto
C. N. Weber, Kitchener

Elected by the University Staff
C. H. Groom
A. E. Lappin

Appointed by the University Senate – Faculty
T. A. Brzustowski
G. E. Cross
K. R. Davis
D. E. Irish
R. M. Irving
D. S. Scott
C. L. Siegfried

Appointed by the University Senate – Undergraduate Students
A. P. Palma
D. B. Pattison
K. H. Reynolds

Graduate Students
E. A. Hall
R. H. Irving

Senate

Officers
Chairman – The President
Vice-Chairman – The Academic Vice-President
Secretary – The University Secretary

Ex Officio
The Chancellor – C. A. Pollock, B.A.Sc., B.S.
The Chairman, Board of Governors – W. M. Rankin
The Vice-Chairman, Board of Governors – TBA
The President – B. C. Matthews, B.S.A., A.M., Ph.D.
The Vice-President, Academic – T. A. Brzustowski, B.A.Sc., A.M., Ph.D.
The Vice-President, Finance & Operations –
A. B. Gellatly, B.A., C.G.A.
The Librarian – M. C. Shepherd, B.Ed., M.A.
The Registrar – C. T. Boyes, B.A.
The President, Federation of Students – J. Shortall

The Principal of each Federated or Affiliated College
C. L. Siegfried, C.R., B.A., M.Sc., LL.D. (President, St. Jerome's College)
J. O. Towler, B.A., M.Ed., Ph.D. (Principal, Renison College)
A. M. McLachlin, M.A., B.D., Th.D. (Principal, St. Paul's United College)

The Dean of each Faculty or School of the University
J. S. Minas, B.A., Ph.D. (Dean of Arts)
A. McLachlin, B.Eng., M.S., Ph.D. (Dean of Engineering)
J. G. Nelson, B.A., M.A., Ph.D. (Dean of Environmental Studies)
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)

Board of Governors' Representatives
To 1976
D. W. Maguire, B.A.Sc.

To 1977
K. A. Reichert, B.A.Sc., M.A.Sc.

To 1978
J. Bergsma, B.A.Sc., M.A.Sc., M.B.A.
G. Chapman
Elected Members – Faculty, Students and Alumni

Faculty Representatives
To 1976
W. C. Lennox, B.A.Sc., M.Sc., Ph.D. (Engineering)
R. M. Schuster, B.S., M.S., Ph.D., D.Eng., (Environmental Studies)
J. G. Kalbfleisch, B.Sc., Ph.D. (Mathematics)
G. C. S. Woo, O.D., M.Sc., Ph.D. (Science)
E. P. McCormack, M.A., Ph.D. (St. Jerome’s College)
T. L. Batke, B.A.Sc., Ph.D. (At large)
R. R. Dubinski, M.A., Ph.D. (At large)
G. N. Soulis, B.A.Sc. (At Large)
J. H. G. Howard, B.Sc., M.Sc., Ph.D. (At large)
M. E. Snyder, B.Sc., M.Sc. (At large)

To 1977
K. K. Davis, B.A., M.A., Ph.D. (Arts)
D. S. Scott, B.Sc., M.Sc., Ph.D. (Engineering)
R. M. Irving, B.A., M.A., Ph.D. (Environmental Studies)
P. J. Ponzo, M.A., Ph.D. (Mathematics)
H. B. N. Hynes, B.Sc., M.Sc., Ph.D., A.R.C.S. (Science)
B. Hubbard, B.A., M.A., Ph.D. (St. Jerome’s College)
W. Klaassen, B.A., B.D., Ph.D. (Conrad Grebel College)
E. L. Holmes, B.Sc., M.A.Sc., Ph.D. (At large)
J. M. Wilson, B.A., M.A. (At large)
H. E. Leipholz, Dipl.Eng., Dr.Eng., Docent Habil (At large)

To 1978
K. L. Ledbetter, A.B., M.A., Ph.D. (Arts)
M. M. Yovanovich, B.Sc., M.S., M.E., Sc.D. (Engineering)
R. Johnson, B.A., M.A., Ph.D. (Human Kinetics and Leisure Studies)
R. C. Mullin, B.A., Ph.D. (Mathematics)
D. E. Irish, B.Sc., M.Sc., Ph.D., F.C.I.C. (Science)
D. R. Letson, B.A., M.A., Ph.D. (St. Jerome’s College)
G. E. Cross, M.A., Ph.D. (At large)
H. K. Fillerton, B.Sc., M.A. (At large)
M. F. McDonald, B.A., M.A., Ph.D. (At large)
P. M. Reilly, U.E., B.A.Sc., D.I.C., Ph.D., F.S.S. (At large)
M. D. Vogel-Sprott, B.A., M.A., Ph.D. (At large)

Student Representatives
To 1976
Undergraduate
A. P. Telegdi (Arts)
K. H. Reynolds (Environmental/Integrated Studies)
P. B. Thomas (Science)

Graduate
E. A. Hall
L. van Goozen

To 1977
Undergraduate
D. B. Pattison (Engineering)
N. Smith (Human Kinetics and Leisure Studies)
H. Vanderzand (Mathematics)
F. Mensink (At large)

Graduate
R. A. Harrington
R. H. Irving

Alumni Representatives
To 1976
C. L. Heck, B.A.Sc.

To 1977
B. P. Barrett, B.A.Sc.

To 1978
J. M. Martin, B.A.Sc.
B. E. Mottershead, B.A.Sc., M.A.Sc.
Administrative Offices

President
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.

President Emeritus
B. C. Matthews, B.S.A., A.M., Ph.D.

President and Vice Chancellor
J. G. Hagey, B.A., LL.D.
Administrative Offices

Faculty of Mathematics
Dean of Mathematics
P. J. Ponzo, M.A., Ph.D.
Associate Dean (Undergraduate Studies)
K. D. Fryer, B.A., M.A., Ph.D.
Associate Dean (Undergraduate Studies)
D. D. Cowan, B.A.Sc., Ph.D.
Associate Dean (Graduate Studies)
R. G. Dunkley, B.A.
Assistant to the Dean
P. C. Brillinger, B.A., M.A.
Director of First Year Studies

Dean of Mathematics

Faculty of Science
Dean of Science
D. A. Brisbin, B.Sc., Ph.D.
Associate Dean (Undergraduate Affairs)
F. W. C. Boswell, B.A., M.A., Ph.D.
Associate Dean (Graduate Affairs)

University Graduate Office
L. A. K. Watt, B.Sc., M.S., Ph.D.
Dean of Graduate Studies
H. Bensusan
Associate Registrar (Graduate Studies)

Computing Centre
P. H. Dirksen, B.Sc., M.A.
Director
J. W. Dodd, B.A.Sc., M.Sc.
Associate Director, Operations
P. J. Sprung, B.A., M.A.
Associate Director, Information Systems and Planning

Academic Services
D. P. Robertson, B.Comm.
Director of Academic Services

Audio Visual Centre
G. Downie
Director

Co-ordination and Placement
Director

Associate Directors
B. A. McCallum, B.A.
J. C. Wilson, B.Sc., C.E., P.Eng.

Centre for the Arts
G. F. Butler
Manager

Counselling Services
W. W. Dick, B.A., B.D., M.A., Ph.D.
Director

Counsellors
J. B. Goodman, B.Sc., M.A., Ph.D.
J. C. Hawkins, B.A.
L. Kellar (Ms), B.A., M.A.Sc.
R. L. Knight, B.A.
R. P. Kunkle, B.A., M.S.
S. Minas (Ms), B.A., M.A.
R. Rempel (Ms), B.A.
I. J. H. Smart, B.A., M.A.Sc.
R. J. Walsh, B.A., M.A.Sc.
O. Weizmann (Ms), B.A., M.Ed., Ph.D.
J. L. Williams, B.A., M.A., Ph.D.
J. J. Wine, B.A., M.S., Ph.D.

Data Processing
J. D. Walker, B.A., M.A.Sc.
Director

Health Services
D. E. Andrew, B.A., M.D., F.R.C.P. (C)
Medical Director
S. M. Gutenberg, R.N., R.P.N.
Head Nurse
S. Sundberg, R.N., P.N., B.A., M.A.Sc.
Counsellor

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

Assistant Librarians
B. MacNeil, B.Sc., M.I.L.S.
Reader Services
C. D. Emery, B.A., A.L.A.
Support Services
C. Presser, A.B., M.L.S.
Co-ordinator, E.M.S. Divisional Library
D. E. Lewis (Mrs.), B.A., B.L.S., LL.D.
Collections Development Librarian
A. Dunnet, B.B.A.
Assistant to the Librarian – Administration

Office of the Registrar
C. T. Boyes, B.A.
Registrar
B. A. Lumsden, B.A.
Associate Registrar, Admissions and Records
W. G. Ullman
Associate Registrar, Systems
G. L. Buckley
Assistant to the Registrar
G. V. Ambrose
Assistant Registrar – Arts, Science
R. J. Bullen, B.Math
Assistant Registrar – Engineering, Mathematics
J. E. Fauquier, B.A.
Assistant Registrar – Environmental Studies, Human Kinetics and Leisure Studies, Integrated Studies
W. D. Derry
Co-ordinator of Scheduling
S. J. Little, B.A.
Liaison and Publications Officer
D. L. Kasta, B.A., M.A.
Student Awards Officer and Co-ordinator of Part-time Studies

Vice-President, Finance and Operations
A. B. Gellatly, B.A., C.G.A.
Vice-President, Finance and Operations
B. R. Foord, C.A.
Internal Auditor
S. S. Farrell, B.A., M.B.A.
Operating Budgets Analyst

Financial Services
A. H. Headlam, F.C.A.
Comptroller
J. M. Robb, C.G.A.
Director of Accounting
V. E. Leavoy, (Miss)
Research and Trust Funds Officer
J. S. Phillips, M.C.I.
Student Accounts
D. J. Battie (Miss)
Payroll Manager
B. Scott, B.Math
Registration Accountant

Administrative Services Group
W. G. Deeks
Director
Ancillary Enterprises
E. Dodds, (Mrs.)
Book Store Manager
R. W. Mudie
Food Service Director
J. W. Hammond
Graphic Services Manager
A. Lawrence
Central Store Manager
G. F. Currie
Purchasing Agent

Personnel
E. S. Lucy, B.A.
Director
R. J. Elliott, B.A.
Assistant Director – Wage and Salary
L. W. Brown
Assistant Director – Recruitment
A. H. Boyd
Assistant Director – Pensions and Benefits

Physical Resources Group
Director
A. E. Lappin, P.Eng.
Director, Physical Planning
Director, Plant Operations
N. Ozaruk
Director, Safety
Housing and Residences Operation
H. R. N. Eydt, M.Sc., Ph.D.
  Warden of Residences
H. C. Vinnicombe, B.Sc.
  Director, Housing and Residence Operations

Security
A. E. Romenco, B.Sc.
  Director
Walkway from Arts Library to Chemistry Buildings.
Index 1 – Faculty Members by Department

**Arts, Faculty of**
- Arts, 201
- Canadian Studies, 208
- Classics and Romance Languages (Dept. of), 227
- Drama and Theatre Arts Group, 239
- Economics (Dept. of), 245
- English (Dept. of), 255
- Fine Arts, 263
- Germanic and Slavic Languages and Literature (Dept. of), 279
- History (Dept. of), 286
- Human Relations and Counselling Studies (Dept. of), 295
- Philosophy (Dept. of), 345
- Political Science (Dept. of), 359
- Psychology, 365
- Religious Studies, 374
- Social Development Studies, 384
- Sociology and Anthropology (Dept. of), 390

**Engineering, Faculty of**
- Chemical Engineering (Dept. of), 211
- Civil Engineering (Dept. of), 222
- Electrical Engineering (Dept. of), 251
- Management Sciences (Dept. of), 302
- Mechanical Engineering (Dept. of), 335
- Systems Design Engineering (Dept. of), 402

**Environmental Studies, Faculty of**
- Architecture (School of), 194
- Environmental Studies, 261
- Geography (Dept. of), 270
- Man-Environment Studies (Dept. of), 304
- Urban and Regional Planning (School of), 408

**Human Kinetics and Leisure Studies, Faculty of**
- Dance Group, 237
- Kinesiology (Dept. of), 296
- Recreation (Dept. of), 370

**Mathematics, Faculty of**
- Applied Math (Dept. of), 308
- Combinatorics and Optimization (Dept. of), 309
- Computer Science (Dept. of), 310
- Pure Mathematics (Dept. of), 311
- Statistics (Dept. of), 311
- Strategy Board Members, 312

**Science, Faculty of**
- Biology (Dept. of), 204
- Chemistry (Dept. of), 215
- Earth Sciences (Dept. of), 242
- Optometry (School of), 341
- Physics (Dept. of), 352
Index 2 - General

A

Academic Calendar, 6, 7, 8, 9
Academic Organization, 14
Administrative Offices, 418
Admissions, 22
   Adult Students, 24
   Advanced Level Standing, 24
   Application Dates, 26
   Application Procedures, 25
   Colleges of Applied Arts and Technology, 24
   English Proficiency Test, 25
   Equivalent Certificates, 24
   General Requirements, 22
   Landed Immigrant Status, 25
   Limited Enrolment, 22
   Non-Grade 13 (Year 5), 24
   Ontario Year 5, 22
   Specific Requirements and Recommendations, 23
   Transfer Credit, 24
Anthropology, 71, 397
Applied Mathematics, 142, 308
Architecture, 114, 194
Arts, (Fine Arts), 263
Arts, 201
Arts, Faculty of, 66
   Admission, 66
   Degrees, 66
   Examinations and Standings, 66
   General Programme, 70
   Honours Programmes, 71
   Non-Major, General Arts, 70
   Pass Programme, 70
Asian Studies, 70
Athletics Dept., 18
Averages, interpretation of, 17
Awards and Financial Assistance, 32

B

Biology, 163, 204
Board of Governors, 416
Book Store, 18
Bursaries, 38
Business Administration Option, 150

C

Calendar, Undergraduate, 2
Campus Health Services, 19
Campus Map, 10, 11
Canadian Studies, 22, 208
Careers Information Centre, 18
Career Planning & Placement, 60
Centre for the Arts, 18
Chartered Accountancy Option, 75, 150
Chemical Engineering, 94, 211
Chemistry, 165, 215
Child Care Option, 84
Chinese, 201
Church Colleges, 14
Civil Engineering, 96, 222
Classical Studies, 73, 227
Classics, 227
Combinatorics and Optimization, 142, 309
Computer Science, 143, 310
Computing Centre, 18
Co-ordination and Placement (Dept. of), 46
Conrad Grebel, 15
   Residence, 15
Co-op System of Study, 16, 47
Co-operative Plan, 43
Co-operative Student Employers, 51
Correspondence Courses, 16
Continuing Education, 16
Counselling Services, 19
Counselling Studies (Dept. of Human Relations and), 294
Cross-Registration (with Wilfrid Laurier University), 17

D

Dance, 135, 237
Dean of Women, (Office of), 19
Degrees Offered, 15
   (See also Faculty areas), 66, 90, 110, 130, 144, 154
Drama and Theatre Arts, 73, 239

E

Early Childhood Education, 84
Earth Sciences, 172, 339
Economics, 74, 245
Electrical Engineering, 98, 251
Engineering, Faculty of, 90
   Academic Programmes, 93
   Admission, 90
   Chemical Engineering, 94, 211
   Civil Engineering, 96, 222
   Co-operative Programme, 90
   Degrees, 90
   Electrical Engineering, 98, 251
   Examinations and Promotions, 91
   Management Sciences, 108
   Mechanical Engineering, 101
   Systems Design, 104
   Work Term Reports, 92
English, 76, 255
   English Proficiency Test, 25
Environmental Studies, Faculty of, 110
   Academic Programmes, 112
   Admission, 110
   Architecture, School of, 114, 194
   Degrees, 110
   Examinations and Standings, 111
   Geography, Dept. of, 117, 270
   Man-Environment Studies, Dept. of, 121, 304
   Urban and Regional Planning, School of, 124
   Equivalent Certificates, 24
   Examinations, 111
   (See Faculty sections), 66, 91, 111, 131, 145, 155

F

Faculty Members (See Index 1), 424
   Federation of Students, 17
   Fees and Registration, 28
   Financial Aid, 32
   Fine Arts, 76, 263
   Arts, 201, 263
   Music, 267
   French, 77, 230
   Full-time Students, 15

G

General Engineering, 269
   Geography, 78, 270
   Geology, 172, 339
   (see Earth Sciences)
   German, 78, 279
   Governing Bodies and Staff, 416
   Administrative Offices, 418
   Board of Governors, 416
   Senate, 416
   Government Assistance Programmes, 44
   Grading System, 16
   (see also Faculty sections)
   Greek, 73, 229

H

Health Studies, 134, 300
   History, 79, 286
   Honorary Degrees, 15
   Human Kinetics and Leisure Studies, Faculty of, 130
   Admission, 131
   Degrees, 130
   Dance, 135, 237
   Examinations and Standings, 131
   Health Studies, 134
   Kinesiology, 133, 296
   Recreation, 135, 370
   System of Study, 131
   Human Relations and Counselling Studies, 294

I

Industrial Advisory Council, 50
   Integrated Studies, 138
   Interdisciplinary Social Science, 385
   International Student Office, 20
   Italian, 234

K

Kinesiology, 133, 296

L

   Landed Immigrant Status, 25
   Latin, 73, 80, 229
   Leisure Studies, (Faculty of Human Kinetics and), 130
   Libraries, 62
   Limited Enrolment, 22
   Loan Funds, 43

M

   Man-Environment Studies, 121, 304
   Management Sciences, 108, 302
   Mathematics, Faculty of, 142
   Academic Programmes, 147
   Admission, 144
   Course Descriptions, 315
   Degrees, 144
   Standings and Promotions, 145
   Mechanical Engineering, 101, 335
   Medieval Studies, 81
   Music (Fine Arts), 267
Index
General

N
Notre Dame
Residence, 14

O
O.P.I.R.G., 30
Optometry, 182, 342

P
Part-time Studies, 16
Philosophy, 81, 345
Physics, 176, 352
Polish, 284
Political Science, 83, 359
Psychology, 83, 365
Prizes, 41
Pure Mathematics, 143, 311

R
Recreation, 135, 370
Registrar, (Office of), 19
Registration, 26, 28
Regular System of Study, 16
Religious Studies, 84, 374
Renison College, 15
Admission, 22
Residence, 15
Research Administration (Office of), 19
Residences, 20, 30
Russian, 85, 282

S
St. Jerome’s College, 14
Admissions, 22
Awards, 37
Residence, 14
St. Paul’s College, 15
Residence, 15
Scholarships, 32
Science, (Elective Course Descriptions), 381

Science, Faculty of, 154
Academic Programmes, 158
Admissions, 154
Biology, 163, 204
Chemistry, 165, 215
Degrees, 154
Earth Sciences, 172, 339
Examinations and Standings, 155
General Science, 187
Honours Science, 186
Optometry, 182, 341
Physics, 176, 352

Senate, 416
Social Development Studies, 85, 384
Social Work, 388
Sociology, 86, 390
Spanish, 87, 235
Statistics, 144, 311
Student Awards, 32
Students’ Council, 17
Student Services, 17
System of Study, 15
Systems Design, 104, 402

T
Theatre Arts, 239
Teaching Certification, 66
Teaching Option, 151
TOEFL (Test of English as a Foreign Language), 25
Tuition, 29

U
Ukrainian, 285
University, 14
Colours and Coat of Arms, 14
Jurisdiction, 16
Mace, 14
Urban and Regional Planning, 124, 408

W
Waterloo Co-operative Residence Incorporated, 20
Wilfrid Laurier University (Cross Registration), 17
Women, Dean of, 19
Women’s Studies, 413
Work Terms, 48