# Courses of Instruction

**Academic Writing** (ACWR)

Instruction offered under the direction of the Effective Writing Program in the Faculty of Communication and Culture.

Program Director - J. Andre

Introductory, intermediate, intermediate/advanced, and advanced courses in the writing styles, genres, and modes of evidence and reasoning appropriate to a specific discipline. Emphasis will be placed on connections between reading, writing, critical reasoning, and, where appropriate, other discourse forms such as oral and electronic presentation.

Specific sections of these courses will be offered in conjunction with academic departments and/or designated courses within those departments. Registration will be limited to students taking courses in the appropriate disciplines. See the Master Timetable for prerequisites and corequisites.

### Senior Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACWR 301</td>
<td>Academic Writing</td>
<td>Q(1.5-0)</td>
</tr>
<tr>
<td>ACWR 303</td>
<td>Academic Writing for Specialized Audiences</td>
<td>H(3-0)</td>
</tr>
</tbody>
</table>

### Accounting (ACCT)

Instruction offered by members of the Haskayne School of Business.

Accounting Chairperson - D. Green

Note: Students have the opportunity to take courses offered by the Haskayne School of Business without the stated prerequisites, with the written permission of the Associate Dean (Undergraduate Programs) as appropriate, upon the recommendation of the instructor of the course. However, should a student fail to achieve satisfactory standing in any course for which the stated prerequisite(s) is (are) lacking, he/she may be required to successfully complete the stated prerequisite(s) prior to being permitted to repeat the course. Students are required to have consent of the Haskayne School of Business Office before registering in 600-level courses offered by the Haskayne School of Business.

### Senior Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCT 317</td>
<td>Introductory Financial Accounting</td>
<td>H(3-1T)</td>
</tr>
<tr>
<td>ACCT 341</td>
<td>Intermediate Financial Accounting I</td>
<td>H(3-1T)</td>
</tr>
<tr>
<td>ACCT 343</td>
<td>Intermediate Financial Accounting II</td>
<td>H(3-1T)</td>
</tr>
<tr>
<td>ACCT 361</td>
<td>Cost Accounting</td>
<td>H(3-1T)</td>
</tr>
<tr>
<td>ACCT 421</td>
<td>Taxation</td>
<td>H(3-1T)</td>
</tr>
<tr>
<td>ACCT 425</td>
<td>Auditing</td>
<td>H(3-1T)</td>
</tr>
</tbody>
</table>

### Accounting 443

**H(3-1T)**

**Advanced Financial Accounting**

Topics include accounting for business combinations and intercorporate investments, foreign currency transactions and translation, bankruptcy, partnerships, and not-for-profit organizations.

Prerequisites: Third year standing and Accounting 343.

### Accounting 445

**H(3-0)**

**Accounting Theory**

Examines the origins of financial accounting and current theories on the use of financial accounting information by investors, regulators, standard setters, and other corporate stakeholders.

Prerequisites: Third year standing and Accounting 343.

### Accounting 465

**H(3-0)**

**Managerial Control Systems**

Case approach to Management Control Systems explaining the use of accounting data from a
### Actuarial Science Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Prerequisites</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACSC 427</td>
<td>Actuarial Science 427</td>
<td>Accounting 327</td>
<td>Note: Actuarial Science 325 is recommended.</td>
</tr>
<tr>
<td>ACSC 427</td>
<td>Actuarial Science 427</td>
<td>Accounting 327</td>
<td>Note: Actuarial Science 325 is recommended.</td>
</tr>
<tr>
<td>ACSC 527</td>
<td>Actuarial Science 527</td>
<td>H(3-T)</td>
<td>Multiple decrement models: time until and causes of death. Associated single decrement tables. Various pension funding cost methods: unit credit, projected unit credit, entry age normal, individual level premium and aggregate. Experience gains and losses: allocating losses to investment, mortality, retirement and salary components. Prerequisites: Mathematics 323 and Actuarial Science 327.</td>
</tr>
<tr>
<td>ACSC 533</td>
<td>Actuarial Science 533</td>
<td>H(3-T)</td>
<td>Corequisite: Statistics 421.</td>
</tr>
<tr>
<td>ACSC 535</td>
<td>Mathematics of Demography</td>
<td>H(3-T)</td>
<td>Conventional and adjusted measures of mortality; measures of fertility; measures of morbidity; North American demographic characteristics and trends; evaluation of demographic data; projections for stable and stationary populations; actuarial applications of demographic characteristics and trends. Prerequisites: Actuarial Science 327 and Mathematics 323.</td>
</tr>
<tr>
<td>ACSC 539</td>
<td>Special Topics in Actuarial Science</td>
<td>H(3-T)</td>
<td>Offered under various subtitles. Prerequisite: Actuarial Science 327. Corequisite: Statistics 421.</td>
</tr>
<tr>
<td>ACSC 599</td>
<td>Life Contingencies III</td>
<td>H(3-T)</td>
<td>MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>ACSC 527</td>
<td>Actuarial Science 527</td>
<td>H(3-0)</td>
<td>Note: Actuarial Science courses listed below, along with Statistics 407, 421, 431, 433, and 437, cover significant portions of the course of study for the Casualty Actuarial Society Examinations/Society of Actuaries Courses 1 through 4. Students are advised to select additional courses in Economics, Finance, Risk Management and Insurance, and Statistics as electives in order to complete the course of study for these professional examinations, and also to prepare for Casualty Actuarial Society Examinations/Society of Actuaries Courses 5 and 6. Students should speak with an advisor in the division of Statistics and Actuarial Science for guidance.</td>
</tr>
<tr>
<td>ACSC 327</td>
<td>Life Contingencies I</td>
<td>H(3-1T)</td>
<td>The survival function, force of mortality, life tables, analytical laws of mortality, life insurance, continuous and discrete life annuities, recursion equations. Introduction to benefit premiums and/or insurance and annuity models with interest as a random variable as time permits. Prerequisite: A grade of &quot;C&quot; or higher in Mathematics 321. Note: Actuarial Science 325 is recommended.</td>
</tr>
<tr>
<td>ACSC 325</td>
<td>Theory of Interest/Mathematics of Finance</td>
<td>H(3-1T)</td>
<td>Measurement of interest, elementary annuities, general annuities, amortization schedules and sinking funds, bonds and other securities. Prerequisite: Mathematics 253 or 263 or Applied Mathematics 219; or Mathematics 249 or 251 or Applied Mathematics 217 with the permission of the Division.</td>
</tr>
<tr>
<td>ACSC 327</td>
<td>Life Contingencies I</td>
<td>H(3-1T)</td>
<td>The survival function, force of mortality, life tables, analytical laws of mortality, life insurance, continuous and discrete life annuities, recursion equations. Introduction to benefit premiums and/or insurance and annuity models with interest as a random variable as time permits. Prerequisite: A grade of &quot;C&quot; or higher in Mathematics 321. Note: Actuarial Science 325 is recommended.</td>
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<td>ACSC 527</td>
<td>Actuarial Science 527</td>
<td>H(3-0)</td>
<td>Note: Actuarial Science 527 and Mathematics 323.</td>
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<td>ACSC 327</td>
<td>Life Contingencies I</td>
<td>H(3-1T)</td>
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<td>ACSC 533</td>
<td>Mathematics of Demography</td>
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<td>ACSC 539</td>
<td>Special Topics in Actuarial Science</td>
<td>H(3-T)</td>
<td>Offered under various subtitles. Prerequisite: Actuarial Science 327. Corequisite: Statistics 421.</td>
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<td>Life Contingencies III</td>
<td>H(3-T)</td>
<td>MAY BE REPEATED FOR CREDIT</td>
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<tr>
<td>ACSC 527</td>
<td>Actuarial Science 527</td>
<td>H(3-0)</td>
<td>Note: Actuarial Science courses listed below, along with Statistics 407, 421, 431, 433, and 437, cover significant portions of the course of study for the Casualty Actuarial Society Examinations/Society of Actuaries Courses 1 through 4. Students are advised to select additional courses in Economics, Finance, Risk Management and Insurance, and Statistics as electives in order to complete the course of study for these professional examinations, and also to prepare for Casualty Actuarial Society Examinations/Society of Actuaries Courses 5 and 6. Students should speak with an advisor in the division of Statistics and Actuarial Science for guidance.</td>
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<td>ACSC 327</td>
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### African Studies Courses

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<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Prerequisites</th>
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</thead>
<tbody>
<tr>
<td>AFST 301</td>
<td>Introduction to African Studies</td>
<td>H(3-0)</td>
</tr>
</tbody>
</table>
African Studies 400  F(9-0)

Field Study in Africa

A field course for the in situ interdisciplinary study of a country or region of Africa, emphasizing the geographical, archaeological, historical, cultural, political, economic and artistic aspects. For further information students should contact the Academic Programs Office or the Program Coordinator.

Prerequisite: Consent of the Program Co-ordinator.

African Studies 501  H(3S-0)

Seminar

Study of a particular topic(s) or region(s) from an interdisciplinary and comparative perspective. Students will be required to examine how political, social, economic and cultural factors intersect to shape various issues in the African setting.

Prerequisites: African Studies 301 and one of Anthropology 317, History 401, Political Science 371 or consent of the Faculty.

Anthropology ANTH

Instruction offered by members of the Department of Anthropology in the Faculty of Social Sciences.

Department Head: A. Smart

Junior Courses

Anthropology 201  H(3-0)(Area II)

Introduction to Primatology and Human Evolution

Introduction to evolutionary theory and processes, with particular reference to the primates. Topics include primate taxonomy, distribution, reproduction, locomotion, diet, social organization, and evolution, with special emphasis on the path of human evolution.

Anthropology 203  H(3-0)(Area II)

Introduction to Social and Cultural Anthropology

The nature of human society: its elements, its variability and its perpetuation. Conclusions will be drawn from comparisons of institutions (political, economic, religious, educational and sexual) in both small-scale and large-scale societies.

Anthropology 213  H(3-0)(Area II)

Contemporary Aboriginal Issues in Canada

An exploration of the history of Aboriginal/state relations, the development of Indian policy, and current efforts of Aboriginal peoples to address historical matters through the critique of the residential school system and the pursuit of self government, land claims, modern treaties and Aboriginal rights. Includes a critical examination of Canadian historical writing, popular culture, and stereotypes of Indians and will survey contemporary Aboriginal expressions of identity in the arts, literature, cultural performances, and other public contexts.

Senior Courses

Anthropology 303  H(3-0)(Area II)

Business in Cultural Context

Ways in which differences in cultural values and practices affect the form and nature of interaction between business parties, especially those of differing national/cultural/ethnic backgrounds.

Anthropology 307  H(3-3)(Area III)

Introduction to Anthropological Statistics

The basic techniques and applications of statistics in Anthropology.

Prerequisite: Anthropology 201 or 203 or consent of the Department.

Note: Credit towards degree requirements will be given for only one of Anthropology 307, Applied Psychology 301/303, Engineering 319, Political Science 399, Psychology 312, Sociology 311/315, Statistics 201/211, 213/217, 333, 357; that one being a course appropriate to the degree program.

Anthropology 311  H(3-0)(Area III)

Primate Behaviour

Primate behaviour and related topics: social dynamics, sociobiology, socio-ecology, dominance, aggression, kinship, sexual behaviour, socialization, learning, cognition, communication, ape language, and conservation.

Anthropology 317  H(3-0)(Area II)

Ethnographic Survey of Africa South of the Sahara

Traditional societies in sub-Saharan Africa, concentrating on a number of classical social anthropological fieldwork studies.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 319  H(3-0)(Area II)

Ethnographic Survey of North Africa

Ethnographic survey of the peoples of North Africa, including the Sahara, and historical analysis of their incorporation within the contemporary national states of the region.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 321  H(3-0)(Area II)

Ethnographic Survey of Latin America

A survey of cultural traditions of Mexico, the Caribbean, and Central and South America as they have evolved since the 16th century.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 323  H(3-0)(Area II)

Culture and Society of China

Diversity of social and cultural patterns in imperial and contemporary times.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 327  H(3-0)(Area II)

Culture and Society of Modern Japan

Sources of Japanese identity: historical introduction; dynamic interaction between culture and personality; social structure and religion; how traditional values have shaped social and scientific modernization; sources of problems in cross-cultural communication.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 331  H(3-0)(Area II)

(Formerly Anthropology 407)

Culture and Environment of Selected Circumpolar Peoples

Peoples and cultures of the circumpolar area with an emphasis upon environmental adaptation and the effects of culture contact.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology of Gender

Comparative analysis of gender as a central feature of social identity and of social relations of power, with particular reference to feminist approaches to the exploration of women’s experience in their historical and cultural variety.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 335  H(3-0)(Area II)

Courses of Instruction
<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Anthropology 337</td>
<td>H(3-0)(Area II)</td>
<td><strong>Indigenous Knowledge and Global Developments</strong></td>
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<tr>
<td></td>
<td>Contemporary anthropological approaches to indigenous knowledge and peoples, particularly in their relationships to industrial and post-industrial societies.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 341</td>
<td>H(3-0) (Area II)</td>
<td><strong>Medical Anthropology</strong></td>
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<td>A survey of anthropological approaches to disease, illness and the maintenance of health.</td>
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<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<td><strong>Note:</strong> Not open to students with credit in Anthropology 483.</td>
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<tr>
<td>Anthropology 351</td>
<td>H(3-3)(Area III)</td>
<td><strong>Method and Theory in Primatology</strong></td>
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<td></td>
<td>Focus on observational methods and analysis, with practical application in laboratory study at the Calgary Zoo. Theoretical perspectives of behavioural ecology as applied to primate studies.</td>
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<td><strong>Prerequisite:</strong> Anthropology 201 or consent of the Department.</td>
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<td><strong>Note:</strong> Field trips required. Anthropology 307 or equivalent statistical course is highly recommended.</td>
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<tr>
<td>Anthropology 353</td>
<td>H(3-3)(Area III)</td>
<td><strong>Primate Evolution</strong></td>
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<td></td>
<td>Focus on cladistic methods in taxonomy and theory in systematics and evolution. Discussion of major problems in primate evolution. Laboratory work involving cladistic analyses of fossil primate lineages.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 201 or Archaeology 203 or consent of the Department.</td>
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<td><strong>Note:</strong> Anthropology 307 or equivalent statistical course is highly recommended.</td>
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<tr>
<td>Anthropology 355</td>
<td>H(3-0) (Area II)</td>
<td><strong>An Ethnographic Survey of Native North America</strong></td>
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<td>(formerly Anthropology 255)</td>
<td>Selected North American Indian cultures in terms of the relationships among basic subsistence adaptations, social, ceremonial, and ideological structures.</td>
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<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 357</td>
<td>H(3-0)(Area II)</td>
<td><strong>Applied Anthropology</strong></td>
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<tr>
<td></td>
<td>Introduction to the practical use of anthropological knowledge and research methods. Includes discussion of the specific challenges of practicing anthropology outside of academia.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 363</td>
<td>H(3-0)(Area II)</td>
<td><strong>Anthropological Perspectives on Religion</strong></td>
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<td></td>
<td>Contemporary anthropological theoretical perspectives on indigenous and world religions.</td>
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<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 365</td>
<td>H(3-0)(Area II)</td>
<td><strong>Anthropological Theory</strong></td>
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<tr>
<td></td>
<td>Study of a variety of theories in Social and Cultural Anthropology, and their implications for research design and fieldwork.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 367</td>
<td>H(3-0)(Area II)</td>
<td><strong>Ritual and Cultural Performance</strong></td>
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<tr>
<td></td>
<td>Anthropological theories of political, social, symbolic and performative aspects of ritual and the role of ritual in the reproduction and contestation of cultural identities.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 371</td>
<td>H(3-0)(Area II)</td>
<td><strong>Political Anthropology</strong></td>
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<tr>
<td></td>
<td>Comparative analysis of power, authority, dependency relations, and processes of governance, from the perspective of social anthropology, with primary emphasis on stateless societies and formative states.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 375</td>
<td>H(3-0)(Area II)</td>
<td><strong>Anthropology of Law</strong></td>
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<tr>
<td></td>
<td>Systems of law and social control in both state and non-state societies.</td>
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<tr>
<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 379</td>
<td>H(3-0)(Area II)</td>
<td><strong>Urban Anthropology</strong></td>
</tr>
<tr>
<td></td>
<td>A study of tribalism, ethnicity, sub-cultures, social networks and related phenomena in urban societies. Attention will be paid to planning and applied urban anthropology.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 383</td>
<td>H(3-0)(Area II)</td>
<td><strong>The Nature of Ethnographic Writing</strong></td>
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<tr>
<td></td>
<td>Paradoxes of the boundary between fiction and non-fiction, contrasting the poetics and “Aliterary” features of conventional ethnography with the factuality and analytical power of ethnic novels and stories. Between these two extremes, a variety of intermediate or “blurred” genres (personal diaries, experimental anthropology, etc.) will be identified and explored.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 385</td>
<td>H(3-0)(Area II)</td>
<td><strong>Economic Anthropology</strong></td>
</tr>
<tr>
<td></td>
<td>Comparative analysis of production, distribution and consumption in small-scale and complex societies; theories of exchange; effects of capitalism upon traditional economies and social organization.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 387</td>
<td>H(3-0)(Area II)</td>
<td><strong>Ethnography of Global-Local Dynamics</strong></td>
</tr>
<tr>
<td></td>
<td>Changes in the international division of labour and resulting social, cultural, and political effects, with particular attention to the incorporation of small-scale societies.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203, or consent of the Department.</td>
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<td><strong>Note:</strong> Not open to students with credit in Anthropology 485.</td>
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<tr>
<td>Anthropology 399</td>
<td>H(3-0)(Area II)</td>
<td><strong>Ethnographic Survey of Selected World Areas</strong></td>
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<td></td>
<td>Arranged for various topics in the anthropology of world areas. Consult department for topics in any given year.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<td><strong>MAY BE REPEATED FOR CREDIT</strong></td>
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<tr>
<td>Anthropology 402</td>
<td>F(3-0)(Area II)</td>
<td><strong>Independent Study</strong></td>
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<td></td>
<td>Selected topics in anthropology to be offered Majors and Honours in their fourth year. Topics for each student to be arranged on the basis of special interest and need. For Honours students, submission of an acceptable honours essay is required for completion of the honours program and this course.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Consent of the Department.</td>
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<tr>
<td>Anthropology 404</td>
<td>F(3-0)(Area III)</td>
<td><strong>Ecology of Tropical Forest Societies</strong></td>
</tr>
<tr>
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<td>Selected topics in anthropology to be offered Majors and Honours in their fourth year. Topics for each student to be arranged on the basis of special interest and need. For Honours students, submission of an acceptable honours essay is required for completion of the honours program and this course.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Consent of the Department.</td>
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<tr>
<td>Anthropology 405</td>
<td>H(3-0)(Area II)</td>
<td><strong>Methods and Analysis for Anthropology</strong></td>
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<td></td>
<td>Adaptation of indigenous societies to their tropical forest habitat, and their transformation under the impact of industrial society.</td>
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<td></td>
<td><strong>Prerequisite:</strong> Anthropology 203 or consent of the Department.</td>
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<tr>
<td>Anthropology 411</td>
<td>H(3-0)(Area II)</td>
<td><strong>Ethnography of the Great Plains</strong></td>
</tr>
<tr>
<td></td>
<td>Comparative study of peoples and cultures of the Great Plains past and present.</td>
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<tr>
<td></td>
<td><strong>Prerequisite:</strong> Anthropology 365 or 383 or consent of the Department.</td>
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<tr>
<td>Anthropology 419</td>
<td>H(3-0)(Area II)</td>
<td><strong>Contemporary Latin American Society</strong></td>
</tr>
<tr>
<td></td>
<td>An examination of selected issues in the anthropological study of contemporary Latin America.</td>
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</tr>
</tbody>
</table>
Courses of Instruction

Prerequisite: Anthropology 321 or consent of the Department.

Anthropology 427 H(3-0)(Area II)

Women in East Asian Societies

Comparison of women’s roles in China, Japan, and Korea, with particular reference to family structure and economic organization.

Prerequisite: Anthropology 323 or 325 or 327.

Anthropology 431 H(3-0)(Area II)

The Ethnographic Construction of Reality

Written and pictorial techniques used by anthropologists in classic and experimental ethnographies to establish their authority and to persuade readers that the facts and patterns they report have an objective existence.

Prerequisite: Anthropology 365 or 383 or consent of the Department.

Anthropology 435 H(3-0)(Area III)

Evolutionary Anthropology

Analysis of evolutionary principles and processes (such as natural selection, sexual selection, kin selection, and human behavior) as they are applied to the current study of human and nonhuman primate behavior. Special emphasis on evolutionary ecology.

Prerequisite: Anthropology 311 or consent of the Department.

Anthropology 451 H(3-3)(Area III)

Primate Behavioural Ecology

BeHAVIour and ecology of selected primate societies, and related theory. Discussion of advanced techniques of field study in behavioural ecology.

Prerequisite: Anthropology 351 or consent of the Department.

Anthropology 457 H(3-3)(Area III)

Palaeo primatolog ener

Examination of the fossil primates, construction of evolutionary models and cladistic scenarios. Techniques for the reconstruction of ecological relationships, behavior, and social structures of primate lineages.

Prerequisite: Anthropology 353.

Anthropology 461 H(3-0)(Area II)

History of Anthropology

Historical survey of anthropological thought from the enlightenment to the present.

Prerequisite: Anthropology 363 or 365 or consent of the Department.

Anthropology 465 H(3-0)(Area II)

Identity, Nationalism and Post-Colonialism

A study of the creation of colonial national identities and their disruption by indigenous assertions of identity and sovereignty in settler societies including Canada, Australia and New Zealand.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 473 H(3-0)(Area II)

Belief Systems

An anthropological approach to the social construction of reality: the internal logic and structure of closed systems of ideas; processes of legitimation of belief; the resolution of contradictions; and properties of belief systems under conditions of social change.

Prerequisite: Anthropology 363 or 365 or consent of the Department.

Anthropology 477 H(3-0)(Area II)

Comparative Studies of Kinship and Family

An introduction to theories of kinship, marriage, family, and gender; their manifestations in diverse cultural and social settings.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 481 H(3-0)(Area II)

Environment, Society and Culture

The relationship between human societies and the physical environment will be examined with emphasis on the relation between cultural behaviour and environmental phenomena.

Prerequisite or Corequisite: One of the following ethnographic courses: Anthropology 315, 317, 319, 321, 323, 325, 327, 329, 331, 339, 343, 347, 413, 427, Archaeology 345, 355, 357, 380, 419, 425.

Anthropology 501 H(3-0)(Area II)

Conference Course in Anthropology

Arranged for various topics of anthropology on the basis of special interest and need.

Prerequisite: Anthropology 203 or consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 505 H(3-0)(Area III)

Conference Course in Primatology

Arranged for various topics of primatology on the basis of special interests and need.

Prerequisites: Anthropology 311 and one additional senior Area III primatology course and consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 535 H(3-0)(Area II)

History and Theory in Primatology and Physical Anthropology

Historical and theoretical study of ideas about the biological bases of human and nonhuman primate social behaviour. Impacts of the theoretical models of the modern synthesis, ethology, behavioural ecology, socio-ecology, and sociobiology on the study of human and non-human primates.

Prerequisite: Minimum Third Year Standing.

Anthropology 541 H(3-0)(Area II)

Field Study in Social and Cultural Anthropology

Research projects carried out off campus, under the supervision of a member of academic staff, and resulting in a graded project report.

Prerequisite: Consent of the Department.

Anthropology 552 F(3-3)(Area III)

Field Studies in Primatology

Intensive training and practice in field methods of observational primate behaviour or behavioural ecology.

Prerequisites: Anthropology 351 and consent of the Department.

Anthropology 553 H(3-3)(Area III)

May be repeated for credit

Anthropology 555 H(3-0)(Area II)

Primate Behavioural Research Design

Design of a research project, including the identification and operationalization of a research question and the collection and analysis of data.

Prerequisites: Anthropology 552 and consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 563 H(3-0)(Area II)

Anthropology of Missions

Missionary endeavours, their interior logic, and their methodological and ethnographic contributions to anthropology.
Anthropology/Applied Mathematics

Courses of Instruction

Prerequisite: Anthropology 363 or consent of the Department.

Anthropology 567 H(3-1T)(Area II)
Communications Studies 567

Advanced Studies in Visual Culture

Advanced studies in visual communication with special attention to historical and theoretical aspects of visual practices. Students will explore diverse expressions of visuality and undertake applied visual research and production. Topics may include the social production of visual discourse, visual media and social change, visual anthropology, and strategies for visual research.

Prerequisite: Communications Studies 367 or Anthropology 411 or consent of the Faculty of Communication and Culture.

Anthropology 583 H(3-0) (Area II)

Applied Anthropology

Application of anthropological methods and perspectives in various social contexts.

Prerequisite: Anthropology 203 or consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 589 H(3-0)(Area III)
Archaeology 589

Nutritional Anthropology

The study of human dietary practices from biological and cultural perspectives. Subjects covered include the development of nutritional anthropology, principles of nutrition, principles of ecology, diet from an evolutionary, comparative and historic perspective, the impact of undernutrition on human physiology, and behaviour and methods in nutritional anthropology.

Prerequisite: Anthropology 201 or 203 or Archaeology 305 or consent of the Department.

Note: Not open to students with credit in Archaeology 533.04.

Graduate Courses

Only where appropriate to a student’s program may graduate credit be received for courses numbered 500-599.

Anthropology 601 H(3-0)

Conference Course in Anthropology

A specialized area of Anthropology selected on the basis of particular interest and need.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 603 H(3S-0)

Thesis Development

A reading and conference course in the student’s substantive area conducted jointly by at least two faculty members.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 609 H(3-0)
Archaeology 609 | Geography 609

Human Ecological Systems

The development of human ecology, its current directions and application of analytical techniques as they apply to anthropology, archaeology and geography.

Prerequisite: Consent of the Department.

Anthropology 611 H(3-0)
Methods in Anthropological Research

A variety of topics relevant to research and the logic of inquiry in Anthropology.

Prerequisite: Consent of the Department.

Anthropology 613 H(3-0)
Current Issues in Methodology in Primatology

A variety of topics relating to aspects of data collection and data analysis in primatology, with a focus on ecological and behavioural data.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 631 H(3-0)
Anthropological Theory I

Prerequisite: Consent of the Department.

Anthropology 633 H(3-0)
Anthropological Theory II

Prerequisite: Consent of the Department.

Anthropology 635 H(3-0)
Primatological Theory

Seminar dealing with the theoretical material of primatological and biobehavioural perspectives in Anthropology.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 659 H(3-3)
Primatology

Specialized topics and laboratory training in this field will vary from year to year and may include: behavioural ecology, biomechanics, evolution, biosociology, and field methodology.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 701 H(3-0)
Independent Studies

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Applied Mathematics AMAT

Instruction offered by members of the Department of Mathematics and Statistics in the Faculty of Science.

Department Head - T. Bisztriczky

Note: For listings of related courses, see Actuarial Science, Mathematics, Pure Mathematics and Statistics.

Applied Mathematics 001 E(12 hours)

Module M1

Introduction to Maple, Mathematica and Matlab.

Prerequisites: Mathematics 221 and 253 or 263 or Applied Mathematics 219.

NOT INCLUDED IN GPA

Applied Mathematics 002 E(12 hours)

Module M2

Advanced use of Maple, Mathematica and Matlab with applications.

Prerequisite: Applied Mathematics 001.

NOT INCLUDED IN GPA

Junior Courses

Applied Mathematics 217 H(3-1T-1.5)

Calculus for Engineers and Scientists

Functions, limits, continuity, derivatives, Mean Value Theorem, integrals, Fundamental Theorem of Calculus, applications to the physical sciences.

Prerequisites: A grade of 70% or higher in Mathematics 30 or Pure Mathematics 30 and credit in Mathematics 31; or admission to the Faculty of Engineering including credit in Mathematics 30 or Pure Mathematics 30, and Mathematics 31.

Note: Credit for both Applied Mathematics 217 and either Mathematics 249 or 251 will not be allowed.

Applied Mathematics 219 H(3-1T-1.5)

Multivariable Calculus for Engineers

Techniques of integration, double and triple integrals, partial derivatives, applications.

Prerequisite: Applied Mathematics 217; or Mathematics 249 or 251 and consent of Applied Mathematics Division.

Note: Credit for both Applied Mathematics 219 and either Mathematics 253 or 263 will not be allowed.

Senior Courses

Applied Mathematics 307 H(3-1.5T)

Differential Equations for Engineers

Definition, existence and uniqueness of solutions, first and second order equations with applications, series solutions about regular points and singular points, special functions. Laplace transform, systems of equations.

Prerequisites: Applied Mathematics 219 and Mathematics 221.

Note: Credit for both Applied Mathematics 307 and 311 will not be allowed.

Applied Mathematics 309 H(3-1.5T)

Vector Calculus for Engineers

Functions of several variables, chain rule and differentials. Vector calculus, line, surface and volume integrals, Green's, Gauss' and Stokes' theorems.

Prerequisite: Applied Mathematics 219.

Note: Credit for both Applied Mathematics 309 and either Mathematics 351 or 353 will not be allowed.

Applied Mathematics 311 H(3-1T)

Differential Equations I

Classification of ordinary differential equations, first and second order equations with applications, series solutions about regular points and singular points, special functions, Laplace transform.

Prerequisite: Mathematics 253 or 263 or Applied Mathematics 219.

Note: Credit for both Applied Mathematics 307 and 311 will not be allowed.

Applied Mathematics 371 H(3-0)

Computing for Mathematicians

Modules M1 (Applied Mathematics 001), M2 (Applied Mathematics 002) and the completion of a project in Computational Mathematics.

Prerequisites: Mathematics 221 and 253 or 263 or Applied Mathematics 219.
Courses of Instruction

Applied Mathematics 411 H(3-1T)
**Differential Equations II**
Existence and uniqueness theorems, comparison and oscillation theorems, Green’s functions, Sturm-Liouville problems, systems of equations, phase portraits, stability.
**Prerequisites:** One of Applied Mathematics 311 or 307, and one of Mathematics 331, 353, Applied Mathematics 309, or consent of the Division.
**Note:** It is recommended that students complete Pure Mathematics 435 before taking this course.

Applied Mathematics 413 H(3-1T)
*Introduction to Partial Differential Equations*
**Prerequisites:** One of Mathematics 353, Applied Mathematics 309, Mathematics 331; or consent of the Division. Familiarity with a computer programming language is strongly advised.
**Note:** Credit for both Applied Mathematics 413 and 407 will not be allowed.

Applied Mathematics 415 H(3-1T)
*Mathematical Methods*
Mathematical analysis of linear systems. Fourier and Laplace transforms, applications and numerical methods. Functions of a complex variable and applications.
**Prerequisite:** One of Applied Mathematics 311, 307, Mathematics 331, 353, or Applied Mathematics 309.

Applied Mathematics 425 H(3-1T)
*Introduction to Optimization*
**Prerequisites:** Mathematics 311; and Mathematics 353 or Applied Mathematics 309 or Mathematics 331.

Applied Mathematics 433 H(3-1T)
*Mathematical Methods in Physics*
**Prerequisites:** Applied Mathematics 307 or 311 or Physics 321 or 341, Applied Mathematics 309 or Mathematics 353 or 331.

Applied Mathematics 451 H(3-1T)
*Introduction to Mathematical Modelling*
Mathematical formulation, solution and interpretation of real-world problems chosen from various areas. Students may consult the division for typical problem areas for any given year.
**Prerequisites:** Mathematics 311 or Applied Mathematics 311; and Mathematics 353 or Applied Mathematics 309 or Mathematics 331; or consent of the Division.

Applied Mathematics 481 H(3-1T)
*Introduction to Mathematical Finance*
Introduction to financial markets and derivatives, asset price random walks, Black-Scholes option pricing model, American options and other generalizations.
**Prerequisites:** Mathematics 323 and 353.

Applied Mathematics 483 H(3-1T)
*Computational Methods in Mathematical Finance*
Review of financial models, Monte-Carlo simulation, binomial and trinomial trees, finite-difference method, aspects of time series and parameter estimation, volatility modelling and estimation.
**Prerequisites:** Applied Mathematics 481 and 491.
**Corequisite:** Applied Mathematics 493.

Applied Mathematics 491 H(3-1T)
*Numerical Analysis I*
Interpolation and approximation, numerical integration, numerical methods for the solution of nonlinear equations, systems of linear equations and the eigenvalue problem.
**Prerequisites:** Mathematics 311, 349, and 353 or Applied Mathematics 309, and Computer Science 231 or 215; or consent of the Division.
**Note:** Not open to students with credit in Computer Science 491.

Applied Mathematics 493 H(3-1T)
*Numerical Analysis II*
Numerical differentiation, numerical solution of ordinary and partial differential equations.
**Prerequisites:** Mathematics 311, 353, Applied Mathematics 311, 413, and 491 or Computer Science 491.
**Corequisite:** Applied Mathematics 371.

Applied Mathematics 501 H(3-0)
*Seminar in Applied Mathematics*
Topics will be chosen according to the interests of instructors and students.
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Mathematics 503 H(3-1T)
*The Mathematics of Wavelets, Signal and Image Processing*
Continuous and discrete Fourier transforms, the Fast Fourier Transform, wavelet transforms, multiresolution analysis and orthogonal wavelet bases, and applications.
**Prerequisite:** Applied Mathematics 491 or Computer Science 491.
**Corequisite:** Applied Mathematics 371.

Applied Mathematics 505 H(3-0)
*Calculus on Manifolds*
Integral and differential calculus on manifolds including tensor fields, covariant differentiation, Lie differentiation, differential forms, Frobenius' theorem, Stokes' theorem, flows of vector fields.
**Prerequisites:** Pure Mathematics 445; and one of Applied Mathematics 311 or 307, or consent of the Division.

Applied Mathematics 507 H(3-0)
*Introduction to Relativity Theory*
**Prerequisites:** Applied Mathematics 505 and consent of the Division.

Applied Mathematics 509 H(3-0)
*Analytical Dynamics*
Symplectic geometry, Hamilton's equation, Hamilton-Jacobi theory, constraints and reduction.
**Prerequisites:** Applied Mathematics 506 and consent of the Division.

Applied Mathematics 581 H(3-0)
*Advanced Futures and Options*
Stochastic calculus and the dynamics of asset prices, martingale theory and risk-neutral valuation, interest rate models, energy and commodity markets, value-at-risk and risk management.
**Prerequisites:** Applied Mathematics 483 and Statistics 407.
**Corequisite:** Statistics 409.

Graduate Courses
In addition to the prerequisites listed below, consent of the Applied Mathematics Division is a prerequisite for all Graduate Courses in Applied Mathematics.

Applied Mathematics 601 H(3-0)
*Topics in Applied Mathematics*
Topics will be chosen according to the interests of instructors and students.
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Mathematics 605 H(3-0)
*Differential Equations III*
**Prerequisite:** Applied Mathematics 411 or equivalent.

Applied Mathematics 613 H(3-0)
*Partial Differential Equations II*
Fundamental solutions, integral equations, eigenvalue problems, non-linear problems.
**Prerequisite:** Consent of the Division.

Applied Mathematics 617 H(3-0)
(formerly Pure Mathematics 617)
*Analysis IV*
Analysis in abstract spaces. Function spaces.
**Prerequisite:** Pure Mathematics 545.

Applied Mathematics 621 Q(2S-0)
*Research Seminar*
Reports on studies of the literature or of current research.
**Note:** All graduate students in Mathematics and Statistics are required to participate in one of
Applied Mathematics 621, Pure Mathematics 621, Statistics 621 each semester.

MAY BE REPEATED FOR CREDIT NOT INCLUDED IN GPA

Applied Mathematics 643 H(3-0)

Perturbation Theory

Perturbation problems for ordinary differential equations, matrices and more general operators. Applications. Methods will be motivated by discussion of physical problems.

Prerequisite: Familiarity with complex variables, linear algebra and differential equations.

Applied Mathematics 671 H(3-0)

Numerical Linear Algebra

Iterative and elimination methods for linear systems of equations, determination of eigenvalues, linear and convex programming.

Prerequisites: Applied Mathematics 441 and 491.

Applied Mathematics 673 H(3-0)

Approximation Theory

Existence, uniqueness of minimal solutions, Haar systems, characterization by alternation, Remez algorithm, monotone operators, spline approximation.

Prerequisites: Applied Mathematics 491 and Pure Mathematics 435.

Applied Mathematics 677 H(3-0)

Numerical Solution of Partial Differential Equations

Explicit and implicit methods for PDE, difference equations.

Prerequisites: Applied Mathematics 311 and 491.

In addition to the numbered and titled courses shown above, the department offers a selection of advanced level Graduate Courses specifically designed to meet the needs of individuals or small groups of students at the advanced doctoral level. These courses are numbered in the series 800.01 to 899.99. Such offerings are, of course, conditional upon the availability of staff resources.

Applied Physics APPH

Instruction offered by members of the Department of Physics and Astronomy in the Faculty of Science.

Department Head R.B. Hicks

Note: For listings of related courses, see Astronomy, Astrophysics, Physics, Medical Physics, and Space Physics.

Senior Courses

Applied Physics 407 H(3-3)

(formerly Applied Physics 507)

Electronics for Scientists

Basic principles of electronics. Active and passive components, feedback, operational amplifiers, digital electronics, interfacing.

Prerequisite: Physics 313 or 323 or 355 or consent of the Department.

Note: Credit for both Applied Physics 407 and either of Applied Physics 509 or Chemistry 513 will not be allowed.

Applied Physics 427 H(3-0)

(formerly Physics 427)

Fundamentals of Radiation Detection

Radiation techniques such as employed in geophysical prospecting, non-destructive testing, agriculture, etc. The basic physical principles involved in the design, construction, and operation of detectors of alpha, beta, gamma rays, and neutrons are investigated. Elements of nuclear spectroscopy using Nal and semi-conductor devices are included. Other topics include C-14 dating and neutron activation. Practical work will replace some lecture periods.

Prerequisites: Physics 325; Applied Mathematics 217 or Mathematics 249 or 251 or 261.

Applied Physics 573 H(3-0)

Atmospheric and Environmental Physics


Prerequisite: Physics 347 or 447 or Chemistry 371 or consent of the Department.

Applied Physics 575 H(3-0)

Optics and Electro-Optics


Prerequisite: Physics 311 or 323 or 355 or consent of the Department.

Applied Physics 599 H(0-9)

Independent Study

Each student will be assigned a project in consultation with a tutor. A written report and oral presentation are required.

Prerequisite: Consent of the Department.

Applied Psychology APSY

Instruction offered by members of the Division of Applied Psychology in the Faculty of Education.

Associate Dean - B. A. Hibbert

Note: Additional Education courses are offered under the course headings Education In-Service, Education Teacher Preparation, and Educational Research.

Note: Only Psychology courses may be used to fulfill the requirements for the Major or Minor in Psychology.

Senior Courses

Note: For all listed prerequisites, "or equivalent" and "or consent of the Division" are assumed.

Applied Psychology 301 H(3-2)

Statistics in Applied Psychology and Education I

An introduction to statistics and research design with particular reference to the treatment of data derived from instructional processes.

Note: Credit towards degree requirements will be given for only one of Anthropology 307, Applied Psychology 301/303, Engineering 319, Political Science 399, Psychology 312, Sociology 311/315, Statistics 201/211, 213/217, 333, 357; that one being a course appropriate to the degree program.

Applied Psychology 303 H(3-2)

Statistics in Applied Psychology and Education II

An intermediate-level study of behavioural statistics and research design relevant to the applied field.

Prerequisite: Applied Psychology 301 or equivalent.

Note: Credit towards degree requirements will be given for only one of Anthropology 307, Applied Psychology 301/303, Engineering 319, Political Science 399, Psychology 312, Sociology 311/315, Statistics 201/211, 213/217, 333, 357; that one being a course appropriate to the degree program.

Applied Psychology 307 H(3-0)

Applied Psychometrics

Introduction to principles of measurement in applied psychology and education.

Note: Not open to students with credit in Psychology 407.

Applied Psychology 311 H(3-0)

Applied Developmental Psychology: Children

Developmental psychology of children, with particular implications for applied psychology and education.

Note: Not open to students with credit in Psychology 351.

Applied Psychology 313 H(3-0)

Applied Developmental Psychology: Adolescence

Developmental psychology of adolescence, with particular implications for applied psychology and education.

Note: Not open to students with credit in Psychology 355.

Applied Psychology 315 H(3-0)

Applied Developmental Psychology: Adult

Developmental psychology of adulthood, with particular implications for applied psychology and education.

Applied Psychology 321 H(3-0)

Introduction to Counselling Psychology

An introduction to theory and practice in counselling psychology.
Courses of Instruction

Applied Psychology 323  H(2-1)

Communicating Across Cultures

Interpersonal communication theory and practice to support cultural diversity in education and applied psychology.

Applied Psychology 325  H(3-0)

Human Sexuality: Psychological Issues and Problems

Studies in the psychology of human sexual behaviour.

Applied Psychology 327  H(2-2)
(formerly General Studies 305)

Career Management

An introduction to the practical and theoretical aspects of career planning, higher education and managing career transitions. Provides students with both theoretical understanding and practical skills pertinent to managing their careers.

Applied Psychology 341  H(3-0)

Introduction to School Psychology

Introduction to theory and practice in school psychology.

Applied Psychology 361  H(3-0)

Introduction to the Education of Students with Exceptional Needs

An introduction to exceptional children, covering a range of exceptionality. Emphasis on serving children with special needs in the regular classroom.

Applied Psychology 411  H(3-0)

Cognition and Learning in Applied Psychology

Introduction to cognitive processing and skill acquisition in applied settings.

Note: Not open to students with credit in Psychology 365.

Applied Psychology 413  H(2-1)

Assessment of Classroom Learning

Assessment and evaluation of student learning and achievement.

Applied Psychology 415  H(3-0)

Applied Psychology of Motivation

An examination of the dynamics of behaviour basic to understanding how people are motivated.

Applied Psychology 417  H(3-0)

Psychology of Adjustment

A study of the social and psychological adjustments that individuals make to meet the challenges of life.

Applied Psychology 419  H(1-2)

Communication Skills in Guidance and Counselling

The application of communication skills to interpersonal relationships in counselling psychology.

Applied Psychology 421  H(3-0)

Psychosocial Interventions

A systematic survey of pupil personnel services in instructional settings; an analysis of approaches to facilitating human development in instructional settings.

Applied Psychology 427  H(3-0)

Stress and Burnout

Organizational structure and the individual as sources of stress and "burn out" in the helping professions; methods of preventing and coping with "burn out."

Applied Psychology 461  H(3-0)

Psycho-educational Assessment of Exceptional Students

Theory and practice of the use of standardized diagnostic measures in psycho-educational assessment.

Applied Psychology 521  H(2-7)

Practicum in Guidance

Supervised practice in psycho-educational interventions in schools and applied psychology settings.

Prerequisites or Corequisites: Applied Psychology 419 and 421 or consent of the Division.

Applied Psychology 565  H(3-0)

Psychology and Education of Children and Youth with Emotional and/or Behavioural Problems

Study of the psychology of children with emotional and/or behavioural problems, with emphasis on educational strategies.

Prerequisite: Applied Psychology 361 or equivalent or consent of the Division.

Note: Not open to students with credit in Psychology 359.

Applied Psychology 569  H(3-0)

Psychology and Education of Children with Learning Problems

Definition, diagnosis, educational remediation and management of learning problems in children.

Prerequisite: Applied Psychology 361 or equivalent or consent of the Division.

Applied Psychology 571  H(3-0)

Psychology and Education of Gifted and Talented Individuals

Definition, screening, identification, special educational provisions for gifted and talented individuals.

Prerequisite: Applied Psychology 361 or equivalent or consent of the Division.

Applied Psychology 593  H(3S-0)

Seminar: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 597  H(1-3)

Planning and Implementing Programs for Small Group Instruction

Practicum in identifying levels of performance, designing and implementing educational interventions for a small group of students with exceptional needs.

Prerequisite: Applied Psychology 361 or equivalent or consent of the Division.

Applied Psychology 599  H(1-3)

Planning and Implementing Programs for Whole Class Instruction

A practicum in the application of strategies for whole class instruction, including behaviour management, arranging the classroom environment, planning, scheduling and record keeping, curriculum differentiation, program design, and collaboration.

Prerequisite: Applied Psychology 361 or 461 or 597 or equivalent or consent of the Division.

Graduate Courses

Note: Graduate Courses within the Division of Applied Psychology can be taken only with consent of the Division of Applied Psychology and in specific cases additional requirements may be necessary (see below).

Applied Psychology 601  H(3-3)

Psychological Assessment of Adults

Seminars and related experiences in laboratory and field settings in the administration, scoring and interpretation of psychological tests/assessments with adults.

Prerequisite: Applied Psychology 315 or equivalent and consent of the Division.

Applied Psychology 603  H(3-0)

Ethics in Applied Psychology

Ethical and legal issues in Applied Psychology. Professional issues in practice settings.

Prerequisite: Consent of the Division.

Applied Psychology 605  H(3-2)

Research Design and Statistics in Applied Psychology

Research design and statistics, including methods for research in applied psychology and related laboratory instruction.

Applied Psychology 607  H(3-2)

Research in Applied Psychology - Multivariate Analysis

Research design and statistics in applied psychology, with special reference to large sample techniques.

Prerequisites: Applied Psychology 301 and 303 or equivalents.

Applied Psychology 611  H(3-2)

Qualitative Research Methodologies

Advanced study of qualitative research methods for use in applied psychology and education.

Prerequisites: Applied Psychology 301 and 303 or consent of the Division.

Applied Psychology 619  H(3-0)
(formerly Applied Psychology 609)

Counselling Girls and Women

Sex role development; stereotyping and social roles; counselling theories; counselling approaches.

Applied Psychology 621  H(2-2)

Creating a Working Alliance

Theory and practice in developing skills contributing to working alliance and problem clarification. Ethical,
<table>
<thead>
<tr>
<th>Course Name</th>
<th>Prerequisite or Corequisite</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Psychology 623</td>
<td></td>
<td>H(3-0)</td>
<td>iska: History and systems involved in counselling psychology and client change.</td>
</tr>
<tr>
<td>Theory in Counselling</td>
<td></td>
<td></td>
<td>Prerequisite: Consent of the Division.</td>
</tr>
<tr>
<td>Applied Psychology 625</td>
<td></td>
<td>H(3-0)</td>
<td>Cultural Influences on Professional Practice An examination of cultural influences on theory and practice in applied psychology.</td>
</tr>
<tr>
<td>Prerequisite: Consent of the Division.</td>
<td></td>
<td></td>
<td>iska: Consent of the Division.</td>
</tr>
<tr>
<td>Applied Psychology 627</td>
<td></td>
<td>H(3-1)</td>
<td>Group Processes in Applied Psychology Theory of group practice in applied psychology, with experiential laboratory.</td>
</tr>
<tr>
<td>Applied Psychology 629</td>
<td></td>
<td>H(3S-2)</td>
<td>Theory and Applications: Selected Topics MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Prerequisite: Consent of the Division.</td>
<td></td>
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<td>iska: Consent of the Division.</td>
</tr>
<tr>
<td>Applied Psychology 631</td>
<td></td>
<td>H(3-0)</td>
<td>Theories of Career Development Study of career development theory and related research; implications for the applied field.</td>
</tr>
<tr>
<td>Applied Psychology 633</td>
<td></td>
<td>H(2-2)</td>
<td>Career Counselling Laboratory and field experiences in career counselling with related seminars.</td>
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<tr>
<td>Applied Psychology 637</td>
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<td>H(3-0)</td>
<td>Relationship Counselling Review of theory and systems in marriage and family counselling. Structured observation activities.</td>
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<tr>
<td>Applied Psychology 640 or consent of the Division.</td>
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<td></td>
<td>Prerequisite: Applied Psychology 631.</td>
</tr>
<tr>
<td>Prerequisite: Applied Psychology 661 or equivalent.</td>
<td></td>
<td></td>
<td>iska: Consent of the Division.</td>
</tr>
<tr>
<td>Applied Psychology 667</td>
<td></td>
<td>H(3-3)</td>
<td>Play Therapy Theory and Process The theoretical foundations and basic orientation necessary to understand and use play as therapy are outlined, along with the developmental underpinnings of play in children and the basic principles upon which child-centered play therapy is built.</td>
</tr>
</tbody>
</table>

**Courses of Instruction**

**Applied Psychology**

legal and professional issues are the context for the application of generic counselling skills in laboratory experiences.

**Prerequisite:** Applied Psychology 419 or consent of the Division.

**Prerequisite or Corequisite:** Applied Psychology 623.

**Note:** Not open to unclassified students.

**Applied Psychology 623**

**H(3-0)**

Theory in Counselling

History and systems involved in counselling psychology and client change.

**Prerequisite:** Consent of the Division.

**Applied Psychology 625**

**H(3-0)**

Cultural Influences on Professional Practice

An examination of cultural influences on theory and practice in applied psychology.

**Prerequisite:** Consent of the Division.

**Applied Psychology 627**

**H(3-1)**

Group Processes in Applied Psychology

Theory of group practice in applied psychology, with experiential laboratory.

**Applied Psychology 629**

**H(3S-2)**

Theory and Applications: Selected Topics

**MAY BE REPEATED FOR CREDIT**

**Applied Psychology 631**

**H(3-0)**

Theories of Career Development

Study of career development theory and related research; implications for the applied field.

**Applied Psychology 633**

**H(2-2)**

Career Counselling

Laboratory and field experiences in career counselling with related seminars.

**Prerequisite:** Applied Psychology 631.

**Applied Psychology 637**

**H(3-0)**

Relationship Counselling

Review of theory and systems in marriage and family counselling. Structured observation activities.

**Prerequisite or Corequisite:** Applied Psychology 640 or consent of the Division.

**Applied Psychology 639**

**H(2-2)**

Counselling Interventions

Theory and practice in planning and implementing client change interventions; the application of counselling interventions in laboratory experiences.

**Prerequisites:** Applied Psychology 621 and 623 or consent of the Division.

**NOT INCLUDED IN GPA**

**Applied Psychology 640**

**F(2-7)**

Practicum in Counselling Psychology

Supervised counselling experience and related seminars.

**Prerequisites:** Applied Psychology 621, 623, 625 and either 601 or 685 and consent of the Division.

**Applied Psychology 641**

**H(3-0)**

Development, Learning and Cognition - Child and Adolescence

The interactions of development, learning and cognition in childhood and adolescence.

**Applied Psychology 642**

**H(3-0)**

Development, Learning and Cognition - Adult

The interactions of development, learning and cognition in childhood and adulthood.

**Applied Psychology 643**

**H(3-0)**

Cognitive Processes

The nature and development of cognitive processes related to intelligence and creativity.

**Applied Psychology 647**

**H(3-0)**

Instructional Psychology

Examination of models of instruction in relation to motivation and cognition. Analysis and evaluation of selected models of instruction with reference to the empirical literature.

**Applied Psychology 649**

**H(3-0)**

Advanced Study of Learning Theories

An analysis of contemporary learning theories relevant to school learning.

**Applied Psychology 653**

**H(3-0)**

Applied Developmental Psychology: Child

Principles and foundations of social and cognitive development in infancy, early childhood and middle childhood and their implications for learning and education.

**Applied Psychology 655**

**H(3-0)**

Applied Developmental Psychology: Adolescence

Theory and applications in human development during adolescence.

**Applied Psychology 659**

**H(3-0)**

Applied Social Psychology

Study of the influence of other people on the individual in applied settings.

**Applied Psychology 661**

**H(3-0)**

Psychological Foundations of Student Exceptionality

Major trends, developments, theoretical foundations, and current practices and challenges relative to the education of students with diverse learning needs.

**Applied Psychology 663**

**H(2-2)**

Consultation and Collaboration for Students with Special Needs

Examination of current theory, issues and practice of the consultative role of special educators in the school. Practicum is based upon within school implementation of a consultation model.

**Applied Psychology 667**

**H(3-3)**

Assessment of Students with Exceptional Learning Needs

Theory and practice in school-based academic and social-emotional assessment techniques and strategies for use with students with diverse learning needs. Laboratory and field experiences.

**Prerequisite:** Applied Psychology 661 or equivalent.

**Applied Psychology 671**

**H(1-3)**

Practicum in School-based Interventions for Children and Youth with Exceptional Learning Needs: I

Practicum in educational interventions for children and adolescents with special learning needs. Focus on general assessment, analysis, intervention, and strategies in applied settings.

**Prerequisite:** Applied Psychology 661 or equivalent.

**Applied Psychology 673**

**H(3-3)**

Practicum in School-based Interventions for Children and Youth with Exceptional Learning Needs: II

Advanced practicum in educational interventions for children and adolescents with special learning needs. Focus on specialized assessment, analysis, interventions, and strategies in applied settings.

**Prerequisite:** Applied Psychology 671 or equivalent.

**Applied Psychology 677**

**H(3-0)**

Play Therapy Theory and Process

The theoretical foundations and basic orientation necessary to understand and use play as therapy are outlined, along with the developmental underpinnings of play in children and the basic principles upon which child-centered play therapy is built.

**Applied Psychology 679**

**H(3-0)**

Fundamentals of Solution-Oriented Therapy

Provides a working knowledge of the theory and practice of solution-oriented therapy and related models.

**Applied Psychology 681**

**H(3-2)**

Psychometric Theory and Practice in Applied Psychology

In-depth study of classical and modern techniques of measurement, assessment and evaluation in applied psychology and education.

**Applied Psychology 683**

**H(3-0)**

Psychology of Childhood Disorders

Study of theory and research in child and adolescent psychopathology.

**Prerequisite:** Consent of the Division.

**Applied Psychology 685**

**H(3-4)**

Individual Psychological Assessment of Children and Adolescents

Individual intellectual assessment, behavioural assessment, ecologically based assessment in laboratory and field settings.

**Prerequisites:** Applied Psychology 311 or 313 or equivalent and consent of the Division.
Courses of Instruction

Applied Psychology 687  
**H(1-5)**
**Applied Psychology Practicum: Childhood Disorders**
Practicum in interventions dealing with emotional and behavioural problems in children and adolescents.
**Prerequisites:** Applied Psychology 683 and consent of the Division.
**Note:** Not open to unclassified students.

Applied Psychology 688  
**F(3-8)**
**Practicum in School Psychology**
Practicum in school psychology; seminar on theoretical and professional issues in assessment and intervention. Development of competence in formulating intervention programs in the context of a consultation model.
**Prerequisites:** Applied Psychology 685 and consent of the Division.
**Prerequisites or Corequisites:** Applied Psychology 683 and 687.
**Note:** Not open to unclassified students.

Applied Psychology 691  
**Q(1.5S-0)**
**Graduate Seminar: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Psychology 692  
**F(3S-0)**
**Graduate Seminar: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Psychology 693  
**H(3S-0)**
**Graduate Seminar: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Psychology 694  
**F(1S-3)**
**Graduate Practicum: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Psychology 695  
**H(1S-3)**
**Graduate Practicum: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Psychology 701  
**H(3-0)**
**Advanced Research Design and Statistics in Applied Psychology**
Advanced study of research designs and their problems, particularly non-experimental and field research in applied contexts.

Applied Psychology 703  
**H(3-0)**
**Advanced Seminar in Applied Psychology**
Doctoral seminar in issues in applied psychology. Dissertation development.
**NOT INCLUDED IN GPA**

Applied Psychology 705  
**H(3-0)**
**Advanced Seminar in Special Education I**
Advanced study of theoretical, empirical, and practical issues affecting individuals with exceptional learning needs.
**Prerequisite:** Applied Psychology 661 or equivalent.

Applied Psychology 707  
**H(3-0)**
**Advanced Seminar in Special Education II**
Special topics in special education.
**Prerequisite:** Applied Psychology 705 or consent of the Division.

Applied Psychology 709  
**H(3-0)**
**Advanced Seminar in Applied Learning and Developmental Psychology I**
Advanced study of theory and practice in human development and learning.

Applied Psychology 711  
**H(3-0)**
**Advanced Seminar in Applied Learning and Developmental Psychology II**
Special topics in applied learning and developmental psychology.
**Prerequisite:** Applied Psychology 709 or consent of the Division.

Applied Psychology 713  
**H(3-0)**
**Advanced Seminar in School Psychology I**
Advanced study of school psychology theory and research.

Applied Psychology 715  
**H(2-7)**
**Advanced Practicum in School Psychology I**
School and community placements for the advanced study of school psychology; related campus seminar.
**NOT INCLUDED IN GPA**

Applied Psychology 717  
**H(2-7)**
**Advanced Practicum in School Psychology II**
Advanced, special placement practicum in school psychology, with related seminars.
**Prerequisite:** Applied Psychology 715 or consent of the Division.
**NOT INCLUDED IN GPA**

Applied Psychology 719  
**H(3-0)**
**Advanced Seminar in School Psychology II**
Selected topics in school psychology.
**Prerequisite:** Applied Psychology 713 or consent of the Division.

Applied Psychology 723  
**H(2-7)**
**Advanced Practicum in Special Education I**
Advanced, special placement practicum in special education, with related seminars.
**NOT INCLUDED IN GPA**

Applied Psychology 725  
**H(2-7)**
**Advanced Practicum in Special Education II**
Advanced, special placement practicum in special education, with related seminars.
**Prerequisite:** Applied Psychology 723 or consent of the Division.
**NOT INCLUDED IN GPA**

Applied Psychology 740  
**F(3-0)**
**Advanced Seminar in Counselling Psychology**
Advanced study of counselling psychology theory and research.

Applied Psychology 742  
**F(2-7)**
**Advanced Practicum in Counselling**
Advanced practicum in counselling psychology, and related seminars.
**NOT INCLUDED IN GPA**

Applied Psychology 743  
**F(3-0)**
**Advanced Seminar: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Psychology 745  
**H(3S-0)**
**Graduate Seminar: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Psychology 751  
**F(1S-3)**
**Advanced Practicum: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Applied Psychology 753  
**H(1S-3)**
**Advanced Practicum: Selected Topics**
**Prerequisite:** Consent of the Division.
**MAY BE REPEATED FOR CREDIT**

Archaeology 201  
**H(3-3)(Area III)**
**Introduction to Archaeology**
Basic principles of archaeology. How archaeological remains are located, recovered and interpreted.

Archaeology 203  
**H(3-3)(Area III)**
**An Introduction to Physical Anthropology**
Survey of the major subfields of physical anthropology including evolution, human paleontology, genetics, osteology and variation, and techniques of data collection.
Courses of Instruction

Archaeology 205  H(3-0)(Area II)
Ancient Peoples and Places
An overview of Old and New World archaeology; the emergence of humans; development of humans and culture from hunting/gathering to agricultural and ancient urban societies.

Senior Courses

Archaeology 303  H(3-0)(Area II)
Archaeology of North America
Prehistoric cultural developments in North America.

Archaeology 305  H(3-0)(Area II)
Human Variation and Adaptation
Some of the major problems involved in interpreting modern and recent human diversity. Emphasis is placed on the interaction between human cultural and biological systems and on cultural influences upon human biological diversity. Factors important to archaeological interpretation will be stressed.
Prerequisite: Archaeology 203 or Biology 231 or 205.

Archaeology 306  F(0-7)(Area III)
Field Course in Archaeological Techniques
Practical application of modern field techniques in archaeology, including excavation, recording and analysis of sites, artifacts and related materials. (Advanced students are referred to Archaeology 506.)
Prerequisite: Consent of the Department.
Note: Normally offered during the Spring and/or Summer Sessions.

Archaeology 307  H(3-0)(Area II)
Introduction to Ethnoarchaeology
Ethnoarchaeology and analogical reasoning in archaeology. Survey of theoretical approaches and field methods. Case studies in several domains of material culture worldwide. Actual and potential contributions to archaeology and anthropology.
Prerequisite: Archaeology 201 or consent of the Department.

Archaeology 311  H(0-6)(Area III)
Archaeological Survey
Practical use of methods and techniques employed in the location, identification, and evaluation of archaeological sites.
Prerequisite: Archaeology 201 or consent of the Department.
Note: This is a field course and students should plan their program to allow adequate travel time to and from the location of the survey. Transportation is provided.

Archaeology 325  H(3-0)(Area II)
Ancient Civilizations
The rise and achievements of the earliest civilizations in both the Old and New Worlds. Emphasis will be placed on the civilizations of Mesopotamia, Egypt, India, China, Mesoamerica and the Andes.

Archaeology 341  H(3-0)(Area II)
Ancient Mexico
Ancient cultures of Mexico, excluding the Maya, from their beginnings to the historic period.

Archaeology 343  H(3-0)(Area II)
The Ancient Maya
Ancient Maya, from their beginnings to the historic period. Emphasis on the Classic Maya civilization, from AD 200-900.
Prerequisite: Archaeology 201 or 205 or consent of the Department.

Archaeology 345  H(3-0)(Area II)
Indians of Middle America
Traditional native cultures of Middle America. Emphasis is on technology, social organization, economic systems, religions, arts and languages, particularly in the culture centres of Mexico.
Prerequisite: One Archaeology or Anthropology course.

Archaeology 347  H(3-0)(Area II)
Regional Studies in Latin American Archaeology
Content varies according to region in Latin America where course is taught. A general survey of the archaeology of the region and an intensive look at the archaeology of the immediate vicinity, including visits to sites and museums. Individual and group study are interspersed with formal instruction.
Prerequisite: Consent of the Department.
Note: This course is offered only during Spring and/or Summer Sessions.

Archaeology 351  H(3-0)(Area II)
Archaeology of South America: The Lowlands and the Northern Andes
Prehistoric cultural development in the tropical areas of South America with particular emphasis on the Amazon Basin.
Prerequisite: Archaeology 201 or 205 or consent of the Department.

Archaeology 353  H(3-0)(Area II)
Archaeology of South America: The Central Andes
The rise of civilization in the Peruvian and Bolivian Andes. Beginning with the first hunting cultures before 8000 B. C., this course reviews the major events and cultural processes which ultimately led to the development of the Inca civilization.
Prerequisite: Archaeology 201 or 205 or consent of the Department.

Archaeology 355  H(3-0)(Area II)
Indians of South America: The Lowlands and the Northern Andes
A survey of the culture and linguistics of aboriginal South America, with emphasis on the lowland regions.

Archaeology 357  H(3-0)(Area II)
The Incas and Their Successors
Traditional cultures of the Ecuadorian, Peruvian and Bolivian Andes. Special emphasis is placed on the social, political and economic organizations of the Inca empire.

Archaeology 375  H(3-1)(Area II)
Museology
An overview of the history, philosophy and organization of museums and their role in the contemporary world. Practical aspects of financing, visitor research, and exhibits as well as acquisition, cataloging, processing and curating of museum specimens are explored in cooperation with city museums.

Archaeology 399  H(3-0)(Area III)
Ethnohistory of Africa
The ethnohistory of the area. Emphasis will be placed on a study of the material culture of non-industrial societies both in the present and the recent past, language distribution, oral tradition and other aspects of ethnohistory.

Archaeology 401  H(3-0)(Area II)
Archaeology of the Near East
An overview of the archaeology of the Near East.
Prerequisite: Archaeology 201 or 205 or consent of the Department.

Archaeology 409  H(3-0)(Area II)
Prehistory of Europe
A survey of the prehistoric archaeology of Europe.
Prerequisite: Archaeology 201 or 205 or consent of the Department.

Archaeology 413  H(3-2)(Geography 413)
Soil Characteristics and Formation
Characteristics of soils and the processes and factors of soil formation. Soil development related to geomorphic materials, geomorphic events, anthropogenic sources, and erosional and depositional landscapes.
Prerequisite: Geography 313 or consent of the Department.

Archaeology 415  H(0-6)(Area III)
Lithic Technology
Study and analysis of tools and other artifacts, including their forms, methods of manufacture and use.
Prerequisite: Archaeology 201.
Note: Until August 15, preference in enrollment is given to students who have declared a major in Archaeology.

Archaeology 417  H(0-6)(Area III)
Zoarchaeology
The study and analysis of osteological remains used in reconstructing the subsistence strategies of past peoples.
Prerequisite: Archaeology 201.
Note: Until August 15, preference in enrollment is given to students who have declared a major in Archaeology.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>H(3-0)(Area)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archaeology 419</td>
<td>Ethnography of the Great Plains</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Archaeology 201 or 205 or consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 421</td>
<td>Archaeology of the Great Plains</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Archaeology 201 or 205 or consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 422</td>
<td>Archaeology of the Arctic</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 427</td>
<td>Archaeology of Northwestern North America</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Archaeology 201 or 205 or consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 431</td>
<td>Oceanic Prehistory</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 433</td>
<td>Archaeology of Eastern North America</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 451</td>
<td>Introduction to Method and Theory</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Archaeology 201.</td>
</tr>
<tr>
<td>Archaeology 453</td>
<td>Fundamentals of Geoarchaeology</td>
<td>H(3-3)(Area III)</td>
<td></td>
</tr>
<tr>
<td>Archaeology 471</td>
<td>Ceramic Analysis</td>
<td>H(3-2)(Area III)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 493</td>
<td>Problems of Homininid Evolution</td>
<td>H(3-0)(Area III)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 501</td>
<td>Practical Problems in Archaeological Interpretation</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Archaeology 201 or 205 or consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 503</td>
<td>Gender in Prehistory</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 505</td>
<td>Topics of Debate</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 506</td>
<td>Advanced Archaeological Field Techniques</td>
<td>F(0-7)(Area III)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 509</td>
<td>Computer Applications in Archaeology</td>
<td>H(3-1)(Area III)</td>
<td></td>
</tr>
<tr>
<td>Archaeology 511</td>
<td>Mesoamerican Writing Systems</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 513</td>
<td>Comparative Writing Systems</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 517</td>
<td>Special Topics in Archaeology</td>
<td>H(3-0)(Area III)</td>
<td>(formerly Archaeology 531.41)</td>
</tr>
<tr>
<td>Archaeology 521</td>
<td>Maya)</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 531</td>
<td>Special Topics in Archaeology</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 533</td>
<td>Special Topics in Archaeology</td>
<td>H(3-0)(Area III)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
<tr>
<td>Archaeology 535</td>
<td>Circum-Caribbean Archaeology and History</td>
<td>H(3-0)(Area II)</td>
<td>Prerequisite: Consent of the Department.</td>
</tr>
</tbody>
</table>

Courses of Instruction

Prerequisites:
- Archaeology 201 or Geography 201 or Geology 201 or consent of the Department.

Note: Not open to students with credit in Archaeology 527.

Prerequisite: Archaeology 201 or Geography 201 or consent of the Department.

Note: Not open to students with credit in Archaeology 527.

Prerequisite: Consent of the Department.

Prerequisite: Consent of the Department.

Prerequisites: Archaeology 301 or 306.

Note: Not open to students with credit in Archaeology 531.61.

Note: Open to graduate students or students admitted to the Honours program.

Prerequisite: Consent of the Department.

Note: List of courses on the Honours program.

Prerequisite: Consent of the Department.

MA Y BE REPEATED FOR CREDIT

Prerequisite: Consent of the Department.

This course is offered periodically to meet special needs of students or visiting faculty members.

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Note: Not open to students with credit in Archaeology 531.61.
### Courses of Instruction

**Archaeology 555**  
H(3-2)(Area III)  
**Human Osteology**  
Introduction to identification and interpretation of human skeletal and dental remains. Emphasis is on functional anatomy and reconstruction of prehistoric lifeways.  
**Prerequisite:** Archaeology 203 or consent of the Department.  
**Note:** Not open to students with credit in Anthropology 613.  
**Note:** Until August 15, preference in enrollment is given to students who have declared a Major in Archaeology or Anthropology.  
**Archaeology 555 H(3S-0)(Area III)**  
$\text{Independent Research (BSc)}$  
Thesis normally required of Honours BSc students and also open for credit to other undergraduate Majors. Students are expected to carry out an analytical research project on a subject acceptable to the Department and to produce a final report written in a professional manner. Normally the project will be directed by one staff member who will consult with another staff member in arriving at an evaluation of the report.  
**Prerequisite:** Consent of the Department.

**Archaeology 579**  
H(3S-0)(Area II)  
**Independent Reading Course**  
An independent reading course for archaeology Majors. Each student is required to choose reading in consultation with an advisor.  
**Prerequisite:** Consent of the Department.

**Archaeology 598**  
F(3S-0)(Area II)  
**Independent Research (BA)**  
Thesis normally required of Honours BA students and also open for credit to other undergraduate Majors. Students are expected to carry out a research project in a subject acceptable to the Department and to produce a final report written in a professional manner. Normally, the project will be directed by one staff member who will consult with another staff member in arriving at an evaluation of the report.  
**Prerequisite:** Consent of the Department.

**Archaeology 599**  
H(3-0)(Area III)  
**Independent Readings in Archaeology**  
An independent reading course for archaeology majors. Emphasis will be on the methodological, technical and scientific literature relating to archaeological interpretation. Each student is required to choose reading in consultation with an advisor.  
**Prerequisite:** Consent of the Department.

**Graduate Courses**

**Archaeology 601**  
H(3-0)  
**Theoretical Foundations**  
The philosophy of science, the history of anthropological theory, and a survey of contemporary theoretical approaches in anthropology. Throughout, the relevance to and connections with the subdisciplines of archaeology and biological anthropology will be emphasized.  
**Prerequisite:** Consent of the Department.

**Archaeology 603**  
H(3S-0)  
**Seminar on Special Topics**  
Intensive study of special problems of particular interest to Archaeology Department graduate students. Subject matter for any particular year to be left to the discretion of the Department.  
**Prerequisite:** Consent of the Department.  
**MAY BE REPEATED FOR CREDIT**

**Archaeology 605**  
H(3-2)  
**Advanced Zooarchaeology**  
Specialized techniques of zooarchaeological analysis employed in research areas including site seasonality, aging and sexing, paleo-environmental reconstruction and identification techniques for non-mammalian species.  
**Prerequisite:** Archaeology 417 or equivalent.

**Archaeology 607**  
H(0-6)  
**Interpretation in Lithic Analysis**  
Lithic analysis methodology, including issues such as reduction stage analysis, usewear and residue analysis, material sourcing, replication, and spatial patterning. The use of lithic remains in interpretation of the social behaviour of archaeological cultures.  
**Prerequisite:** Consent of the Department.

**Archaeology 609**  
H(3S-0)  
(Anthropology 609)  
( Geography 609)  
**Human Ecological Systems**  
The development of human ecology, its current directions and application of analytical techniques as they apply to anthropology, archaeology and geography.  
**Prerequisite:** Consent of the Department.

**Archaeology 611**  
H(3-2)  
**Advanced Geoarchaeology**  
Critical evaluation of case studies and field examples to explore analytical methods and interdisciplinary theoretical approaches used in geoarchaeology. Field and laboratory projects will be accompanied by seminar discussions of methodological and analytical approaches to geoarchaeology.  
**Prerequisite:** Consent of the Department.

**Archaeology 613**  
H(3-1S-2)  
**Analysis of Human Skeletal Remains**  
Methods of analyzing human remains from archaeological contexts with emphasis on identification and description. Lecture, lab and weekly seminar directed to Archaeology graduate students who have not had a previous course in human osteology.  
**Prerequisite:** Consent of the Department.  
**Note:** Not open to students with credit in Archaeology 555 or 603.07.

**Archaeology 615**  
H(3-0)  
**Topics in Archaeological Theory and Method**  
The history of archaeological theory and contemporary theoretical and methodological approaches used in archaeological research.  
**Prerequisite:** Consent of the Department.

**Archaeology 617**  
H(3-0)  
**Theory and its Application in Biological Anthropology**  
Basic issues in the study of human adaptation with a focus on principles of evolutionary biology as they apply to modern studies. Throughout, a bio-cultural approach will be emphasized.  
**Prerequisite:** Consent of the Department.

**Archaeology 619**  
H(3-0)  
**Advanced Topics in Human Osteology**  
Current developments in interpretation of human skeletal and dental remains. Topics include forensic anthropology, bone biology, and population reconstruction.  
**Prerequisite:** Archaeology 555 or consent of the Department.
Archaeology 621  H(3S-0)
-problems in Ethnoarchaeology

Seminar on selected topics relating to 
ethnoarchaeology.
Prerequisite: Consent of the Department.

Archaeology 623  H(3S-0)
Reconstructing Plains Culture

Archaeological and ethnographic Plains culture and 
the methodological and theoretical issues involved 
in the use of archaeological reconstructions of the 
past. Normally focus will be on the northern Plains.
Prerequisite: Consent of the Department.

Archaeology 625  H(3S-0)
Hunter-Gatherer Adaptations

Intensive study of contemporary and prehistoric 
hunter-gatherer social and economic adaptations.

Archaeology 627  H(3S-0)
Origins of Agriculture

Intensive study of the origins of agriculture 
throughout the world.

Archaeology 637  H(3S-0)
Mesoamerican Archaeology and History

Ancient history of Mesoamerica, emphasizing a 
conjunctive approach based on hieroglyphic, 
historical and ethnohistorical sources as well as on 
archaeological evidence.
Prerequisite: Consent of the Department.

Archaeology 699  H(3S-0)
Conference Course in Technical Writing

Laboratory analysis and report writing.

Archaeology 701  H(3S-0)
Special Topics in World Archaeology

Archaeology of particular geographical areas such as 
Circumpolar, North America, Mesoamerica, 
South America, Africa, Oceania, and Europe and 
Near East.

MAY BE REPEATED FOR CREDIT

Archaeology 703  H(3S-0)
Advanced Seminar in Selected Topics

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

In addition to the numbered and titled courses shown above, the department offers a selection of 
advanced level Graduate Courses specifically 
designed to meet the needs of individuals or small 
groups of students at the advanced doctoral level. 
These courses are numbered in the series 800.01 to 
899.99. Such offerings are, of course, conditional 
upon the availability of staff resources.

Architectural Studies  ARST

A collaborative offering of the Faculties of Communi-
cation and Culture and Environmental Design, For 
information contact the Academic Programs Office, 
220-8343.

Additional interdisciplinary courses are offered under 
the course headings African Studies, Canadian 
Studies, Central and East European Studies, 
Communications Studies, Latin American Studies, 
Law and Society, Leisure, Tourism and Society, 
Museum and Heritage Studies, Northern Planning 
and Development Studies, Science, Technology and 
Society, South Asian Studies, and Women’s 
Studies.

Senior Courses

Architectural Studies 443  H(0-8)

Introductory Studio in Architecture

An introduction to architectural design. Through 
exercises in the manipulation and composition of 
space and form students will develop the foundation 
of basic design skills necessary to pursue more 
advanced architectural design studios.
Note: Credit for both Architectural Studies 443 and 
Environmental Design Architecture 581 will not be 
allowed.
Note: Open only to students enrolled in the 
Architectural Studies Minor program.

Architectural Studies 444  F(0-16)

Studio II in Architecture

An introduction to the application of ordering 
principles of architecture and to the numerous layers 
that contribute to the quality of inhabitation of place 
and space through design. Issues explored include 
the formal, the experiential and the theoretical 
concerns of architectural design in today’s cultural 
context.
Prerequisites: Architectural Studies 443, 451 and 
455.
Note: Credit for both Architectural Studies 443 and 
Environmental Design Architecture 582 will not be 
allowed.
Note: Open only to students enrolled in the 
Architectural Studies Minor program.

Architectural Studies 449  H(3-1)

Building Science and Technology I

Functioning of the building enclosure: demonstration of 
the behaviour of building elements and their sub-
assemblies under differential temperature and 
pressure stresses; fundamentals of acoustics; 
nature and use of building materials; response of 
building materials to climatic cycles radiation, 
precipitation, heating and cooling.
Note: Credit for both Architectural Studies 449 and 
Environmental Design Architecture 511 will not be 
allowed.
Note: Open only to students enrolled in the 
Architectural Studies Minor program.

Architectural Studies 451  H(0-6)

Graphics Workshop I

A skill building course with instruction and 
supervised experience in basic drafting, sketching 
and rendering; principles of perspective, drawing 
and presentation conventions. A variety of 
instruction may be offered to accommodate the 
varied level of student development.

Corequisites: Architectural Studies 443 and 455.
Note: Credit for both Architectural Studies 451 and 
Environmental Design Architecture 541 will not be 
allowed.
Note: Open only to students enrolled in the 
Architectural Studies Minor program.

Architectural Studies 453  H(0-8)

Graphics Workshop II

Instruction and supervised experience in drafting, 
sketching and rendering; drawing and presentation 
conventions. Builds on Architectural Studies 451. A 
variety of instruction may be offered to accommodo-
ate the varied level of student development.
Prerequisites: Architectural Studies 443, 451 and 
455.
Corequisites: Architectural Studies 444 and 461.
Note: Credit for both Architectural Studies 453 and 
Environmental Design Architecture 543 will not be 
allowed.
Note: Open only to students enrolled in the 
Architectural Studies Minor program.

Architectural Studies 455  H(3-0)

Introduction to Design Theories

The contemporary cultural, social and philosophical 
arenas in which architecture exists are examined 
through lectures, readings and seminars. The 
course runs in conjunction with Architectural Studies 
443.
Corequisites: Architectural Studies 443 and 461.
Note: Credit for both Architectural Studies 455 and 
Environmental Design Architecture 521 will not be 
allowed.
Note: Open only to students enrolled in the 
Architectural Studies Minor program.

Architectural Studies 457  H(3-0)

History of Architecture and Human Settle-
ments

A survey history of architecture and human 
settlement from the prehistoric world until the 
present. The first course addresses the pre-modern 
traditions of the major world cultures. The second 
course explores the traditions of the Western world 
from the beginning of the Italian Renaissance until 
the present. The courses will examine the changes 
in world view that have altered the course of 
ar
d

547.01. History of Architecture and Human Settle-
s
547.02. History of Architecture and Human Settle-
s

Architectural Studies 457 and 461.

Note: Credit for both Architectural Studies 457 and 
Environmental Design Architecture 523 or 623 will 
not be allowed.

Note: Open only to students enrolled in the 
Architectural Studies Minor program.

Architectural Studies 461  H(3-0)

Site Planning and Design

Observation gathering, recording and interpreting 
site information. Diagrammatic and pictorial graphic 
expression. Geophysical, biophysical, climatic, 
cultural, social and economic site factors. Sense of 
place. Site analysis, landscape potentials and 
constraints, development factors and criteria are 
discussed and applied to a human settlement 
project. Small and large scale projects are compared.
Courses of Instruction

**Art**

**Prerequisites:** Architectural Studies 443, 451 and 455.

**Corequisites:** Architectural Studies 444 and 453.

**Note:** Credit for both Architectural Studies 461 and any of Architectural Studies 459, Environmental Design 597.01, 597.02 and 645 will not be allowed.

**Note:** Open only to students enrolled in the Architectural Studies Minor program.

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**Art Fundamentals: 2D**

- **Art 231**  
  H(3-3)  
  **Contemporary Art Forms I**  
  Electronic visualization involving computer applications in drawing, painting, and image manipulation.  
  **Prerequisite:** One half course in Art or consent of the Department.

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**Art Fundamentals: 3D**

- **Art 233**  
  H(3-3)  
  **Painting II**  
  Further study and work in painting.  
  **Prerequisite:** Art 351.

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**Art Fundamentals: 3D**

- **Art 233**  
  H(3-3)  
  **Contemporary Art Forms II**  
  An extension of work done in Art 331, using contemporary media.  
  **Prerequisite:** Art 331.

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**Art Fundamentals: 2D**

- **Art 231**  
  H(3-3)  
  **Painting I**  
  Painting on a two-dimensional surface; the use of oils and acrylics.  
  **Prerequisites:** Art 231, 233 and 243.

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**Art Fundamentals: 2D**

- **Art 233**  
  H(3-3)  
  **Painting I**  
  Painting on a two-dimensional surface; the use of oils and acrylics.  
  **Prerequisites:** Art 231, 233 and 243.

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**Junior Courses**

- **Art 209**  
  H(3-3)  
  **Introduction to Art with Children**
  Studio exploration of materials and concepts appropriate for working with children aged 3 to 12.  
  **Note:** Not open to students with credit in Art 210 or 310 or Curriculum and Instruction 310.

- **Art 211**  
  H(3-3)  
  **Applied Concepts in Early Childhood Art**
  Theory and methods of creating meaningful experiences for young children (ages 3-8), with a practical component.  
  **Prerequisite:** Art 209 or consent of the Department.  
  **Note:** Not open to students with credit in Art 210.

- **Art 231**  
  H(3-3)  
  **Drawing I**
  Basic theory and practice of drawing, involving mainly still life and figure projects in monochromatic media.

- **Art 241**  
  H(3-3)  
  **Drawing II**
  Continuation of Art 241, introducing colour media.  
  **Prerequisite:** Art 241.

- **Art 271**  
  H(3-3)  
  **Introduction to Printmaking**
  Basic concepts and techniques in Fine Art Printmaking.

- **Art 273**  
  H(3-3)  
  **Historical Methods in Printmaking**
  Practical experience with selected printmaking media and study of printmaking in varied cultural contexts.

- **Senior Courses**

- **Art 301**  
  H(3-0)  
  **Studies in Contemporary Canadian Art**
  Study of recent Canadian art from a range of perspectives in art criticism.

- **Art 307**  
  H(3-3)  
  **Applied Concepts in Art with Children**
  Theory and methods of creating meaningful art experiences for children aged 6 to 12, with a practical component.  
  **Prerequisite:** Art 209 or consent of the Department.  
  **Note:** Not open to students with credit in Art 310 or Curriculum and Instruction 310.

- **Art 321**  
  H(3-3)  
  **Web Art: Theory and Practice**
  Examination of the work of Web artists and investigation of the Internet as a vehicle to extend art and design practice.

- **Art 331**  
  H(3-3)  
  **Contemporary Art Forms I**
  Electronic visualization involving computer applications in drawing, painting, and image manipulation.  
  **Prerequisite:** One half course in Art or consent of the Department.

- **Art 333**  
  H(3-3)  
  **Contemporary Art Forms II**
  An extension of work done in Art 331, using contemporary media.  
  **Prerequisite:** Art 331.

- **Art 335**  
  H(3-3)  
  **Photography I**
  Fundamental technical and aesthetic considerations in the use of the still camera and silver-based photographic materials; basic use of the microcomputer in support of digital image processing in art.  
  **Prerequisites:** Art 231, 233 and 243.  
  **Note:** Credit for both Art 235 and 335 will not be allowed.

- **Art 337**  
  H(3-3)  
  **Photography II**
  Further work in photography, including intensive use of the variables of exposure, development and printing of photographic materials; exploration of corresponding digital image controls.  
  **Prerequisites:** Art 335 or 235, and 231, 233 and 243.

- **Art 339**  
  H(3-3)  
  **Applied Colour Theory**
  Investigations into the notions and concepts which have determined theories of colour in the visual arts.

- **Art 341**  
  H(3-3)  
  **Drawing III**
  Theory and practice of drawing at an intermediate level involving an extended range of drawing media.  
  **Prerequisites:** Art 231, 233 and 243.

- **Art 343**  
  H(3-3)  
  **Drawing IV**
  Continuation of Art 341 extending the range of concepts and practices.  
  **Prerequisite:** Art 341.

- **Art 345**  
  H(3-3)  
  **Anatomical Drawing I**
  Perceptual and drawing skills pertaining to human anatomical relationships.  
  **Prerequisites:** Art 231, 233 and 243.

- **Art 347**  
  H(3-3)  
  **Anatomical Drawing II**
  Continuation of Art 345. Further study and work in anatomical drawing.  
  **Prerequisite:** Art 345.

- **Art 351**  
  H(3-3)  
  **Painting I**
  Further study and work in painting.  
  **Prerequisite:** Art 351.
### Courses of Instruction

#### Art 373
**Printmaking, Lithography I**
Basic concepts and techniques of lithographic printing.
**Prerequisites:** Art 231, 233 and 243.

#### Art 377
**Printmaking, Serigraphy I**
Basic concepts and techniques of silk-screen printing.
**Prerequisites:** Art 231, 233 and 243.

#### Art 379
**Printmaking, Relief and Intaglio**
Basic concepts and techniques in relief and intaglio printmaking.
**Prerequisites:** Art 231, 233, and 243.

#### Art 381
**Sculpture I**
Development and realization of sculpture with various techniques and materials.
**Prerequisites:** Art 231, 233 and 243.

#### Art 383
**Sculpture II**
Further study and work in sculpture.
**Prerequisite:** Art 381.

#### Art 387
**Sculpture Metal Casting**
The casting of bronze and aluminum as it pertains to Fine Art. Unique and simple reproductive processes in sculpture will be taught.
**Note:** MAY BE REPEATED FOR CREDIT

#### Art 391
**Art for Intermediate and Senior Students I**
Theory and methods of creating meaningful art experiences for students aged 12 to 18, with a practical component.
**Prerequisites:** Art 231, 233 and 243; or consent of the Department.
**Note:** Not open to students with credit in Art 390.

#### Art 393
**Art for Intermediate and Senior Students II**
Development of teaching rationales and strategies for students aged 12 to 18.
**Prerequisites:** Art 231, 233 and 243; or consent of the Department.
**Note:** Not open to students with credit in Art 390.

#### Art 395
**Introduction to Visual Art I**
Studio-centered exploration of materials, processes, and concepts related primarily to two-dimensional art. This is a course for non-majors.
**Note:** Art 395 does not serve as a prerequisite for further study in BFA (Art) or BFA (Developmental Art) programs.

#### Art 397
**Introduction to Visual Art II**
Studio-centered exploration of materials, processes and concepts related primarily to three-dimensional art. This is a course for non-majors.
**Note:** Art 397 does not serve as a prerequisite for further study in BFA (Art) or BFA (Developmental Art) programs.

#### Art 399
**Art in Theory and Practice I**
Theories of art, critical methodologies, and aesthetics in the visual arts.
**Note:** Restricted to BFA (Art), BA (Art History), and BFA (Developmental Art) students.

#### Art 401
**Studies in Contemporary International Art**
Study of recent international art practices from a range of perspectives in art criticism.

#### Art 410
**Contemporary Art Forms III**
Studies in digital visualization involving multimedia software.
**Prerequisite:** Art 331.

#### Art 431
**Contemporary Art Forms IV**
Continuing study in digital visualization and multimedia applications, with an emphasis on extended projects.
**Prerequisite:** Art 331.

#### Art 433
**Photography III**
Investigation of technical and conceptual aspects of Zone System photography; individual study and work in silver-based and microcomputer-based photography.
**Prerequisite:** Art 337.

#### Art 437
**Photography IV**
Continuing work in photography, with emphasis on hand-coated printing media.
**Prerequisite:** Art 435.

#### Art 439
**Introduction to Electronic Media**
Theory and practice of art using electronic media; introduction to technical, aesthetic and conceptual aspects of video and audio art.
**Prerequisite:** One studio half course at the 300 level or consent of the Department.

#### Art 441
**Drawing V**
Drawing at an intermediate level with an increased emphasis on individual initiative and contemporary concepts in defining objectives.
**Prerequisite:** Art 343.

#### Art 443
**Drawing VI**
Continuation of Art 441.
**Prerequisite:** Art 441.

#### Art 451
**Painting III**
Intermediate work in painting intended to increase ability to deal with painting concepts through appropriate media-technical means.
**Prerequisite:** Art 353 or consent of the Department.

#### Art 453
**Painting IV**
Continuation of Art 451.
**Prerequisite:** Art 451.

#### Art 461
**Honours Studio I**
Directed studio research and production.
**Prerequisites:** Enrollment in the BFA Honours (Art) program, and four studio half courses at the 300 level, which must include two in the proposed area of study.

#### Art 463
**Honours Studio II**
Directed studio research and production.
**Prerequisites:** Enrollment in the BFA Honours (Art) program and Art 461.

#### Art 471
**Intermediate Printmaking: Technique**
Intermediate work in printmaking with an emphasis on technique and a concentration in one of the four (relief, etching, silkscreen, lithography) print media.
**Prerequisites:** Two of Art 373, 377 or 379.

#### Art 473
**Intermediate Printmaking: Colour**
Intermediate work in printmaking with an emphasis on colour and a concentration in one of the four (relief, etching, silkscreen, lithography) print media.
**Prerequisites:** Two of Art 373, 377 or 379.

#### Art 481
**Sculpture III**
Problems of three-dimensional form in a variety of materials and techniques.
**Prerequisite:** Art 383.

#### Art 483
**Sculpture IV**
Continuation of Art 481.
**Prerequisite:** Art 481.

#### Art 485
**Sculpture, Three Dimensional Study from the Human Figure I**
An introduction to and development of three dimensional study skills in which the student works directly from the human figure using clay and plaster.
**Prerequisites:** Art 231, 233 and 243 or consent of the Department.
Art 487  H(3-3)
Sculpture. Three Dimensional Study from the Human Figure II
Further study from the human figure together with the introduction of a variety of materials.
Prerequisite: Art 485.

Art 491  H(2-1)
Community-Based Art Experiences I
A seminar and field experience course introducing prospective educators to all facets of planning and implementing positive art experiences in a non-school setting.
Prerequisite: One of Art 211, 307 or 393.

Art 499  H(3-0)
Art in Theory and Practice II
Examination and discussion of theoretical issues associated with current practice in art.
Note: Restricted to BFA (Art), BA (Art History), and BFA (Developmental Art) students.

Art 509  H(3-0)
Curriculum Building for Art
Analysis and development of curriculum structure based on current theory with a field research component.
Prerequisites: Art 211, 307, or 393 and three full courses in Art.
Note: Not open to students with credit in Art 510.

Art 513  H(0-3T)
Directed Study
Prerequisite: Consent of the Department.
MAY BE REPEATED FOR CREDIT

Art 515  H(3S-0)
Designing Programs for Art
A seminar course devoted to the analysis and design of program structures derived from current theory with a field research component.
Prerequisites: Art 211, 307, or 393 and three full courses in Art.
Note: Not open to students with credit in Art 510.

Art 535  H(3-3)
Photography V
Photography for advanced students taking individual directions with special attention to the interrelation of technique and aesthetics.
Prerequisite: Art 437.

Art 537  H(3-3)
Photography VI
Photography for advanced students taking individual directions in black and white and colour photography, with emphasis on the presentation of groups of photographs of related theme or technique.
Prerequisite: Art 535.

Art 541  H(3-3)
Drawing VII
Drawing for advanced students taking individual directions.
Prerequisite: Art 443.

Art 543  H(3-3)
Drawing VIII
Drawing for advanced students taking individual directions.
Prerequisite: Art 541.

Art 551  H(3-3)
Painting V
Painting for advanced students taking individual directions.
Prerequisite: Art 453.

Art 553  H(3-3)
Painting VI
Painting for advanced students taking individual directions.
Prerequisite: Art 551.

Art 560  F(1T-6)
Honours Studio Thesis
Independent studio research and production supported by a research paper, culminating in a Thesis Exhibition.
Prerequisites: Enrollment in the BFA Honours (Art) program and Art 463.
Note: Normally completed concurrently with Art 561/563, but requires a body of studio production distinct from that of Art 561/563.

Art 561  H(3-3)
Honours Senior Studio I
Directed studio research and production.
Prerequisite: Art 463 or consent of the Department.

Art 563  H(3-3)
Honours Senior Studio II
Further directed studio research and production.
Prerequisite: Art 561.

Art 571  H(3-3)
Advanced Printmaking: Technique
Printmaking for advanced students taking individual directions with emphasis on technique.
Prerequisites: Two half courses in 400-level printmaking.

Art 573  H(3-3)
Advanced Printmaking: Colour
Printmaking for advanced students taking individual directions with emphasis on colour.
Prerequisites: Two half courses in 400-level printmaking.

Art 581  H(3-3)
Sculpture V
Sculpture for advanced students taking individual directions. Workshop facilities are available for work in plastics, metal, wood, stone, clay and related materials.
Prerequisite: Art 581.

Art 591  H(2-1)
Community-Based Art Experiences II
A seminar and field experience course in which students take increased individual responsibility for implementation of educational strategies in diverse field settings.
Prerequisite: Art 491.

Art 595  H(3-3)
Studio Research
Independent studio research.
Prerequisite: Consent of the Department.
Corequisite: A studio course at either the 400 or 500 level.
MAY BE REPEATED FOR CREDIT

Graduate Courses

Art 601  H(0-3T)
History of Art I
Individual study: In consultation with the instructor, the student will select a research topic in art history or art criticism.
Prerequisite: Consent of the Department.

Art 603  H(0-3T)
History of Art II
Individual study: In consultation with the instructor, the student will select a research topic in art history or art criticism.
Prerequisite: Art 601 or consent of the Department.

Art 605  H(0-3T)
Critical Study and Research
Individual study and research in the area of studio specialization, critical theory, methodological issues and/or historical topics.
Prerequisite: Consent of the Department.
MAY BE REPEATED FOR CREDIT

Art 619  H(0-3)
Studies at the Banff Centre
Advanced art studies. Although the Banff Centre does not provide credit course instruction, students with advanced experience in art at the Banff Centre may apply for graduate-level credit from the University of Calgary.
Prerequisite: Consent of the Department.
MAY BE REPEATED FOR CREDIT
NOT INCLUDED IN GPA
Courses of Instruction

Art History ARHI

Art History 301 H(3-0) Art of Canada: 1600-1900
Forms and concepts in art in Canada from the Early French and English Colonial periods to 1900.
Prerequisites: Any two of Art History 201/203/205/207 or consent of the Department.

Art History 303 H(3-0) Art of Canada: 1900 to the Present
Forms and concepts in Canadian art from 1900 to the present; the Group of Seven, Nationalism, Regionalism and more recent developments in Canadian art.
Prerequisites: Any two of Art History 201/203/205/207 or consent of the Department.

Art History 305 H(3-0) Architecture of Canada to 1900
A chronological, thematic and regional examination of architectural developments in Canada to c.1900.
Prerequisites: Any two of Art History 201/203/205/207 or consent of the Department.

Art History 309 H(3-0) Architecture of Canada since 1900
A chronological, thematic and regional examination of Canadian architecture since c.1900.
Prerequisites: Any two of Art History 201/203/205/207 or consent of the Department.

Survey of Indigenous Arts
An introduction to the arts of the native peoples of Africa, Oceania, Pre-Columbia and North America. The definitions and roles of art within traditional society will be examined.

Art History 311 H(3-0)

Early Medieval Art: From Early Christianity to the Eleventh Century
A chronological examination of the arts and architecture from the decline of the Roman Empire to the beginning of the Romanesque Age.
Prerequisites: Art History 201 and one of Art History 203/205/207 or consent of the Department.

Art History 313 H(3-0)

High Medieval Art: Romanesque and Gothic
A chronological examination of the arts and architecture from the 11th Century to about 1300 A.D. Special attention will be given to how the Romanesque and Gothic Cathedral reflect the great social, religious and philosophical synthesis of the Age.
Prerequisites: Art History 201 and one of Art History 203/205/207 or consent of the Department.

Art History 319 H(3-0) The Arts of Western Africa
A chronological and stylistic study of the arts of the various Western Sudanic peoples and the early historical cultures found in Mali, Ghana and Nigeria.

Art History 321 H(3-0) The Arts of Central and Southern Africa
A chronological and stylistic study of the arts of central and southern Africa with emphasis upon their cultural context.

Art History 323 H(3-0) Survey of Far Eastern Art: India and Related Civilizations
A chronological examination of the art and architecture of ancient India and related civilizations, with special emphasis on Buddhist, Hindu and Islamic art.

Art History 325 H(3-0)

Survey of Far Eastern Art: China and Related Civilizations
A chronological examination of the art and architecture of ancient China and related civilizations, with special emphasis on Confucian, Taoist and Buddhist art.

Art History 327 H(3-0) Renaissance Art
A chronological examination of the arts and architecture from the Proto-Renaissance in Italy to the threshold of the High Renaissance (c. 1300-1500). Special attention will be given to the artistic cultures of Florence and Flanders.
Prerequisites: Art History 203 and one of Art History 201/205/207 or consent of the Department.

Art History 329 H(3-0) High Renaissance and Mannerism
A chronological examination of the arts and architecture from about 1500 to the end of the 16th Century. Special attention will be given to the key
Art History

Prerequisites: Art History 203 and one of Art History 201/205/207 or consent of the Department.

Art History 357
Italian Baroque Art
A chronological examination of the art and architecture during the 17th Century. Special attention will be given to Rome.
Prerequisites: Art History 203 and one of Art History 201/205/207 or consent of the Department.

Art History 359
Northern Baroque and Rococo Art
A chronological examination of the art and architecture in northern Europe from c. 1600 to 1789.
Prerequisites: Art History 203 and one of Art History 201/205/207 or consent of the Department.

Art History 365
Survey of Far Eastern Art: Japan
A chronological examination of the art and architecture of dynastic Japan, with special emphasis on Shinto and Buddhist traditions.

Art History 367
Native North American Art in its Cultural Context
Survey of the forms and purposes of Native art in Woodlands, Plains, Northwest Coast and Southwest cultures throughout the prehistoric and historic periods and in conjunction with a study of cultural development and change.

Art History 369
Northern and Inuit Sculpture in its Cultural Context
Focus on the three-dimensional artistic expression of the prehistoric to contemporary Eskimo and Inuit of Canada, Greenland and Alaska, based on Arctic cultural history and archaeology.

Art History 405
Late Eighteenth and Early Nineteenth Century Art
A chronological examination of European painting and sculpture from the late eighteenth century through the Romantic period.
Prerequisites: Art History 203 and 205 or consent of the Department.

Art History 407
Mid to Late Nineteenth Century Art
A chronological examination of European painting and sculpture of the Realist, Impressionist and Post-Impressionist periods.
Prerequisites: Two of Art History 201/203/205 or consent of the Department.

Art History 409
Independent Research and Study Abroad
Independent research based upon study of art and monuments in international settings or museums.
Prerequisites: Six half courses in Art History or consent of the Department.
MAY BE REPEATED FOR CREDIT

Art History 411
Selected Topics in the History of Art
Topics to be announced. Possible topics include: The Art of Michelangelo, Surrealism, Abstract Art in Canada, Painting in New York from WW II to Present, Art of the West African Sudan, The Canadian Landscape.

Art History 411.01
Selected Topics in the History of Art I
Prerequisites: Three full-course equivalents in Art History or consent of the Department.

Art History 413
Modern Art: 1880s to the First World War
Forms and concepts in painting, sculpture and architecture from the late 19th century to the advent of the First World War.
Prerequisites: Two of Art History 201/203/205 or consent of the Department.

Art History 415
Modern Art: From the End of the First World War through the 1950s
Study of the forms and concepts in painting, sculpture, and architecture from the end of the First World War through the 1950s.
Prerequisites: Two of Art History 201/203/205 or consent of the Department.

Art History 419
Photography in the Nineteenth Century
Origins of photography and its development as technology and art up to 1900.

Art History 423
Photography in the Twentieth Century
The development of photography from 1900 to the present, with attention to the theory and criticism of photography as an art form.

Art History 425
Architecture in the Western World Since 1900
A survey of the most significant examples of modern architecture, defining their stylistic character in light of developments in technology, the history of ideas, and social and historical factors.
Prerequisites: Art History 201 and 203 or consent of the Department.

Art History 469
Graphic and Textile Arts of the Inuit
An in-depth examination of the graphic and textile arts of the Canadian Inuit, including comparisons with these areas in Alaska and Greenland, based in part on Inuit legends and traditions.
Note: Some background knowledge in Inuit Culture is recommended.

Art History 501
Independent Research in Art History I
Independent research projects for advanced students in art history.
Prerequisites: Five full-course equivalents in Art History and/or consent of the Department.

Art History 503
Independent Research in Art History II
Continuation of Art History 501.
Prerequisite: Art History 501 or consent of the Department.

Art History 509
Independent Research and Study Abroad
Independent research based upon study of art and monuments in international settings or museums.
Prerequisites: Eight half courses in Art History or consent of the Department.
MAY BE REPEATED FOR CREDIT

Art History 511
Seminar in the History of Art
Topics to be announced. Possible topics include: The Art of Bernini, Cubism, The Group of Seven in Canada.
Prerequisites: Four full-course equivalents in Art History including Art History 411, or consent of the Department.
MAY BE REPEATED FOR CREDIT

Graduate Courses

Art History 601
Independent Research in Art History I
Students will select research topics in consultation with the instructor.
Prerequisite: Consent of the Department.

Art History 603
Independent Research in Art History II
Students will select research topics in consultation with the instructor.
Prerequisite: Consent of the Department.

Art History 611
Seminar in Art History
Selected topics in art history.
Prerequisite: Consent of the Department.
MAY BE REPEATED FOR CREDIT

Art History 613
Independent Study in Art History
Prerequisite: Consent of the Department.
MAY BE REPEATED FOR CREDIT

Art History 615
Conference Course in Art History
Specialised study in an area of art history selected on the basis of particular interest and need.
Prerequisite: Consent of the Department.
MAY BE REPEATED FOR CREDIT

Art History 617
Thesis Development
A reading and conference course in the student's research area.
Prerequisite: Consent of the Department.
Astronomy and Trigonometry

Note: For listings of related courses, see Applied Physics, Astrophysics, Physics, Medical Physics, and Space Physics.

†Note: Students who wish to pursue a degree program with an emphasis on Astronomy should consider a program with Astrophysics as the major field.

Junior Courses

Astronomy 205 H(3-0)

The Modern Universe

A comprehensive, descriptive survey of modern astronomy which focuses on the development of our present views of the universe. Topics include: solar system exploration by telescope and spacecraft; the birth and death of stars; the violent interstellar medium; the milky way and other galaxies; cosmic rays, pulsars and supernovae; the concept of a black hole; exploding galaxies and quasars; the beginning and end of the universe; the possibilities of extraterrestrial life and interstellar communication. The opportunity for a field trip to the observatory will be provided. This course is not recommended for physics or science majors.

Note: Not open to students with credit in Astronomy 211.

†Astronomy 211 H(3-1-T)

Fundamentals of Astronomy I

Basic concepts of astronomy with emphasis on our solar system including: spherical astronomy; Newton’s laws and gravitation; time; elements of celestial mechanics; astronomical observation and measurement; telescopes and accessories; the planets and their satellites; the sun and the rest of the solar system. Laboratory exercises will be held at the Rothney Astrophysical Observatory as circumstances permit. Recommended for science majors.

Prerequisites: Pure Mathematics 30 or Mathematics 30.

†Astronomy 213 H(3-1-T)

Fundamentals of Astronomy II

Observations of stars and galaxies and their interpretation. Topics include: distances and motions in the universe; radiation and matter; characteristics of stars and star clusters; the interstellar medium; binary and variable stars; stellar structure and evolution; galaxies and cosmology. Laboratory exercises will be held at the Rothney Astrophysical Observatory as circumstances permit. Recommended for science majors.

Prerequisite: Astronomy 211.

Senior Course

†Astronomy 301 H(3-0)

Archaeo-Astronomy

Astronomy of ancient European, Mid-Eastern, Eastern and New World civilizations. Topics include: the appearance of ancient skies; the movement of the sky and the motions of the sun, moon and planets among the stars; eclipses; ancient observatories; the kind of observations made and the solution methods used by the ancients; time and date measurements; calendars; ancient cosmologies and cosmic myths.

Note: This course contains a significant amount of algebra and trigonometry.

Astrophysics ASTR

Instruction offered by members of the Department of Physics and Astronomy in the Faculty of Science.

Department Head - R.B. Hicks

Note: For listings of related courses, see Applied Physics, Astronomy, Physics, Medical Physics, and Space Physics.

Senior Courses

Astrophysics 401 H(3-0)

Galactic Astrophysics

The galaxy: space distribution of stars and interstellar material; kinematics and dynamics of stellar systems; rotation and spiral structure; classification and global properties of galaxies; active galaxies.

Prerequisites: Astronomy 213, Physics 325, and Mathematics 349 or 351 or Applied Mathematics 311.

Astrophysics 403 H(3-0)

Stellar Structure and Evolution

Observational properties of stars; equations of stellar structure; physics of stellar interiors; structure of main sequence stars; early post-main sequence evolution and the ages of star clusters; advanced evolution phases; final stages of stellar evolution; white dwarfs, neutron stars and black holes.

Prerequisites: Astronomy 213 and Physics 325.

Astrophysics 409 H(3-1)

(formerly Astrophysics 309)

Solar System Astrophysics


Prerequisites or Corequisites: Astronomy 211, Physics 325, and 313 or 323 or 355.

Astrophysics 501 H(3-0)

Stellar Atmospheres

Observational aspects of stellar atmospheres; the equations of transfer of radiation in stellar atmosphere; the Gray atmosphere; the equations of state; opacity, equations of statistical equilibrium; model atmospheres, spectrum line formation, comparison of synthetic spectra with real spectra of stars.

Prerequisite: Astrophysics 403.

Astrophysics 503 H(3-0)

Diffuse Matter in Space

Observations of gas and of grains in our galaxy and other galaxies; interactions amongst interstellar particles; interstellar molecules; distribution, small scale and large scale dynamics of the interstellar medium, formation of stars.

Prerequisite: Astrophysics 501.

Astrophysics 505 H(3-0)

(formerly Astrophysics 405)

Large-Scale Structure and Cosmology

Clusters of galaxies; microwave and X-ray background radiation; dark matter; overview of cosmology; general relativistic considerations; large-scale structure and expansion of the universe; nucleosynthesis.

Prerequisite: Astrophysics 501.

Astrophysics 507 H(1-5)

Senior Astrophysics Laboratory

Lectures and laboratory sessions in observational astronomy, emphasizing methods of observation, data reduction, and analysis. Photometry and spectroscopy will be carried out on telescopes at the Rothney Astrophysical Observatory.

Prerequisite: Astronomy 213.

Prerequisite or Corequisite: Any 400-level Astrophysics course.

Note: Offered in odd-even dated academic years; see also Astrophysics 405.

Graduate Courses

Astrophysics 609 H(3-1)

Advanced Theoretical Astrophysics

Theories of radiation transfer and dynamics with applications to stellar atmospheres, stellar and galactic structure, and the interstellar medium. There will be an emphasis on computational techniques, model development, and comparison with observations.

Astrophysics 611 H(3-0)

Radio Astronomy

Wave propagation, antennas, interferometry, aperture synthesis, radio receivers, and spectrometers. Applications to continuum and line radiation in stars, interstellar medium, and extragalactic objects.

Astrophysics 617 H(3-0)

Advanced Stellar Evolution

Structure and evolution of binary stars, mass transfer and mass loss from the system, angular momentum transfer and angular momentum loss from the system, interacting stellar winds in binary stars; consequences for stellar evolution. Specific aspects of binary evolution that bear on phenomena seen in astrophysics such as the Be-star phenomenon, blue stragglers, cataclysmic variables, pulsars, and x-ray sources. Aspects of evolution common to single as well as multiple-star systems will not be included.

Note: It is expected that a student’s background will include Astrophysics 403 or equivalent.

Astrophysics 621 H(3-0)

High Energy Astrophysics

Interaction of high energy particles with matter, propagation and origin of cosmic rays; structure of white dwarfs and neutron stars; the physics of jets
and the accretion process onto compact objects; supernovae and supernova remnants; active galactic nuclei.

Astrophysics 697 H(3-0) Topics in Contemporary Astrophysics
Topics will be from the research areas of staff members.
MAY BE REPEATED FOR CREDIT

Astrophysics 699 H(0-9) Projects in Astrophysics
Each student will select a project in consultation with a faculty member. The project may be experimental or theoretical in nature. A written report and an oral presentation are required.

Athletic Therapy ATTH
Instruction offered by members of the Faculty of Kinesiology.

Senior Courses
Athletic Therapy 471 H(1-3) Taping, Bandaging, and Splinting
Current techniques to help athletes safely compete or return to competition.
Prerequisite: Admission to Athletic Therapy Major.

Athletic Therapy 491 H(3-3) Advanced Practicum in Athletic Therapy
Practical case studies to develop leadership and problem solving skills applicable to Athletic Therapy issues. Practical experience in athletic equipment fitting, maintenance, selection, repair, and CSA certification.
Prerequisite: EMR Certificate and Admission to Athletic Therapy Major.
Note: Course begins prior to the start of Fall Session (usually the third week of August).

Bachelor of Accounting Science BACS
Instruction offered by members of the Haskayne School of Business.

Senior Courses
Bachelor of Accounting Science 300 F(3-0) (Humanities 300) Humanistic Issues in Commercial Practice
Covers the cultural, social, political and ethical influences on commercial practices and value-exchange from classical times to the present. Its aim is to develop historical perspective and critical thinking.
Note: Students must be registered in the Bachelor of Accounting Science degree program to register in this course.

Bachelor of Accounting Science 304 F(3-0) (General Studies 304) Change, Society and Technology
An interdisciplinary study of the concepts of change, its variety of forms and its social-psychological causes and consequences, with an emphasis on the impact of technology.
Note: Credit for both Bachelor of Accounting Science 304 (General Studies 304) and either General Studies 341 or 351 will not be allowed.
Note: Students must be registered in the Bachelor of Accounting Science degree program to register in this course.

Bachelor of Accounting Science 472 F(3-0) Taxation
Covers the principles, concepts, and application of Canadian federal income tax legislation. Topics include the concepts of income and liability for tax; income from employment, business, and property; deductions; capital gains and losses; computation of taxable income for individuals and corporations; and an introduction to tax planning. The course emphasizes understanding of the structure of the Income Tax Act and the application of its rules to practical cases. The course also integrates use of tax preparation software.
Note: Students must be registered in the Bachelor of Accounting Science degree program to register in this course.

Bachelor of Accounting Science 476 F(3-0) Auditing
Introduction to the auditing principles and procedures that are applicable to both internal and external audits. Topics include reporting, the ethical and legal environment, audit objectives, audit evidence, audit planning and analytical procedures, materiality and risk, internal control, EDP auditing, and audit sampling. Particular attention is paid to the audit of the sales and collecting cycle. The payroll and personnel cycle, the acquisition and payment cycle, the inventory and warehousing cycle, and the capital acquisition and repayment cycle are also studied. Auditing software is used in this course and the related practice set.
Note: Students must be registered in the Bachelor of Accounting Science degree program to register in this course.

Bachelor of Accounting Science 485 H(3-0) Accounting Theory
Includes an in-depth treatment of current issues and problems in the field. Topics include the contributions of economics, finance, and other disciplines to accounting theory; the practical and theoretical problems of the present value model; foreign exchange accounting; the process and issues of standard-setting; agency theory; and other topics related to specific industries or sectors of the economy.

Note: Students must be registered in the Bachelor of Accounting Science degree program to register in this course.

Bachelor of Accounting Science 494 F(3-0) Managerial Accounting
Focuses on the use of accounting information in planning and decision making under conditions of certainty and uncertainty. Topics include cost flows in organizations, budgeting models, linear programming, decision-making models, cost estimation, cost-volume-profit analysis, financial modelling, issues in management, performance and transfer pricing, executive incentives, and compensation. Spreadsheet software is used to illustrate concepts and provide hands-on experience.
Note: Students must be registered in the Bachelor of Accounting Science degree program to register in this course.

Bachelor of Accounting Science 591 H(3-0) Organization and Leadership
Covers the theory, design and leadership of organizations in the context of change. Students develop the ability to analyze their own and other organizations in terms of structure and design, key processes and interactions, the role of leadership and the responses of the organization to change.
Note: Students must be registered in the Bachelor of Accounting Science degree program to register in this course.

Biochemistry BCEM
Instruction offered by members of the Department of Biological Sciences in the Faculty of Science and Department of Biochemistry and Molecular Biology in the Faculty of Medicine. Department Heads - D.M. Reid (Biological Sciences) L.W. Browder (Biochemistry and Molecular Biology)
Students interested in taking Biochemistry courses are urged to read the advice in the Faculty of Science Program section of this Calendar.
† Limited amounts of non-scheduled class time involvement will be required for these courses.

Senior Courses
Biochemistry 341 H(3-3/2) Biochemistry of Life Processes
Emphasis is placed on describing the chemistry of biochemical molecules including proteins, carbohydrates, lipids, and nucleic acids, and how this relates to cell structure. The metabolism of carbohydrates and lipids.
Prerequisite: Chemistry 341 or 351 or 354.
Note: Credit for both Biochemistry 341 and either 393 or 443 will not be allowed.
Note: Not open to majors in the Department of Biological Sciences or Natural Sciences concentrators in Biological Sciences.

†Biochemistry 393 H(3-3/2) Introduction to Biochemical Molecules
The structure and function of carbohydrates, amino acids, proteins, lipids, coenzymes and enzymes will be presented, along with an introduction to metabolism and energy transduction. Laboratory: Modern biochemical techniques for analysis of
carbohydrates, amino acids, lipids, proteins, enzymes and metabolism.

**Prerequisites:** Biology 311 and Chemistry 351 or 354.

**Corequisite:** Biology 331.

**Note:** Credit for both Biochemistry 393 and 341 will not be allowed.

**Biochemistry 431**  
(formerly Biochemistry 331)  
**Proteins and Proteomics**

Protein structure and chemistry; structural motifs, ligand-binding, conformational changes, chemical modification; protein folding; structure prediction by molecular modeling. Identification of proteins in the proteome: 2D gel electrophoresis and chromatography, mass spectrometry; post-translational modifications; protein-protein interactions.

**Prerequisite:** Biochemistry 393.

**Biochemistry 443**  
(H3-4)

**Metabolism and the Synthesis of RNA, DNA and Protein**

Lectures: Biochemical energetics; intermediary metabolism and its regulation; DNA, RNA and protein synthesis. Laboratory: Modern biochemical techniques concerning: metabolism and toxicological effects on metabolism; photosynthesis; RNA, DNA and protein synthesis; effects of antibiotics; lipids.

**Prerequisites:** One of Chemistry 353 or 355, or 354; and Biochemistry 393.

**Note:** Credit for both Biochemistry 443 and 341 will not be allowed.

**Note:** Enrollment in this course may be limited. See explanation in Program section of Calendar.

**Biochemistry 471**  
(H3-2T)

**Physical Biochemistry**

The laws of thermodynamics as they apply to biological systems: the hydrophobic effect, properties of water, electrolyte solutions and lipid binding. Optical spectroscopic methods including UV/visible absorption, fluorescence, circular dichroism, and infrared as applied to biological molecules.

**Prerequisites:** Biochemistry 341 or 393; Chemistry 341 or 353 or 355 or 354; one of Mathematics 249, 251 or 253 and one of Mathematics 253, 256, 211 or 221; one of Physics 211 or 221, and 223.

**Biochemistry 507**  
(H3-3)

**Special Problems in Biochemistry**

Lectures, seminars, term papers and training in theoretical and/or laboratory methods. After consultation with a Departmental faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be signed by the course supervisor before a student can register.

**Prerequisites:** Third or higher-year standing and consent of the Department.

**MAY BE REPEATED FOR CREDIT**

**Biochemistry 528**  
(F0-6)

**Independent Studies in Biochemistry**

Original and independent thought, practical research and the completion of written and oral reports. After consultation with a Departmental faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be signed by the course supervisor before a student can register.

**Prerequisites:** Fourth-year standing and consent of the Department.

**MAY BE REPEATED FOR CREDIT**

**Biochemistry 530**  
(F0-6)

**Honours Research Project in Biochemistry**

Research project under the direction of one or more faculty members in the Department of Biological Sciences. Formal written and oral reports must be presented on completion of this course. Open only to Honours Biochemistry students or Honours Biological Sciences students. After consultation with a Department faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be completed before a student can register.

**Prerequisites:** Fourth-year standing and consent of the Department.

**Note:** Active participation in Divisional seminar programs is a requirement of this course.

**Biochemistry 537**  
(H3-0)  
**Nucleic Acids**

(Medical Science 537)

Lectures: Chemical structure and physical characterization of nucleic acids. DNA topology. DNA transcription and repair. Nucleic acid-protein interaction as related to transcription and chromosome structure. Cloning of DNA and analysis of recombinant molecules. Recombinant DNA molecules and cloning of DNA.

**Prerequisite:** Biochemistry 443.

**Biochemistry 541**  
(H2-1T-6)

**Advanced Biochemical Laboratory Techniques**

Modern techniques in the biochemical laboratory (gene cloning, DNA sequencing, PCR, site directed mutagenesis, protein purification, electrophoresis and blotting, radiochemical and the use of computers in Biochemistry) will be reviewed in the lectures. The laboratory aims to give practical experience in some of these methods in an integrated manner by focusing on the lacZ gene and the isolation of its product, β-galactosidase.

**Prerequisite:** Biochemistry 443.

**Note:** Enrollment in this course may be limited. See explanation in Program section of Calendar.

**Biochemistry 543**  
(H3-0)

**Enzymology**

The structure, mechanisms and biological interactions of enzymes. Binding, catalysis, rates and regulation will be discussed with regard to chemical principles of kinetics and reaction. The principles of enzyme action will be considered in the context of the biological role that enzymes play.

**Prerequisites:** Biochemistry 393 and Chemistry 353 or 355 or 354.

**Biochemistry 547**  
(H3-0)

**Regulation of Metabolism and Signal Transduction**

The structure, function, compartmentation of selected metabolic pathways in microbes, plants and animals: carbohydrate metabolism, lipid and steroid biosynthesis and nitrogen metabolism, signal transduction pathways from the membrane to the nucleus and structure and function of protein kinases and protein phosphatases.

**Prerequisite:** Biochemistry 443.

**Biochemistry 551**  
(H3-0)

**Structural Biology**

Applications of modern methods to structural studies of proteins and nucleic acids by NMR and X-ray crystallography with a comparison of the structural information derived from the two methods. The crystallization of macromolecules, experimental and theoretical foundations of X-ray structure determination. Non-invasive NMR studies of metabolism, spectroscopic probe studies of membranes and other biomolecular complexes.

**Prerequisite:** Biochemistry 471.

**Biochemistry 555**  
(H3-0)

**Biomembranes**

The structure and function of biological membranes with emphasis on membrane proteins. Topics will include the properties of lipid bilayers, isolation and purification of membranes, preparation of model membrane systems, energetics of membrane potentials and transport, membrane protein function, folding, assembly and structure, and protein secretion and targeting.

**Prerequisite:** Biochemistry 443.

**Prerequisite or Corequisite:** Biochemistry 471.

**Biochemistry 561**  
(Formerly Biotechnology 561)  
(H2-3T)

**Applied Biochemistry and Biotechnology**

An introduction to the language, materials, methods, concepts and commercial applications of biotechnology with emphasis on methodology: biocatalysts, bioreactor designs and operation, scale-up, instrumentation, product recovery, animal and plant cell culture, process economics.

**Prerequisites:** Biochemistry 443 and Biology 311.

**Biochemistry 577**  
(H3-4/2)

**Biomolecular Simulation**

An introduction to simulation and computer modelling methods commonly used in biochemistry and biophysics, with a focus on physical models to understand the behaviour of biomolecules. Topics include simulation methods, dynamics of proteins, DNA, and lipids, calculation of binding constants, protein-drug interactions, properties of ion channels as well as a number of recent literature topics.

**Prerequisites:** One of Biochemistry 341 or 393 and Biochemistry 471 or Chemistry 371.

**Graduate Courses**

Enrollment in any Graduate Course requires consent of the Department.

Only where appropriate to a student’s program may graduate credit be received for courses numbered 500-599.

600-level courses are available with permission to undergraduate students in the final year of their programs.

See also the separate listing of graduate level Chemistry courses.

**Biochemistry 609**  
(H3-0)  
**Gene Expression**

(Medical Science 609)

The flow of genetic information from DNA to final protein product. The subject will be covered in two courses offered in alternating years: gene structure and regulation of transcription, including gene structure and organization, chromatin structure, regulation of transcription and post-translational
Courses of Instruction

Biochemistry/Biology

Selected Topics in Biochemistry

Selected topics in Biochemistry such as those which appear annually in the serial publication Annual Review of Biochemistry.

MAY BE REPEATED FOR CREDIT

Biology 731

H(3-0)

Protein and Metabolic Engineering

Contemporary methods of recombinant DNA technology will be combined with modern methods and strategies for expressing, secreting, purifying and characterizing engineered proteins and enzymes. Genetic engineering of metabolic pathway design and regulation will also be dealt with. The emphasis will be on the utilization of these techniques as tools for studying proteins and metabolism.

Biology 305

H(3-0)

Introduction to Cellular and Molecular Biology

An introduction to human biology that analyzes the structure and function of bodies. Leads to an appreciation of how the human body maintains itself and carries out functions necessary to sustain any organism. A course for non-majors that will develop their understanding of the anatomy and physiology of their own species in a zoological and evolutionary context.

Biology 307

H(3-0)

Ecology and Human Affairs

The major principles of ecology and evolution. How organisms survive in the physical environment; Darwinism; sex and societies; species interactions; who lives where and why; who lives together and how; the biology of ecosystems. The intent of the course is to give non-biologists an understanding of ecological and evolutionary principles that will allow them to better appreciate the place and role of human beings in the modern world.

Note: Credit for Biology 205 and either 231 or 233 will not be allowed.

Note: Not open for credit to Majors or Minors in the Department of Biological Sciences or to Natural Sciences program students with a Concentration in Biological Sciences.

Note: Credit for both Biochemistry 609 and Medical Science 607 will not be allowed.

Note: Credit for both Biochemistry 609.02 and Medical Science 751.14 will not be allowed.

Biochemistry 641

H(3-0)

Introduction to Cellular Biology

Examination of many fundamental principles of life common to all organisms; continues with an overview of structure, replication and function in viruses, bacteria, protists and fungi.

Prerequisites: Biochemistry 30 and Chemistry 30.

Note: Credit for both Biology 205 and 231 will not be allowed.

Note: Not recommended for those students seeking a single half-course, general interest overview of the biological sciences. Those seeking such a course should consider Biology 205.

Note: Biology 231 is not a prerequisite for Biology 233. Biology 231 and 233 may be taken in any order.

Introduction to Organismic Biology of Plants and Animals

Various groups are introduced with a focus on diversity, and form and function in terrestrial plants and major metazoan phyla.

Prerequisites: Biochemistry 30 and Chemistry 30.

Note: Credit for both Biology 205 and 233 will not be allowed.

Note: Not recommended for those students seeking a single half-course, general interest overview of the biological sciences. Those seeking such a course should consider Biology 205.

Note: Biology 231 is not a prerequisite for Biology 233. Biology 231 and 233 may be taken in any order.

Senior Courses

Principles of Genetics

Topics will include Mendelian inheritance, allelic relationships, genetic linkage, sex linkage, sex determination, changes in chromosome structure, segregation and recombination, structure and function of the genetic material, molecular genetics, genetics of bacteria and viruses, gene fine structure, gene function, complementation, and regulation of gene expression. Several selected organisms will be used in the laboratories to illustrate pertinent genetic principles.

Prerequisites: Biology 231, 233 (or second year standing in the Bachelor of Health Sciences program), and Chemistry 203.

Principles of Genetics

H(3-0)

Introduction to Ecology and Evolution

Ecological processes and evolutionary principles that explain the origin, maintenance, and dynamics of biological diversity. Ecological interactions will be studied to understand the dynamics of populations and communities, and the evolution of traits. Mechanisms of genetic change of populations will be discussed and how these changes give rise to large-scale evolutionary patterns.

Prerequisites: Biology 231 and 233.

Prerequisite or Corequisite: Biology 311.

Introduction to Cellular and Molecular Biology

The principles of cellular structure and function. Molecular organization of membranes, organelles, nuclei and cytoplasmic structures; the integration of cellular functions; assembly of organelles; the regulation of cell proliferation; and the interaction of cells with their neighbours and their environment.

Prerequisite: Biology 311.

Introduction to Ecological and Evolutionary Principles

Note: Not open for credit to Majors or Minors in the Department of Biological Sciences or to Natural Sciences program students with a Concentration in Biological Sciences.

Ecology and Human Affairs

The major principles of ecology and evolution. How organisms survive in the physical environment; Darwinism; sex and societies; species interactions; who lives where and why; who lives together and how; the biology of ecosystems. The intent of the course is to give non-biologists an understanding of ecological and evolutionary principles that will allow them to better appreciate the place and role of human beings in the modern world.

Prerequisite: Second-year standing.

Note: Not open for credit to Majors or Minors in the Department of Biological Sciences or to Natural Sciences program students with a Concentration in Biological Sciences.

Note: Credit for both Biochemistry 609 and Medical Science 607 will not be allowed.

Note: Credit for both Biochemistry 609.02 and Medical Science 751.14 will not be allowed.

Biochemistry 641

H(3-0)

Introduction to Cellular Biology

Examination of many fundamental principles of life common to all organisms; continues with an overview of structure, replication and function in viruses, bacteria, protists and fungi.

Prerequisites: Biochemistry 30 and Chemistry 30.

Note: Credit for both Biology 205 and 231 will not be allowed.

Note: Not recommended for those students seeking a single half-course, general interest overview of the biological sciences. Those seeking such a course should consider Biology 205.

Note: Biology 231 is not a prerequisite for Biology 233. Biology 231 and 233 may be taken in any order.

Introduction to Organismic Biology of Plants and Animals

Various groups are introduced with a focus on diversity, and form and function in terrestrial plants and major metazoan phyla.

Prerequisites: Biochemistry 30 and Chemistry 30.

Note: Credit for both Biology 205 and 233 will not be allowed.

Note: Not recommended for those students seeking a single half-course, general interest overview of the biological sciences. Those seeking such a course should consider Biology 205.

Note: Biology 231 is not a prerequisite for Biology 233. Biology 231 and 233 may be taken in any order.

Senior Courses

Principles of Genetics

Topics will include Mendelian inheritance, allelic relationships, genetic linkage, sex linkage, sex determination, changes in chromosome structure, segregation and recombination, structure and function of the genetic material, molecular genetics, genetics of bacteria and viruses, gene fine structure, gene function, complementation, and regulation of gene expression. Several selected organisms will be used in the laboratories to illustrate pertinent genetic principles.

Prerequisites: Biology 231, 233 (or second year standing in the Bachelor of Health Sciences program), and Chemistry 203.

Introduction to Ecology and Evolution

Ecological processes and evolutionary principles that explain the origin, maintenance, and dynamics of biological diversity. Ecological interactions will be studied to understand the dynamics of populations and communities, and the evolution of traits. Mechanisms of genetic change of populations will be discussed and how these changes give rise to large-scale evolutionary patterns.

Prerequisites: Biology 231 and 233.

Prerequisite or Corequisite: Biology 311.

Introduction to Cellular and Molecular Biology

The principles of cellular structure and function. Molecular organization of membranes, organelles, nuclei and cytoplasmic structures; the integration of cellular functions; assembly of organelles; the regulation of cell proliferation; and the interaction of cells with their neighbours and their environment.

Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

Introduction to Cellular and Molecular Biology

The principles of cellular structure and function. Molecular organization of membranes, organelles, nuclei and cytoplasmic structures; the integration of cellular functions; assembly of organelles; the regulation of cell proliferation; and the interaction of cells with their neighbours and their environment.

Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

Introduction to Cellular and Molecular Biology

The principles of cellular structure and function. Molecular organization of membranes, organelles, nuclei and cytoplasmic structures; the integration of cellular functions; assembly of organelles; the regulation of cell proliferation; and the interaction of cells with their neighbours and their environment.

Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

Introduction to Cellular and Molecular Biology

The principles of cellular structure and function. Molecular organization of membranes, organelles, nuclei and cytoplasmic structures; the integration of cellular functions; assembly of organelles; the regulation of cell proliferation; and the interaction of cells with their neighbours and their environment.

Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

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Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

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Introduction to Cellular and Molecular Biology

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Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

Introduction to Cellular and Molecular Biology

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Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

Introduction to Cellular and Molecular Biology

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Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

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Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

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Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)

Introduction to Cellular and Molecular Biology

The principles of cellular structure and function. Molecular organization of membranes, organelles, nuclei and cytoplasmic structures; the integration of cellular functions; assembly of organelles; the regulation of cell proliferation; and the interaction of cells with their neighbours and their environment.

Prerequisite: Biology 311.

Introduction to Cellular and Molecular Biology

H(3-1T)
Courses of Instruction

Biology 451 (formerly Biology 351)

Conservation Biology

The application of ecological theory and principles to the conservation and management of natural and modified ecosystems, with emphasis on preservation of biodiversity and sustainable development. Topics include disturbance as an ecological process, ecological and evolutionary responsiveness of natural systems, ecology of resource harvesting, management of endangered habitats and populations, implications of human population growth and global change.

Prerequisite: Biology 313.

Biology 501 (Medical Science 501)

Principles and Mechanism of Pharmacology

Basic principles of pharmacology, with specific emphasis on receptor signaling mechanisms.

Prerequisites: Consent of the Department and Biochemistry 443, and one of Zoology 461, 463, or Medical Science 404.

Biology 503 (Medical Science 503)

Pharmacology of Organ Systems

Pharmacology of the nervous, cardiovascular, renal and immune systems, as well as anti-cancer therapies. Principles of toxicology.

Prerequisite: Biology 501 (Medical Science 501) or consent of the Department.

Biology 515 (Medical Science 515)

Cellular Mechanisms of Disease

The cellular and molecular mechanisms underlying basic human disease processes and how these can be influenced by lifestyle and environmental factors. The ways in which this knowledge can be used in the laboratory diagnosis of disease.

Prerequisites: Biochemistry 443 and Biology 331.

Biology 520

Field Course in Tropical Biology

An examination of biodiversity in a selected region of the tropics, including aspects of ecology of animals and plants, animal behaviour and an introduction to field techniques for observing and censusing selected taxa. Field studies will take place at forest and savannah sites with consideration of community-based conservation efforts.

Prerequisite: Consent of the Department.

Biology 591

Insect Biodiversity

A field course in the natural history and classification of insects, one of the most diverse groups of organisms known, as they are encountered in their natural habitat. Course material will include techniques for collection and identification of major groups of insects and related terrestrial arthropods; aspects of behaviour and ecology of local species; use of insects as indicators of environmental change; censusing/monitoring insect populations.

Prerequisite: Consent of the Department.

Graduate Courses

Enrollment in any Graduate Course requires consent of the Department.

(Only where appropriate to a student's program may graduate credit be received for courses numbered 500-599.)

600-level courses are available with permission to undergraduate students in the final year of their programs.

Biology 601

Research Seminar

Reports on studies of the literature or of current research. Graduate students normally register in their supervisor's divisional section.

601.01. Biochemistry I

601.02. Biochemistry II

601.03. Botany I

601.04. Botany II

601.05. Cellular, Molecular and Microbial Biology I

601.06. Cellular, Molecular and Microbial Biology II

601.07. Ecology I

601.08. Ecology II

601.09. Zoology I

601.10. Zoology II

NOT INCLUDED IN GPA

Biology 603 (Medical Science 603)

Biology of Laboratory Animals

The course is based on the Canadian Council on Animal Care Syllabus "Basic Principles of Laboratory Animal Science for Research Scientists." In addition to the study of common, research, farm and exotic animals, topics to be covered include ethical considerations, regulation and legislation, animal models, animal facilities and husbandry, hazard control, surgery, anaesthesiology, euthanasia and post-mortem examinations. Practical sessions will provide experience in handling and restraint of specific laboratory animals, injections, blood collection, anaesthesiology and surgery.

Note: Enrollment in this course is restricted in the first instance to graduate students who will do research utilizing animals.

Biology 607

Special Problems in Biology

Lectures, seminars, term papers and training in theoretical and/or laboratory methods.

MAY BE REPEATED FOR CREDIT

Biomedical Engineering 601

Fundamentals of Biomedical Engineering

An introduction to biology, biochemistry, anatomy, physiology, engineering fundamentals, and biostatistics for biomedical engineers. Detailed discussion on bioengineering and biomedical engineering, including current local and international research and industry, emphasis on local strengths.

Biomedical Engineering ENBM

Instruction offered by members of the Faculty of Engineering.

Associate Dean (Academic) - L.E. Turner

Biomedical Engineering 003

Q(20 hours)

Health Care Management

Factors in modern health care provision, economic and social constraints, methods for determining efficacy of treatment (outcome measures), assessment of life quality, provision and control of services, methods for determining local, national and global needs, importance of standards, quality control and measurement, effects of population demographics, historical developments and models of welfare provision.

Senior Courses

Biomedical Engineering 309

H(3-1.5)

Anatomy and Physiology for Engineers

Physiological terminology and anatomical planes of reference, human skeletal structure, types of connective tissues, structure of joints, muscle and organ structure and function, cardiac physiology, blood properties and flow, introduction to autonomous nervous system, disorders of the musculoskeletal system.

Prerequisites: Engineering 201, Chemistry 209.

Biomedical Engineering 325

H(3-2T-3/2)

Instrumentation and Measurement in Biomedical Engineering

Topics in electric circuits and electric systems related to engineering theory and practice in the areas of Chemical, Civil, Geomatics, Mechanical and Manufacturing Engineering. The tutorial and laboratory will introduce basic principles of sensors and measurement in a biomedical context. Includes signal amplification and filtering and analog-to-digital conversion.

Prerequisite: Physics 259.

Biomedical Engineering 327

H(3-2T-3/2)

Instrumentation and Measurement in Biomedical Engineering for Electrical Engineers

Definition of linear elements, independent and dependent sources, sign conventions; basic circuit laws, simple resistive circuits; node and mesh analysis. Thévenin, Norton and other theorems; inductance and capacitance. AC circuit analysis, impedance, admittance, phasor diagrams; average and effective values of waveforms, real, reactive and complex power, power calculations; mutual inductance, ideal transformer, introduction to balanced three-phase circuits, power calculation in three-phase circuits. The tutorial and laboratory will introduce basic principles of sensors and measurement in a biomedical context. Includes signal amplification and filtering and analog-to-digital conversion.

Prerequisite: Physics 259.

Graduate Courses

Biomedical Engineering 601

H(3-0)

Fundamentals of Biomedical Engineering

Instruction offered by members of the Faculty of Engineering.

Associate Dean (Academic) - L.E. Turner

Biomedical Engineering 003

Q(20 hours)

Health Care Management

Factors in modern health care provision, economic and social constraints, methods for determining efficacy of treatment (outcome measures), assessment of life quality, provision and control of services, methods for determining local, national and global needs, importance of standards, quality control and measurement, effects of population demographics, historical developments and models of welfare provision.

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Physiological terminology and anatomical planes of reference, human skeletal structure, types of connective tissues, structure of joints, muscle and organ structure and function, cardiac physiology, blood properties and flow, introduction to autonomous nervous system, disorders of the musculoskeletal system.

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H(3-2T-3/2)

Instrumentation and Measurement in Biomedical Engineering for Electrical Engineers

Definition of linear elements, independent and dependent sources, sign conventions; basic circuit laws, simple resistive circuits; node and mesh analysis. Thévenin, Norton and other theorems; inductance and capacitance. AC circuit analysis, impedance, admittance, phasor diagrams; average and effective values of waveforms, real, reactive and complex power, power calculations; mutual inductance, ideal transformer, introduction to balanced three-phase circuits, power calculation in three-phase circuits. The tutorial and laboratory will introduce basic principles of sensors and measurement in a biomedical context. Includes signal amplification and filtering and analog-to-digital conversion.

Prerequisite: Physics 259.
### Courses of Instruction

**Botany/Campus Alberta Applied Psychology**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>Bota 303</td>
<td>Introduction to Plant Physiology</td>
<td>Basic principles of plant physiology, with an emphasis on how environmental factors influence plant growth and development. Topics include: external and internal controls of germination; growth; tropisms; reproduction; senescence; plant hormone physiology; phloem and xylem transport; the role of phytochrome; and stress physiology. Prerequisites: Botany 231 and 233. Note: Enrollment in this course may be limited. See explanation in Program section of Calendar.</td>
</tr>
<tr>
<td>Botany 309</td>
<td>Plants and People</td>
<td>A review of the structure and function of plants. A survey of the nature of people's basic food plants and an overview of agricultural and forestry practices. Plant improvement by traditional and modern methods, and plant propagation. Prerequisite: Either Biology 205 or 231. Note: Not open for credit to Majors and Minors in the Department of Biological Sciences or to Natural Sciences. Program students with a Concentration in Biological Sciences.</td>
</tr>
<tr>
<td>Botany 321</td>
<td>Plant Anatomy</td>
<td>The cell, tissue, and organ systems of vascular plants, with special reference to angiosperms. meristems, differentiation, and aspects of plant tissue development. An introduction to plant microtechnique. Prerequisites: Biology 231 and 233. Note: Enrollment in this course may be limited. See explanation in Program section of Calendar.</td>
</tr>
<tr>
<td>Botany 327</td>
<td>Morphology and Taxonomy of Plants</td>
<td>The morphology of plants ranging from algae, bryophytes (non-vascular land plants), the primitive psilophytes to the angiosperms. Examples chosen to understand the origin of land plants and their subsequent evolution leading to highly diversified flowering plants. Prerequisites: Biology 231 and 233. Note: Enrollment in this course may be limited. See explanation in Program section of Calendar.</td>
</tr>
<tr>
<td>Botany 441</td>
<td>Taxonomy of the Seed Plants</td>
<td>A study of plants in relation to classification, phylogeny, evolution and identification. Students are required to make a plant collection of fifty plant specimens for identification in the laboratory. It is recommended that the collection be made in the preceding summer. Prerequisite: Botany 327.</td>
</tr>
<tr>
<td>Botany 503</td>
<td>(formerly Botany 403)</td>
<td>Biochemistry of Plant Metabolism</td>
</tr>
<tr>
<td>Botany 507</td>
<td>Special Problems in Botany</td>
<td>Lectures, seminars, term papers and training in theoretical and/or laboratory methods. After consultation with a Departmental faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be signed by the course supervisor before a student can register. Prerequisites: Third or higher-year standing and consent of the Department. MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Botany 528</td>
<td>Independent Studies in Botany</td>
<td>Original and independent thought, practical research and the completion of written and oral reports. After consultation with a Departmental faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be signed by the course supervisor before a student can register. Prerequisites: Fourth-year standing and consent of the Department. MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Botany 530</td>
<td>Honours Research Project in Botany</td>
<td>Research project under the direction of one or more faculty members in the Department of Biological Sciences. Formal written and oral reports must be presented on completion of this course. Only open to Honours Botany students or Honours Biological Sciences students. After consultation with a Department faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be completed before a student can register. Prerequisites: Fourth-year standing and consent of the Department.</td>
</tr>
<tr>
<td>Botany 543</td>
<td>Plant Developmental Biology</td>
<td>Physiology, biochemistry, molecular and cellular aspects of plant growth and development. Emphasis on the coordinated regulation of gene expression, cell-cell communication, and signalling during development. Discussion on the methods used to study development, such as mutants of Arabidopsis and other model systems. Prerequisites: Biology 331 and Botany 303 or 403 or 503. Note: Offered in odd-even dated academic years. Note: Enrollment in this course may be limited. See explanation in Program section of Calendar.</td>
</tr>
<tr>
<td>Botany 633</td>
<td>Recent Advances in Plant Physiology</td>
<td>Lectures, seminars and laboratories on a topic of current interest in plant physiology. Topic being offered will be announced at time of registration. Note: Offered in even-odd dated academic years. MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Botany 645</td>
<td>Dynamic Aspects of Plant Ultrastructure</td>
<td>The ultrastructural and functional aspects of the cell, tissue, and organ systems of vascular plants. Analysis and interpretation of electron micrographs. Seminars on recent research development. Note: Offered in even-odd dated academic years.</td>
</tr>
<tr>
<td>Botany 745</td>
<td>Botanical Microtechniques</td>
<td>Principles and practice of preparation of plant tissues for light microscope study. Plastic embedding techniques, histochemistry, immunohistochemistry, quantitative cytochemistry, fluorescence microscopy, confocal laser scanning microscopy and photomicroscopy are included. Note: Offered in odd-even dated academic years.</td>
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**Business and Environment**

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<thead>
<tr>
<th>Course Code</th>
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</table>
| Bsen 314    | Business and Environment | Instruction offered by members of the Haskayne School of Business. Business and Environment Chairperson - V. Jones Note: Students have the opportunity to take courses offered by the Haskayne School of Business without the stated prerequisites, with the written permission of the Associate Dean (Undergraduate Programs) as appropriate, upon the recommendation of the Instructor of the course. However, should a student fail to achieve satisfactory standing in any course for which the stated prerequisite(s) is (are) lacking, he/she may be required to successfully complete the
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<tbody>
<tr>
<td>Business and Environment 291</td>
<td>H(3-3) (formerly Management Studies 291)</td>
<td>Junior Course</td>
<td>Introduction to Business Introduces the functional areas of business and the integration of these areas for effective and efficient operation of organizations in a variety of sectors. Emphasizes effective team work skills, research skills and decision-making skills, using experiential learning modules to study the problems and issues encountered by organizations. Provides foundation for senior courses in the Haskayne School of Business.</td>
</tr>
<tr>
<td>Business and Environment 295</td>
<td>H(3-0) (formerly Strategy and General Management 395)</td>
<td>Junior Course</td>
<td>Business Law for Strategic Decision-Makers Topics include legal services, regulatory compliance and environment management, tort and contractual liability, legal issues affecting the strategic management of sole proprietorships, partnerships, corporations and joint ventures, personal liability of corporate directors and officers, legal issues in the technological environment, advertising and promotion, consumer protection legislation, legal issues affecting employees and independent contractors, and the strategic management of international business.</td>
</tr>
<tr>
<td>Business and Environment 401</td>
<td>H(3-0) (formerly Strategy and General Management 401)</td>
<td>Senior Courses</td>
<td>Business in Canada A comparative analysis of Canada’s competitive position in the global economy with case studies of the strategies employed by Canadian corporations to win in world markets. Prerequisites: Fourth year standing and one of Entrepreneurship and Innovation 201 or Business and Environment 291. Note: Not available for credit toward the Bachelor of Commerce Degree. Until August 15, preference in enrollment is given to students who have declared a Management and Society minor.</td>
</tr>
<tr>
<td>Business and Environment 485</td>
<td>H(3-0) (formerly Strategy and General Management 485)</td>
<td>Senior Courses</td>
<td>Oil and Gas Marketing Practical introduction to crude oil (light and heavy) and natural gas marketing. Marketing of refined oil products and retail gasoline are not covered. Prerequisites: Admission to the Haskayne School of Business and fourth year standing.</td>
</tr>
<tr>
<td>Business and Environment 559</td>
<td>H(3-0) Selected Topics in Business and Environment</td>
<td>Senior Courses</td>
<td>Investigation of selected topics related to business and environment issues. Prerequisite: Third year standing. MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Business and Environment 561</td>
<td>H(3-0) (formerly Strategy and General Management 561)</td>
<td>Graduate Courses</td>
<td>Ethical Issues and the Professional Manager Covers major principles of ethics from different perspectives to provide tools for making sound ethical decisions in various business situations and in the face of moral dilemmas. Prerequisites: Consent of the Haskayne School of Business and fourth year standing.</td>
</tr>
<tr>
<td>Business and Environment 691</td>
<td>H(3-0) (Civil Engineering 691) formerly Strategy and General Management 691</td>
<td>Graduate Courses</td>
<td>Fundamentals of Project Management Application of management principles to the project environment: planning, control, scope, time and cost processes; project organization and human resource issues. Students review a current major capital project and submit and defend a project report. Prerequisite: Consent of Program Director.</td>
</tr>
<tr>
<td>Business and Environment 719</td>
<td>H(3-0) (formerly Strategy and General Management 719)</td>
<td>Graduate Courses</td>
<td>Project External Issues Corporate influences; financial interfaces; sources of funds; lending environment, owner’s and lender’s risks; government involvement; regulatory requirements; public interfaces; public information; compensation; project commissioning. Prerequisite: Business and Environment 691.</td>
</tr>
<tr>
<td>Business and Environment 761</td>
<td>H(3-0) Ethics and the Professional Manager</td>
<td>Graduate Courses</td>
<td>The role of values in business decision making: alternative moral codes and their principles; moral principles as decision tools, and reasoning through moral dilemmas; role of business in society; specific issues in business ethics; application through cases and exercises.</td>
</tr>
<tr>
<td>Business and Environment 777</td>
<td>H(3-0) (formerly Strategy and General Management 777)</td>
<td>Graduate Courses</td>
<td>Global Environment of Canadian Business Economic, political, social and legal factors affecting management decisions. Topics include Canada in the world economy, business and government relations, business ethics, legal environment for business. Develops knowledge and ability to analyze and deal with complexities of the business environment. Corequisite: Strategy and Global Management 701 or consent of the Haskayne School of Business.</td>
</tr>
<tr>
<td>Business and Environment 789</td>
<td>H(3-0) Seminar in Business and Environment</td>
<td>Graduate Courses</td>
<td>Study and discussion of current research literature and contemporary issues on topics related to Business and Environment. MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Business and Environment 793</td>
<td>H(3-0) (formerly Strategy and General Management 793)</td>
<td>Graduate Courses</td>
<td>Legal Environment of Business The study of the various areas of law which are particularly relevant to someone developing their business: contracts, patents and copyrights, product liability, incorporation, etc. Prerequisites: Human Resources and Organizational Dynamics 601, Operations Management 601, Management Information Systems 601, Accounting 601 or equivalent.</td>
</tr>
<tr>
<td>Business and Environment 797</td>
<td>H(3S-0) Advanced Seminar in Business and Environment</td>
<td>Graduate Courses</td>
<td>Prerequisite: Consent of the Haskayne School of Business. MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Campus Alberta Applied Psychology 601</td>
<td>H(3-0)</td>
<td>Campus Alberta</td>
<td>Theories of Counselling and Client Change Engages students in a critical evaluation of a range of contemporary counselling theories and helps them begin to develop a description of their own emerging theory.</td>
</tr>
<tr>
<td>Campus Alberta Applied Psychology 603</td>
<td>H(3-0) Ethics</td>
<td>Campus Alberta</td>
<td>Ethics Addresses personal and professional ethical issues in counselling. The perspectives of different professional disciplines will be used to highlight commonalities and differences. Students will reflect critically on both personal and collective worldviews and values as well as explore the impact of those perspectives on counselling processes and contexts.</td>
</tr>
<tr>
<td>Campus Alberta Applied Psychology 605</td>
<td>H(2-2) Developing a Working Alliance</td>
<td>Campus Alberta</td>
<td>Developing a Working Alliance Focuses on the understanding and acquisition of skills that are essential for the development of working alliances in counselling contexts. Introduces a theoretical framework for the application of counselling skills in addition to providing the opportunity for skill practice. Prerequisite or Corequisite: Campus Alberta Applied Psychology 601.</td>
</tr>
<tr>
<td>Campus Alberta Applied Psychology 607</td>
<td>H(3-0) Equity and Diversity Issues in Counselling</td>
<td>Campus Alberta</td>
<td>Equity and Diversity Issues in Counselling Focuses on increasing personal awareness, identification of conceptual frameworks, and development of in-depth knowledge of equity and...</td>
</tr>
</tbody>
</table>
diversity issues in counselling. Students will be expected to examine their own attitudes, behaviours, perceptions and biases.

**Campus Alberta Applied Psychology 611 H(2-7)**
**General Counselling Practicum**
Provides an opportunity for professional development and supervised practice in a general counselling setting. Students will be involved in direct work with clients under the supervision of a qualified professional.
**Prerequisites:** Campus Alberta Applied Psychology 601, 603, 605 and 607.

**Campus Alberta Applied Psychology 613 H(2-2)**
**Assessment**
Combines a theoretical and practical focus to develop a framework from which to approach the assessment of client change in a variety of contexts.
**Prerequisites:** Campus Alberta Applied Psychology 601 and 607.

**Campus Alberta Applied Psychology 615 H(2-2)**
**Intervention Strategies**
Combines a theoretical and practical focus to develop a framework from which to plan and implement client change interventions in a variety of contexts.
**Prerequisites:** Campus Alberta Applied Psychology 601 and 607.

**Campus Alberta Applied Psychology 617 H(3-2)**
**Methods of Inquiry**
Helps students critically analyze other research efforts and in the process learn how to think through their own research questions in a critically evaluative manner.

**Campus Alberta Applied Psychology 619 H(2-7)**
**Specialized Practicum**
Provides an opportunity for professional development and supervised practice in a specialized counselling context. Students will be involved in direct work with clients under the supervision of a qualified professional. The practicum allows students to actively explore issues encountered in working with a specialized client population or area of practice.
**Prerequisites:** Campus Alberta Applied Psychology 611, 613 and 615.

**Campus Alberta Applied Psychology 621 H(3-0)**
**Foundations of Career Development**
Focuses on major theories and models of career development and related research. Emphasis will be placed on the integration of theory with career counselling practice.

**Campus Alberta Applied Psychology 623 H(3-0)**
**Processes and Resources for Facilitating Career-Life Transitions**
Provides knowledge of common issues associated with career-life transitions as they pertain to models of career counselling. Students also acquire knowledge about various types of career development resources and gain critical skills for selecting and using resources to facilitate career-life transitions.
**Prerequisite:** Campus Alberta Applied Psychology 621.

**Campus Alberta Applied Psychology 627 H(3-0)**
**Career Development in Organizational Settings**
Designed to combine theoretical and practical concerns regarding applications of career development concepts to human resources contexts in organizations. Concepts will be relevant to counselling and human resources development professionals.

**Campus Alberta Applied Psychology 629 H(3-0)**
**Multicultural Issues In Career Development**
Increasing cultural diversity requires career development practitioners to examine the ways that their services are designed and delivered. Designed to enable students to deliver culturally responsive career counselling services to diverse populations.

**Campus Alberta Applied Psychology 631 H(3-0)**
**Learning Processes**
Addresses the essential features of major theories of learning and presents current research in each area of learning. Students will discover how the principles of learning relate to their own learning and behaviour, and how the principles can be used to understand the behaviour of others and enhance counselling practice.

**Campus Alberta Applied Psychology 633 H(3-0)**
**Human Development**
Introduces a comprehensive view of human development across the lifespan, drawing on the major theoretical positions. Developmental themes are discussed in terms of their application to typical and atypical human development in children, adolescents and adults.

**Campus Alberta Applied Psychology 637 H(3-0)**
**Group Process**
Provides a conceptual understanding of group process, applied to a wide range of contexts and clientele. Incorporates various theories of group counselling and group process to develop an overall conceptual framework. Delivery consists of two integrated components: (a) an on-line component focusing on group theories and conceptual aspects of working in group contexts and (b) a face-to-face component delivered during a summer institute.

**Campus Alberta Applied Psychology 641 H(3-0)**
**Exceptional Children**
Intended to help students enhance their awareness and understanding of major trends, developments, theoretical foundations, and current practices and challenges in counselling and providing consultation for special needs children and adolescents.

**Campus Alberta Applied Psychology 681 H(3-0)**
**Clinical Supervision**
Intended for students to learn the process of clinical supervision and as a result become better consumers of supervision, more effective supervisors, and more able to evaluate their current and future development and involvement in supervisory roles.

**Campus Alberta Applied Psychology 695 H(1-4)**
**Graduate Seminar: Selected Topics**
**Prerequisite:** Consent of the Campus Alberta Program.
**MAY BE REPEATED FOR CREDIT**

**Canadian Studies CNST**

**Courses of Instruction**

**Canadian Studies 201**
**Introduction to Canadian Studies**
An interdisciplinary examination of the nature of Canadian nationalism and regionalism in their developmental and contemporary contexts. The political, economic and cultural dimensions of Canadian identity will be a central focus.

**Canadian Studies 309**
**Development of the Canadian North**
Deals with a number of topics relating to the development and habitation of the Canadian north, including history, government, resources, transportation, communication, environmental design, recreation and culture.

**Canadian Studies 311**
**Native Peoples of the Canadian Plains**
History and culture of the Plains First Nations, with emphasis on the impact of changes from prehistoric to post-contact, nomadic to sedentary, and the impact of reserve and modern life upon traditional Plains culture. An interdisciplinary approach with a strong emphasis on historical events that have affected the Plains peoples.
**Note:** This course may not be offered every year.

**Canadian Studies 313**
**Canadian Native Art and Cultures**
An interdisciplinary study of the intercultural relationships between Native and settler cultures. The focus will be on Native arts and cultural traditions, with an emphasis on contemporary issues.
**Note:** This course may not be offered every year.

**Canadian Studies 315**
**Native Education in Canada**
A study of the development and present form of Native education in Canada from traditional times to the present day, including an examination of the impact of residential schools and local control of First Nations’ schools. The course will focus on the
Courses of Instruction

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<td>Canadian Studies 331</td>
<td><strong>H(2-2)</strong> Studies in Canadian Film Culture</td>
<td>An introduction to key historical and theoretical aspects of Canadian film. Attention will be given to production, policy, distribution, and use. Topics will include the study of Canadian film auteurs, documentary and social change, feature film genres, and the role of government regulation. Students will explore the central themes and issues facing Canadian film makers and audiences.</td>
</tr>
<tr>
<td>Canadian Studies 333</td>
<td><strong>H(3-0)</strong> A Comparison of Canadian and American Cultures</td>
<td>An interdisciplinary comparison of Canadian and American cultures and cultural assumptions. A variety of issues and contexts will be dealt with from historical and contemporary perspectives.</td>
</tr>
<tr>
<td>Canadian Studies 335</td>
<td><strong>H(3-0)</strong> (formerly Canadian Studies 431) Mass Communications and Canadian Society</td>
<td>The role of newspapers, magazines, television, radio, public opinion polling and new technology as purveyors of social and cultural values. Introduces students to the theoretical literature on various aspects of the media, including public policy questions such as the concentration of media ownership, Canadian content requirements, censorship, the role of the media during elections, and the problems and opportunities that might be brought by advances in technology.</td>
</tr>
<tr>
<td>Canadian Studies 337</td>
<td><strong>H(3-0)</strong> Introduction to Folklore: The Canadian Context</td>
<td>Introduction to the academic study of folklore: basic terminology, folk groups, performance and applications with examples taken from the Canadian and Albertan context. Introduction to traditional genres of folkloristic expression and analyses of current folk groups and their folklore.</td>
</tr>
<tr>
<td>Canadian Studies 339</td>
<td><strong>H(3-0)</strong> Canadian Humour and Culture</td>
<td>An examination and evaluation of the traditions and techniques of Canadian humour and humorists in a variety of media. Examples will be drawn from newspaper humorists, oral folk humour, legend, essays and other literary humour, animated and other films, radio and television, and political cartoons. Humour will be analysed as a means of communicating cultural values, traditions, and mythology.</td>
</tr>
<tr>
<td>Canadian Studies 341</td>
<td><strong>H(3-0)</strong> Canadian Animation</td>
<td>The history, techniques, and themes of Canadian animation from the early days to the present. The relationship between animation and Canadian culture, including traditions, values, and motifs will be studied.</td>
</tr>
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**Note:** This course may not be offered every year.

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<td>Canadian Studies 351</td>
<td><strong>H(3-0)</strong> Literature and Identity: Aboriginal Peoples and Early Canadian Immigrants</td>
<td>An introduction to the multicultural foundations of Canada through a study of the folklore, literature and patterns of adaption of Canada’s indigenous peoples and earliest settlers such as the Acadians, immigrants from the British Isles, Scandinavia and Ukraine.</td>
</tr>
<tr>
<td>Canadian Studies 353</td>
<td><strong>H(3-0)</strong> Literature and Identity: Twentieth Century Canadian Immigrants</td>
<td>An introduction to the cultural and social impact on Canada of twentieth century immigration through a variety of texts, including folklore, fiction and poetry. Focuses on the experiences of peoples from Central, Eastern and Southern Europe, Asia, South Asia and the Caribbean.</td>
</tr>
<tr>
<td>Canadian Studies 355</td>
<td><strong>H(3-0)</strong> (formerly Canadian Studies 451) Canadian Cities and Canadian Identity</td>
<td>Canadian urban life from an interdisciplinary perspective. The contribution of urban life to Canadian identity and to national, regional and provincial development and awareness.</td>
</tr>
<tr>
<td>Canadian Studies 361</td>
<td><strong>H(3-0)</strong> Gender, Race and Ethnicity in Canada</td>
<td>An interdisciplinary introduction to gender, race and ethnicity in Canada to provide an understanding of race, ethnicity and gender as simultaneous and intersecting systems of relationship and meaning.</td>
</tr>
<tr>
<td>Canadian Studies 401</td>
<td><strong>H(3-0)</strong> Special Topics in Canadian Studies</td>
<td>An examination of selected topics in Canadian Studies. See the Master Timetable for current topic(s). MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Canadian Studies 415</td>
<td><strong>H(3-0)</strong> (formerly Canadian Studies 515) Canadian Native Art and Cultures: Oral and Written Traditions</td>
<td>An interdisciplinary seminar on the cultural and aesthetic significance of Native oral and written traditions, with reference to visual and other art forms. Particular attention to Inuit traditions, and contemporary First Nations developments. Prerequisite: Canadian Studies 351 or consent of the Faculty.</td>
</tr>
<tr>
<td>Canadian Studies 417</td>
<td><strong>H(3-0)</strong> (formerly Canadian Studies 401.02) Native Culture and Heritage Institutions: Critical Issues</td>
<td>A study of key issues facing museums, archives, parks, and other heritage institutions that research, interpret and protect the material culture of Native peoples. Note: Previous knowledge in Native Studies highly recommended. Note: This course may not be offered every year.</td>
</tr>
<tr>
<td>Canadian Studies 427</td>
<td><strong>H(3-0)</strong> Canadian Architecture in its Social and Historical Context</td>
<td>An outline of Canadian architecture, its institutional and economic setting; the nature and objectives of architecture education and practice in relation to their historical development.</td>
</tr>
<tr>
<td>Canadian Studies 433</td>
<td><strong>H(3-0)</strong> The Arts in Canada</td>
<td>An interdisciplinary study which focuses on the roles of the popular and fine arts (drama, music, literature and the visual arts) in Canadian life. Study of the contribution of artists, arts organizations and institutions to Canadian culture. Note: Students may be required to attend off-campus events outside of class time.</td>
</tr>
</tbody>
</table>

**Note:** This course may not be offered every year.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>Canadian Studies 501</td>
<td><strong>H(3-0)</strong> Contemporary Issues and Canadian Society</td>
<td>This course will focus on contemporary issues in Canadian society from a multidisciplinary or interdisciplinary perspective. Prerequisite: Canadian Studies 201.</td>
</tr>
<tr>
<td>Canadian Studies 517</td>
<td><strong>H(3-0)</strong> Research in Selected Topics</td>
<td>Supervised individual study of a topic in Canadian Studies. Prerequisite: Consent of the Canadian Studies Director and the Associate Dean (Academic). Note: Students should contact the office of the Associate Dean (Academic) prior to the first day of classes to arrange an independent study course. MAY BE REPEATED FOR CREDIT</td>
</tr>
<tr>
<td>Canadian Studies 531</td>
<td><strong>H(3-0)</strong> Senior Seminar in Canadian Studies</td>
<td>Advanced level seminar(s) in Canadian Studies, for examination of particular topics of special interest to senior students. Prerequisite: Fourth year standing in the Canadian Studies Major program or consent of the Faculty. Note: Credit for both Canadian Studies 591 and 505 will not be allowed.</td>
</tr>
</tbody>
</table>

**Cellular, Molecular and Microbial Biology (CMMB)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>Cellular, Molecular and Microbial Biology</td>
<td><strong>CMMB</strong></td>
<td>Instruction offered by members of the Department of Biological Sciences in the Faculty of Science. Department Head: D.M. Reid Note: Limited amounts of non-scheduled class time involvement will be required for this course.</td>
</tr>
<tr>
<td>Senior Courses</td>
<td><strong>CMMB</strong></td>
<td></td>
</tr>
<tr>
<td>† Cellular, Molecular and Microbial Biology 343</td>
<td><strong>H(3-3)</strong> The Life of Bacteria</td>
<td>An introductory study of the systematics, ecology, physiology, molecular biology and role in pathogenesis of the major groups of prokaryotes. Prerequisite: Biology 231 and one of Chemistry 341, 351 or 354.</td>
</tr>
</tbody>
</table>
Courses of Instruction

Prerequisites or Corequisites: One of Biochemistry 341 or 393 and Chemistry 353 or 355 (if 351 is completed as a prerequisite).

Cellular, Molecular and Microbial Biology 403
H(3-1T)

Developmental Biology of Animals
Study of the mechanism of cellular differentiation with emphasis on intra- and intercellular processes.
Prerequisites: Biochemistry 393 or 441, Biology 311 and 331.
Note: Enrollment in this course may be limited. See explanation in Program section of Calendar.

Cellular, Molecular and Microbial Biology 411
H(3-0)

Biochemical Genetics
The biochemical basis of gene action with primary emphasis on the prokaryotes. Topics will include: biochemical and genetic aspects of cellular metabolism, intragenic complementation, genetics of bacterial cell division, regulation and replication of the bacterial genome, genetic exchange in bacteria and bacteriophages, fine structure analysis, genetic damage and its repair, operons and polarity, regulation of transcription and translation of prokaryotic genomes.
Prerequisites: Biology 311 and 331.
Prerequisite or Corequisite: Biochemistry 443.

Cellular, Molecular and Microbial Biology 413
H(3-1T)

Human Genetics
The principles of genetics as applied to human and mammalian genetics. Mendelian and multifactorial inheritance of normal and abnormal traits, pedigree analysis, segregation, linkage and gene mapping. Cytogenetics and developmental genetics. Population genetics including inbreeding and evolution in humans. Genetic predisposition to disease.
Prerequisite: Biology 311.

Cellular, Molecular and Microbial Biology 421
H(3-3)

Virology
Comprehensive overview of virus structure and replication; molecular events involved in virus infection and replication including genetics, biochemistry and molecular biology of bacterial, plant and animal viruses. Areas of persistent viruses, viral immunology, cancer and AIDS will be covered.
Prerequisites: Biochemistry 393 or 441, Biology 313, 331; Cellular, Molecular and Microbial Biology 343.
Prerequisite or Corequisite: Biochemistry 443.
Note: Enrollment in this course may be limited. See explanation in the Program section of this Calendar.

Cellular, Molecular and Microbial Biology 431
H(3-0)

Bacterial Pathogens
An introduction to microbes that cause infections (in humans, other animals and plants.) Topics include: the relationship between pathogen and host, ability of pathogens to colonize, reproduce and cause disease, the role of antibiotics and vaccines in treatment and prevention of infection, antibiotic resistance in bacteria, environmental control of virulence factor production.
Prerequisite: Cellular, Molecular and Microbial Biology 343.

Cellular, Molecular and Microbial Biology 443
H(3-3)

Microbial Physiology
The understanding of micro-organisms with respect to their metabolic pathways and growth in different environments.
Prerequisite: Cellular, Molecular and Microbial Biology 343.
Prerequisite or Corequisite: Biochemistry 443.
Note: Enrollment in this course may be limited. See explanation in the Program section of this Calendar.

Cellular, Molecular and Microbial Biology 451
H(2-5)
(formerly Cellular, Molecular and Microbial Biology 531)

Molecular Analysis of Biological Systems
A laboratory course emphasizing techniques in molecular biology that can be applied to the analysis of problems in cellular, molecular and microbial biology.
Prerequisites: Cellular, Molecular and Microbial Biology 411 and registration in the Cellular, Molecular and Microbial Biology or Biological Sciences Honours programs
Note: Enrollment in this course may be limited. See explanation in the Program section of this Calendar.

Cellular, Molecular and Microbial Biology 505
H(3S-0)

Advanced Developmental Biology
In-depth analyses of the current literature in developmental biology. Emphasis will be on the coordinated regulation of gene expression during development.
Prerequisites: Biochemistry 443, Cellular, Molecular and Microbial Biology 403.

Cellular, Molecular and Microbial Biology 507
H(3-3)

Special Problems in Cellular, Molecular and Microbial Biology
Lectures, seminars, term papers and training in theoretical and/or laboratory methods. After consultation with a Department faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be signed by the course supervisor before a student can register.
Prerequisites: Third or higher-year standing and consent of the Department.
MAY BE REPEATED FOR CREDIT

Cellular, Molecular and Microbial Biology 511
H(3-0)

Molecular Biology and Genetics
The concepts of molecular biology as they apply to genetics. Application of current methodology to the understanding of the genetics of prokaryotes, lower and higher eukaryotes (for example: fungi, yeasts, trypanosomes, plants and animals). Genomic organization and function of subcellular organelles such as mitochondria and chloroplasts will also be considered in detail. The mechanism(s) of regulation of gene expression will be discussed in relation to nuclear as well as organelle genomes.
Prerequisite: Cellular, Molecular and Microbial Biology 411.

Cellular, Molecular and Microbial Biology 519
H(3-0)

Advanced Cell Biology
In-depth analyses of the current literature in cell biology. Topics will include nuclear structure and function, control of cell cycle, and other areas of contemporary cell biological research.
Prerequisites: Biochemistry 443, Biology 311, and Biology 331.

Cellular, Molecular and Microbial Biology 523
H(3-0)

DNA, Genomes and RNA Function
An examination and comparison of the roles of DNA and RNA in the cell. Includes chronatin structure, transcriptional regulation, mechanisms of post-transcriptional regulation at the RNA level, and the diverse roles played by RNA, ranging from information molecules to structural scaffolds to ribozymes.
Prerequisite: Cellular, Molecular and Microbial Biology 411.

Cellular, Molecular and Microbial Biology 527
H(3-3)
(formerly Cellular, Molecular and Microbial Biology 427)

Immunology
Comprehensive overview of the immune responses: antibody-antigen interaction, antibody structure, genetics and synthesis, cellular immunology, MHC, phagocytosis, tolerance, autoimmunity, hypersensitivity, tissue rejection, tumour immunology and vaccine production. Responses to viral, bacterial, fungal and parasite infections. Methods for the study of immunology.
Prerequisites: Biochemistry 443, Biology 311, 331; Cellular, Molecular and Microbial Biology 343.
Note: Enrollment in this course may be limited. See explanation in the Program section of this Calendar.

Cellular, Molecular and Microbial Biology 530
F(0-5)

Independent Studies in Cellular, Molecular and Microbial Biology
Original and independent thought, practical research and the completion of written and oral reports. After consultation with a Department faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be signed by the course supervisor before a student can register.
Prerequisites: Fourth-year standing and consent of the Department.
MAY BE REPEATED FOR CREDIT

Cellular, Molecular and Microbial Biology 531
F(0-5)

Honours Research Project in Cellular, Molecular and Microbial Biology
Research project under the direction of one or more faculty members in the Department of Biological Sciences. Formal written and oral reports must be presented on completion of this course. Open only to Honours Cellular, Molecular and Microbial Biology students or Honours Biological Sciences students. After consultation with a Department faculty member who will supervise the chosen problem, a permission form obtained from the Department Office must be completed before a student can register.
Prerequisites: Cellular, Molecular and Microbial Biology 451, fourth-year standing and consent of the Department.
### Courses of Instruction

#### Corequisite: Cellular, Molecular and Microbial Biology 507 in the Winter Session.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Cellular, Molecular and Microbial Biology 533</td>
<td>Advanced Eukaryotic Genetics</td>
<td>H(3-1T)</td>
</tr>
<tr>
<td>Cellular, Molecular and Microbial Biology 543</td>
<td>Microbiology of Natural Systems</td>
<td>H(3-0)</td>
</tr>
<tr>
<td>Cellular, Molecular and Microbial Biology 549</td>
<td>Microbial Genetics</td>
<td>H(3-0)</td>
</tr>
<tr>
<td>Cellular, Molecular and Microbial Biology 561</td>
<td>Microbiology of Natural Systems</td>
<td>H(3-0)</td>
</tr>
<tr>
<td>Medical Science 561</td>
<td>Cancer Biology</td>
<td>H(3-0)</td>
</tr>
<tr>
<td>Chemical Engineering 401</td>
<td>Chemical Engineering 401</td>
<td>H(3-2T-1)</td>
</tr>
<tr>
<td>Chemical Engineering 403</td>
<td>Chemical Engineering 403</td>
<td>H(3-3T-4/2)</td>
</tr>
<tr>
<td>Chemical Engineering 405</td>
<td>Chemical Engineering 405</td>
<td>H(3-2T-1)</td>
</tr>
<tr>
<td>Separation Processes</td>
<td>Diffusion and convective mass transfer. Staged and continuous contacting. Leaching, distillation, absorption and extraction.</td>
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<tr>
<td>Chemical Engineering 421</td>
<td>Chemical Engineering 421</td>
<td>H(3-1T-1)</td>
</tr>
<tr>
<td>(formerly Chemical Engineering 521)</td>
<td>An Introduction to Cultural Traditions</td>
<td></td>
</tr>
<tr>
<td>Chemical Engineering Kinetics</td>
<td>A study of the design of chemical reactors; a review of the kinetics of homogeneous reactions and the interpretation of kinetic data; the design of single and multiple reactors for simple, simultaneous and consecutive reactions; the influence of temperature, pressure and flow on reactions and reactor design; an introduction to heterogeneous reaction systems and catalyzed fluid reactions.</td>
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<tr>
<td>Chemical Engineering 403</td>
<td>Chemical Engineering 403 and Chemistry 357.</td>
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<tr>
<td>Corequisite: Chemical Engineering 405.</td>
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<tr>
<td>Chemical Engineering 423</td>
<td>Chemical Engineering 423</td>
<td>H(3-2T-1)</td>
</tr>
<tr>
<td>Chemical Engineering Process Development</td>
<td>General approach to the design of chemical processing units and plants; cost estimates and chemical process economics; optimization techniques; introduction to linear programming. Safety and environmental considerations in process design. A team design project will be included. Written reports are required.</td>
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<tr>
<td>Chemical Engineering 427</td>
<td>Chemical Engineering 427</td>
<td>H(4-2T-1)</td>
</tr>
<tr>
<td>Chemical Engineering Thermodynamics</td>
<td>Review of first and second law principles; application to the properties of fluids and solutions; vapour liquid equilibrium; the third law; applications to chemical equilibrium and chemical reactions.</td>
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<tr>
<td>Corequisite: Engineering 311 and Chemical Engineering 315.</td>
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</tbody>
</table>
Courses of Instruction

Chemical Engineering 501  H(3-2T-1)
Transport Processes
Prerequisite: Chemical Engineering 401 or Applied Mathematics 407.

Chemical Engineering 503  H(3-1)
Upgrading and Refining Processes
Upgrading objectives; analysis and composition of non-crude oil material and its relationship to upgrading; upgrading processes; refinery products and specifications. Processes for which technical and scientific data are available will be emphasized. 
Prerequisites: One of Chemistry 409 or 459 and one of Chemical Engineering 421 or 521.

Chemical Engineering 505  H(3-2T-1)
Separation Processes II
Application of fundamental concepts in chemical engineering to develop process design specifications for various unit operations including: evaporation, crystallization, humidification and cooling, drying, adsorption, and membrane processes.
Prerequisite: Chemical Engineering 405.

Chemical Engineering 511  H(3-4)
Chemical Process Design I
Team design project applying principles of process engineering and project management: Gantt charts; critical path method; process simulation; degrees of freedom analysis; considerations in process selection; plant location; block flow diagrams; process flow diagrams; short cut process equipment design sizing procedures; preliminary equipment cost estimating techniques; oral and written presentations are emphasized.
Prerequisites: Chemical Engineering 315, 405, 423 and one of 421 or 521.
Corequisite: Chemical Engineering 521.
Note: Credit for both Chemical Engineering 511 and Petroleum Engineering 511 will not be allowed.

Chemical Engineering 519  H(3-0)
Special Topics
Current advanced topics in Chemical and Petroleum Engineering.
Prerequisite: Consent of the Department Head or designee.
MAY BE REPEATED FOR CREDIT

Chemical Engineering 529  H(3-3-2)
Process Dynamics and Control
The development of mathematical models to describe the transient response characteristics of basic process elements, capacity and dead time; fundamentals of single input/single output systems; use of a dynamic process simulator; block flow diagram of a feedback control loop; process control hardware; basic control modes; tuning feedback controls; cascade control; feedforward control; common control loops; distillation column control; design of multiple single loop controllers; plant wide modelling and control. 
Prerequisites: Chemical Engineering 501, 505 and one of 421 or 521.

Chemical Engineering 531  H(2-6)
Chemical Process Design II
Team design project continuing from Chemical Engineering 511. Detailed design of large commercial plants involving the preparation of a process and instrumentation diagram; emphasis on computer design procedures; specification sheets for chemical processing equipment such as separators, pumps, compressors, columns and process piping. Other topics include operational considerations in design, plant safety; relief system design; waste treatment and pollution control processes; plant and equipment plot plans; control and computer simulation; oral and written presentations are emphasized.
Prerequisite: Chemical Engineering 511.
Note: Credit for both Chemical Engineering 531 and Petroleum Engineering 531 will not be allowed.

Chemical Engineering 535  H(3-2)
Principles of Biochemical Engineering
Introduction to biochemistry, enzyme kinetics and cell growth and metabolism. Aspects of mass transfer, heat transfer and fluid flow related to the design of biological process equipment. Fermentations, sterilization and extraction techniques. Treatment of effluents. Introduction to bio-reactor design and scale-up. Introduction to process instrumentation and control.
Prerequisite: Chemistry 357.

Chemical Engineering 537  H(3-1)
Computational Thermodynamics
Prerequisite: Chemical Engineering 427 or equivalent.

Chemical Engineering 539  H(3-0)
Polymer Engineering
Introduction to polymer synthesis and processing. Overview of polymer structure, characterization, and mechanisms of polymerization. Familiarization with the basic principles of polymer processing, rheology, technical aspects and design for extrusion and various molding processes.
Prerequisite: Chemical Engineering 403.
Prerequisite or Corequisite: Chemistry 357.

Chemical Engineering 541  H (3-1.5T)  
(formerly Chemical Engineering 519.02)
Introduction to Cell and Tissue Engineering
An introduction to tissue engineering. Fundamentals of cell biology, biochemistry, tissue structure and function, biomaterials, cell culture, bioreactors, mass transfer in vivo and in vitro, and clinical applications.
Prerequisite: Chemistry 357 or equivalent.

Chemical Engineering 551  H(1-4)
Chemical Engineering Laboratory
Experiments which demonstrate the operation of chemical process equipment involving heat and/or mass transfer, or kinetics. Lectures will cover experimental design and applied statistics.
Prerequisite: Chemical Engineering 405.
Corequisite: Chemical Engineering 505.
Note: Credit for both Chemical Engineering 551 and Petroleum Engineering 551 will not be allowed.

Graduate Courses

Chemical Engineering 601  E(0-3S)
Research Seminar
Reports on studies of the literature or of current research. Required of all full-time graduate students in Chemical and Petroleum Engineering.
MAY BE REPEATED FOR CREDIT
NOT INCLUDED IN GPA

Chemical Engineering 607  H(3-0)
Natural Gas Processing Principles
A review of the physical and chemical properties of natural gas; phase behaviour; vapour-liquid equilibrium data and computations; water-hydrocarbon systems; flow of gas and gas-liquid mixtures; mass transfer operations applied to separation of gaseous mixtures; heat transfer in gas processing; chemical kinetic aspects; engineering principles used in production of natural gas and its associated liquids.

Chemical Engineering 609  H(3-0)
Natural Gas Processing Technology
A detailed review of design and operations criteria encountered in the production, wellhead treatment, transportation and processing of natural gas; refrigeration and compression; cryogenics; producing of gaswells; field processing; dew point control; LPG recovery; sulphur recovery; environmental control problems in natural gas processing; economic considerations.
Prerequisite: Chemical Engineering 607.

Chemical Engineering 613  H(3-0)
Advanced Topics in Mass Transfer
Review of fundamentals and advanced treatment of mass transfer in multiphase systems. Theories of mass transfer as well as mass transfer with simultaneous chemical reaction and heat transfer will be examined with regard to their application to practical systems.

Chemical Engineering 615  H(3-0)
Model Predictive Control
Advanced model predictive control methods for the control of chemical and process engineering systems. Multiple loop control (multiple loop pairing, tuning and de-coupling). Multiple unit and plant wide control. Model predictive control - single and multi-variable Dynamic Matrix Control (DMC), Internal Model Control (IMC) and General Model Control (GMC). An introduction to self-tuning and adaptive control. An introduction to computational intelligence in control (expert systems, fuzzy logic and neural networks). Application to chemical and process engineering systems.
Courses of Instruction

Chemical Engineering 617  H(3-0)
Modelling and Identification Advanced Control

Chemical Engineering 619  H(3-0)
Special Problems
Designed to provide graduate students, especially at the PhD level, with the opportunity of pursuing advanced studies in particular areas under the direction of a faculty member. Students would be required to consider problems of an advanced nature. Current course offerings include, but are not restricted to, specialized courses in the petroleum, biochemical and environmental engineering fields. MAY BE REPEATED FOR CREDIT

Chemical Engineering 620  F(0-4)
Graduate Project
Individual project in the student's area of specialization under the guidance of the student's supervisor. A written proposal, one or more written progress reports, and a final written report are required. An oral presentation is required upon completion of the course. Open only to students in the MEng (course-based) program.

Chemical Engineering 621  H(3-0)
Reservoir Simulation
The current state of reservoir simulation. Enhanced recovery modelling (generalized black-oil models, compositional and miscible), well treatment, grid orientation and new developments in gridding, thermal models, naturally fractured reservoirs, modelling of induced fractures (hydraulic and waterflood), reservoir geomechanics, and practical aspects of conducting simulation studies.
Prerequisite or Corequisite: Petroleum Engineering 523 or equivalent.

Chemical Engineering 623  H(3-0)
Chemical Reactor Design
An advanced study of the factors involved in the design and operation of chemical reactors for both homogeneous and heterogeneous systems; batch reactors; continuous flow stirred tank reactors; tubular reactors; multibed adiabatic reactors; cold shot cooling in reactors; determination of optimal temperature gradients and yields; catalyst effectiveness factors, optimal control with decaying catalysts. Analysis of sulphur plant reactor design using an approach to equilibrium procedure; optimization of reactor cost including capital, maintenance, feed stock, heat and control.

Chemical Engineering 625  H(3-0)
Advanced Topics in Heat Transfer and Fluid Dynamics

Chemical Engineering 627  H(3-0)
Chemical Process Simulation

Chemical Engineering 629  H(3-0)
Secondary and Tertiary Recovery
Discussion of displacement processes for recovering additional hydrocarbons. Waterflooding, gas flooding, solvent flooding and chemical flooding. Techniques for predicting the performance of these processes.

Chemical Engineering 631  H(3-0)
Fundamentals of Transport Phenomena

Chemical Engineering 633  H(3-0)
Chemical Thermodynamics
Review of basic thermodynamic principles, calculation of thermodynamic properties, ideal and non-ideal solution theory, calculation of phase equilibria, properties of reacting mixtures.
Prerequisite: Chemical Engineering 427 or equivalent.

Chemical Engineering 639  H(3-0)
Applied Numerical Methods in Engineering
Application of numerical methods to engineering problems. Topics include numerical solution of systems of linear and non-linear algebraic equations, eigenvalue problems. Numerical solution of systems of ordinary and partial differential equations. Interpolation and extrapolation. Introduction to finite element and spectral methods.
Prerequisite: Engineering 407 or equivalent.
Note: Knowledge of a programming language is necessary.

Chemical Engineering 643  H(3-0)
Environmental Engineering Aspects of Air Pollution

Chemical Engineering 645  H(3-0)
Environmental Engineering Aspects of Water Pollution
Topics include: Fresh Water Resources, Wastewater sources, Water and wastewater treatment processes, Wastewater Characteristics, Treatment objectives and regulations, Unit Operations and Design (Pre and Primary Treatment, Secondary Treatment and Tertiary Treatment processes), Disinfections.

Chemical Engineering 647  H(3-0)
Thermal Recovery Methods
Note: Credit for both Chemical Engineering 619.27 and 647 will not be allowed.

Chemical Engineering 653  H(3-0)
Horizontal Wells for Petroleum Production
Drilling and completion methods for horizontal wells; mathematical analysis of steady state flow to horizontal wells and well combinations; pseudo steady state and constant well bore pressure models; theoretical comparisons of predicted performance and coning behaviour of horizontal and vertical well patterns; performance in fractured reservoirs; potential for horizontal wells in heavy oil and bitumen production methods; conceptual ideas of steam-assisted gravity drainage.

Chemical Engineering 657  H(3-0)
Advanced Reservoir Engineering
Formulation and solution of reservoir-engineering problems. The solution methods will include combination of variables, Laplace transform, approximate Integral methods, finite difference methods of moving boundary problems. Examples from thermal processes (e.g. hot waterflooding, SAGD), different recovery mechanisms (e.g. imbibition, expansion of steam-gas drive), well testing problems and naturally fractured reservoirs will be presented.
Note: Credit for both Chemical Engineering 619.35 and 657 will not be allowed.
Note: Prior knowledge of reservoir engineering and analytical solution methods of differential equations is necessary.

Chemical Engineering 659  H(3-0)
(formerly Chemical Engineering 619.43)
Advanced Cell and Tissue Engineering
Current challenges in tissue engineering. Focus on specific tissues. Course topics include a brief biology review, cell fate processes, stem cells, tissue microenvironments and mass transfer, bioreactors, and clinical delivery of tissue engineered constructs tissue.
Prerequisite: Consent of the Instructor.

Chemical Engineering 661  H(3-0)
(formerly Chemical Engineering 619.40)
Geostatistics for Reservoir Characterization
Reviews key statistical/probability concepts, exploratory data analysis, spatial structural analysis, estimation theory (Kriging), integration of auxiliary information and conditional stochastic simulation. Special emphasis on reservoir characterization and the particular problems encountered in that area.
The geostatistical methodology for reservoir characterization will be demonstrated on a fluvial reservoir example.

Prerequisite: Consent of the Instructor.

Note: Open to graduate Chemical Engineering, Civil Engineering and Geophysics students, and Geology graduate students with sound quantitative skills. Prior exposure to statistical/probability theory is required.

Chemical Engineering 677 H(3-0)

Advanced Topics in Oil and Gas Production

An advanced study of the problems related to the production of conventional oil, heavy oil and natural gas; analysis of the interactions of oil, water and gas; the effects of fluid properties, rock structure and capillary, gravity and viscous forces acting on the reservoir system; application to the design of improved oil and gas recovery methods. New processes in oil and gas recovery.

Prerequisite: Petroleum Engineering 513 or equivalent.

Chemistry CHEM

Instruction offered by members of the Department of Chemistry in the Faculty of Science.

Department Head - B.A. Keay

Students interested in taking Chemistry courses are urged to read the advice in the Faculty of Science Program section of this Calendar. Students taking Chemistry courses which have a laboratory component are required to provide evidence that they have successfully completed the Chemical Laboratory Safety Course for Undergraduates prior to the first laboratory class. Students who have not completed this course at some time during their undergraduate program will not be allowed into the laboratory until they do so. Information about this course is available from the Chemistry Undergraduate Affairs Office (SA 109), e-mail address: uginfo@chem.ucalgary.ca, or on the World Wide Web at www.chem.ucalgary.ca.

Chemistry 003 Q(16 hours)

Organic Laboratory Skills Upgrade

A laboratory skills enhancement course for those students in a Chemistry program who have not taken Chemistry 355.

Prerequisite: Chemistry 353.

Note: A charge will be levied for excessive breakage of glassware or equipment.

NOT INCLUDED IN GPA

Junior Courses

Chemistry 201 H(3-3)

General Chemistry I

An introduction to university chemistry from a theoretical and practical perspective, exploring the relationship between chemical structure and reactivity. Topics using examples from inorganic and organic chemistry include chemical bonding, intermolecular interactions and kinetics.

Prerequisites: Chemistry 30 (or Continuing Education - Introduction to Chemistry) and one of Mathematics 30 or Pure Mathematics 30 or Mathematics II (offered by Continuing Education). Mathematics 31 is strongly recommended.

Note: Credit for both Chemistry 201 and 209 will not be allowed.

Note: Students who have completed the International Baccalaureate Higher Level examination in Chemistry may request advanced credit in Chemistry 201/203. Those who have completed the Subsidiary Level examination in Chemistry may apply to the Department of Chemistry for advanced placement in Chemistry 201 or 201/203.

Chemistry 203 H(3-3)

General Chemistry II

A continued analysis of the relationship between chemical structure and reactivity. Topics reacting using examples from inorganic and organic chemistry include energetics, equilibria (e.g. acidity and basicity, quantitative and qualitative) and redox reactions.

Prerequisite: Chemistry 201.

Note: Credit for both Chemistry 203 and 209 will not be allowed.

Note: Students who have completed the International Baccalaureate Higher Level examination in Chemistry may request advanced credit in Chemistry 201/203. Those who have completed the Subsidiary Level examination in Chemistry may apply to the Department of Chemistry for advanced placement in Chemistry 201 or 201/203.

Chemistry 209 H(3-T-3/2)

General Chemistry for Engineers


Prerequisites: Chemistry 30 (or Continuing Education - Introduction to Chemistry) and one of Mathematics 30 or Pure Mathematics 30 or Mathematics II (offered by Continuing Education). Mathematics 31 is strongly recommended.

Note: Credit for both Chemistry 209 and either 201 or 203 will not be allowed.

Senior Courses

Note: In all Senior Courses in Chemistry with a laboratory component, a charge will be levied for excessive breakage of glassware or equipment.

Chemistry 311 H(3-4)

(formerly Chemistry 411)

Analytical Chemistry: Quantitative Analysis

Lectures: Principles and practice of precision measurement in chemistry; statistical treatment of data; acid-base and oxidation-reduction equilibria; complexometric analysis. Laboratory: Quantitative analysis of organic and inorganic materials.

Prerequisites: Chemistry 201/203 and Mathematics 251 or 249 or Applied Mathematics 217.

Prerequisite or Corequisite: At least one of Chemistry 331, 351, 354, or 373.

Chemistry 315 H(3-4)

(formerly Chemistry 415)

Analytical Chemistry: Introductory Instrumental Analysis


Prerequisite: Chemistry 311.

Prerequisite or Corequisite: At least one of Chemistry 333, 353, 354, 355, or 371.

Chemistry 331 H(3-3)

Inorganic Chemistry: Main Group Elements

Lectures: The structure of many-electron atoms; bonding, stereochemistry and symmetry in inorganic compounds; solid-state science and aspects of inorganic solution chemistry. The chemistry of the main group elements. Laboratory: Applications of chemical principles to inorganic synthetic and qualitative analytical problems.

Prerequisites: Chemistry 201/203.

Chemistry 333 H(3-3)

Inorganic Chemistry: Transition Metals

Lectures: Bonding models for metals and for transition metal compounds; interpretation of redox and thermodynamic properties based on ligand field theory; coordination and organometallic compounds of the transition metals; metal complexes as catalysts in industry and biology. Laboratory: Synthesis, analysis, and physical investigations of transition metal compounds which illustrate their important properties.

Prerequisite: Chemistry 331.

Chemistry 341 H(3-3)

Elementary Organic Chemistry

A survey of bio-organic and industrial organic chemistry for non-chemistry majors.

Prerequisite: Chemistry 30 or Continuing Education - Introduction to Chemistry.

Note: Credit for both Chemistry 341 and any of 351, 353, 354 or 355 will not be allowed.

Note: This course will not serve as a prerequisite for advanced chemistry courses.

Chemistry 351 H(3-1T-3)

Organic Chemistry I

Lectures: An introduction to Organic Chemistry from a mechanistic perspective. Structure and bonding, aromaticity, physical properties, stereochemistry, kinetics and thermodynamics, spectroscopy (nuclear magnetic resonance, infrared, ultra-violet/visible, and mass spectrometric techniques). Laboratory: The techniques of practical organic chemistry.

Prerequisites: Chemistry 201/203.

Note: Credit for both Chemistry 351 and 341 or 354 will not be allowed.

Note: Students are advised to take Chemistry 351 and 353 in consecutive sessions.

Chemistry 353 H(3-1T-3)

Organic Chemistry II

Lectures: The reactions of common functional groups via substitution, elimination and addition mechanisms with examples of biological significance. Laboratory: Characteristic functional group reactivity, including carbohydrates and lipids, synthesis.

Prerequisite: Chemistry 351.

Note: Credit for both Chemistry 353 and 341 or 354 or 355 will not be allowed.

Note: This course is not open to students in Honours or Major programs in Applied Chemistry or Chemistry or to students in the Honours program in Chemical Physics.

Note: Students are advised to take Chemistry 351 and 353 in consecutive sessions.
Prerequisites: Chemistry 209, 357.

petrochemical processing. including co-product formation and the role of reaction pathways to infer system performance

Analysis of industrial chemical processes based on Engineers

Chemistry 409 H(3-0)

Applied Chemistry and Chemical Pathways for Engineers

Analysis of industrial chemical processes based on reaction pathways to infer system performance including co-product formation and the role of catalysts. Examples from oil, gas, coal and petrochemical processing.

Prerequisites: Chemistry 209, 357.

Chemistry 421 H(3-0)

Environmental Chemistry

A survey course of major aspects of environmental chemistry including the natural chemical cycles in the biosphere, geosphere, hydrosphere and atmosphere and the consequences of anthropogenic disturbances to these cycles. Topics discussed will include: Aquatic Chemistry and Water Pollution; Atmospheric Chemistry and Its Alteration; Soil Chemistry and the Fate of Pollutants; Hazardous Waste; Toxicological Chemistry.

Prerequisite: Chemistry 203 or 209.

Prerequisite or Corequisite: Chemistry 341, 351, 354, or 357.

Chemistry 425 H(3-0)

Industrial Chemistry

Electrochemical processes and the applications of some of their products. Unit operations and reactor types in the chemical industry. Petroleum refining including heavy oil and bitumen. Industrial organic synthesis including monomers for subsequent polymerization. Design of specialized polymers.

Prerequisite: Chemistry 353, 354, or 355.

Chemistry 429 H(3-0)

Industrial Chemistry

Electrochemical processes and the applications of some of their products. Unit operations and reactor types in the chemical industry. Petroleum refining including heavy oil and bitumen. Industrial organic synthesis including monomers for subsequent polymerization. Design of specialized polymers.

Prerequisite: Chemistry 353, 354, or 355.

Chemistry 432 H(3-0)

Advanced Organic Chemistry


Prerequisite: Chemistry 353, 354 or 355.

Note: Students who have Chemistry 353 are required to take 003 in Block Week as a corequisite.

Chemistry 471 H(3-1T-3)

Physical Chemistry III

Vibrational, electronic and magnetic resonance spectra. Reaction kinetics and transport properties in the gas phase and in solution. Catalysis. Laboratory: Experimental measurements, interpretations, and calculations relating to the topics discussed in lectures.

Prerequisites: Chemistry 371 and 373.

Chemistry 502 F(0-9)

Research in Chemistry

Comprehensive research project under the direction of a staff member. A research report must be presented on completion of the course, and attendance at a weekly research seminar is expected.

Prerequisites: Completion of Year Three of a Chemistry, Applied Chemistry, or Chemical Physics program and consent of the Department.

MAY BE REPEATED FOR CREDIT

Chemistry 515 H(3-4)

Advanced Instrumental Analysis


Prerequisites: Chemistry 311/315 or 411/415.

Chemistry 531 H(3-1T)

Advanced Inorganic Chemistry I

Coordination and organometallic chemistry of the transition elements, incorporating the lanthanoids and actinoids. Fundamental and applied aspects, including characterization techniques, reaction mechanisms, catalysis and bioinorganic chemistry.

Prerequisites: Chemistry 333 and 353 or 354 or 355.

Prerequisite or Corequisite: Chemistry 373.

Chemistry 533 H(3-1T)

Advanced Inorganic Chemistry II

Chemistry of the s- and p-block elements. Interpretation of nuclear magnetic resonance, electron paramagnetic resonance, vibrational and mass spectra. Fundamental concepts and industrial uses of inorganic heterocycles and polymers, electron-deficient and organometallic compounds. Solid-state chemistry.

Prerequisites: Chemistry 333 and 353 or 354 or 355.

Prerequisite or Corequisite: Chemistry 373.

Chemistry 551 H(3-1T)

Organic Synthesis

Concepts and strategies of synthesizing molecules with emphasis on carbon-carbon bond-forming reactions, protecting groups, chemo-, regio- and stereoselectivity

Prerequisite: Chemistry 453.

Chemistry 553 H(3-1T)

Bio-organic Chemistry

Organic chemistry applied to the understanding of biomolecules: selected topics from carbohydrate, peptide/protein, lipid and nucleoside chemistry, enzyme inhibition and drug design.

Prerequisite: Chemistry 453.

Chemistry 555 H(1-8)

Advanced Organic Laboratory

Advanced laboratory techniques for the synthesis and characterization of main group compounds, organometallics and solid-state materials using modern spectroscopic and structural methods. Includes a short project.

Prerequisites: Chemistry 333 and 453.

Courses of Instruction
Chemistry 577 H(3-1T)

Natural Product Chemistry
The organic chemistry of important classes of natural products such as polyketides, terpenoids, alkaloids, and antibiotics; illustrating the biosynthetic processes involved in their production, and selected chemical transformations, and syntheses.
Prerequisite: Chemistry 453.

Chemistry 571 H(3-0)

Physical Chemistry of Interfaces
The chemical and electrical nature, as well as basic thermodynamics, of interfaces. Surface films and aqueous interfaces, including micelles and bilayers. Interfaces involving solids such as metals and semiconductors. Absorption phenomena and surface catalysis. Survey of experimental approaches for interfacial studies.
Prerequisites: Chemistry 371, 373 and consent of the Department.

Chemistry 573 H(3-0)

Nature of the Condensed Phase in Chemistry
Theoretical models of liquids and solids. Dielectric continuum, polarization and magnetism. Ionic crystal, insulators, conductors, semiconductors and superconductors. Some aspects of scattering techniques for structure determination.
Prerequisites: Chemistry 371, 373 and consent of the Department.

Chemistry 577 H(3-0)

Introduction to Polymer Science
Polymer synthesis, including free radical polymerization, condensation polymerization, and Ziegler-Natta catalytic polymerization. Topics on polymer characterization include gel permeation chromatography, light scattering, viscometry, and sedimentation. Fundamental theories of polymer chain statistics and the thermodynamic theory of polymer solutions will be treated.
Prerequisites: Chemistry 353 or 354 or 355, 371, 373, and consent of the Department.

Chemistry 579 H(3-0)

Surface and Colloid Chemistry for Engineers
Introduces the fundamental and applied aspects of interfacial phenomena including capillarity, surface and interfacial tension, films, wetting and contact angles, adsorption, micellization, solubilization and emulsification. Examples drawn from colloids, foams, aerosols and macromolecules.
Prerequisites: Chemistry 209, 357 and Chemical Engineering 427.

Graduate Courses
Advanced graduate level courses are listed below. Courses in certain areas are grouped under “Selected Topics” titles. The content and offering of these are decided annually by the Department to meet the requirements of graduate students in the program. A student may receive credit for several courses in a given selected topics area. Details of offerings and course outlines may be obtained from the Department on request.

Unless stated otherwise the prerequisite for entry to all courses at the 600 level and above is “consent of the Department.” Only where appropriate to a student’s program may graduate credit be received for courses numbered 500-599.

Chemistry 601 H(2S-0)
Research Seminar
Reports on studies of the literature or of current research. Required of all graduate students in Chemistry.
NOT INCLUDED IN GPA

Chemistry 603 H(2S-0)
Research Seminar
Continuation of Chemistry 601.
NOT INCLUDED IN GPA

Chemistry 613 H(3-0)
Electrochemical Fundamentals and Methodologies
Origin, significance, and thermodynamics of interfacial potential differences; structure of the double layer; basic principles of electron transfer at interfaces, Butler-Volmer equation; mass transport control of electro-chemical reactions; controlled potential methods as applied to electrode surface reactions and homogenous reactions coupled to electron-transfer processes.

Chemistry 615 H(3-0)
Analytical Separations
Theory and practice of resolving mixtures into separate components for analysis. Basic theory; liquid-liquid extraction; high performance liquid chromatography; gas-liquid, open bed, ion exchange and exclusion chromatography; electrophoresis.

Chemistry 617 H(3-0)
Advanced Analytical Chemistry
Consideration of principles and equilibria pertaining to aqueous and nonaqueous neutralization, redox, complexation, precipitation and potentiometric methods employed in analyses. Statistical considerations of analytical data and analysis.

Chemistry 619 H(3-0)
Selected Topics in Analytical Chemistry
Topics of current interest such as: properties of synthetic polymer membranes, advanced instrumental methods, developments in chemical sensors, speciation studies, environmental analytical chemistry.
MAY BE REPEATED FOR CREDIT

Chemistry 621 H(3-0)
Organometallic Chemistry
A detailed discussion of structure, bonding and preparative methods in organometallic chemistry including the industrial and synthetic applications of organometallic compounds.

Chemistry 623 H(3-0)
Chemistry of the Main Group Elements
The chemistry of electron-deficient, electron-precise, and electron-rich rings, inorganic polymers, and organometallic compounds of the main group elements; applications of physical techniques; industrial uses. Seminars on recent research developments.

Chemistry 625 H(3-0)
Kinetics and Mechanisms of Inorganic Reactions
The dynamics of thermal and photochemical processes involving inorganic compounds, and their relationship to structure and mechanism. Emphasis is on ligand substitution and oxidation/reduction reactions of transition metal complexes in solution.

Chemistry 627 H(3-0)
Theoretical Inorganic Chemistry
Aspects of theoretical inorganic and organometallic chemistry including: quantitative and qualitative molecular orbital theory; the bonding and structure of molecules, clusters, and extended arrays; the fragments of organometallic species; orbital correlation diagrams in inorganic reactions; spectroscopic methods and their interpretation.

Chemistry 629 H(3-0)
Selected Topics in Inorganic Chemistry
Courses are offered to cover topics of current interest, such as bioinorganic chemistry, inorganic solution phenomena, and the inorganic chemistry of the solid state.
MAY BE REPEATED FOR CREDIT

Chemistry 651 H(3-0)
Advanced Organic Stereochemistry
Stereoechemical principles in organic chemistry, including: geometry, bonding, symmetry, molecular isomerism, conformational analysis, asymmetric and stereocontrolled reactions.

Chemistry 655 H(3-0)
Advanced Organic Spectroscopy
Advanced spectroscopic techniques for the determination of organic molecular structure. Techniques include Nuclear Magnetic Resonance Spectroscopy (NMR), Infrared and Raman Spectroscopy, Ultraviolet and Visible Spectroscopy; (absorption, fluorescence, chiroptics), Mass Spectrometry, and an outline of the single-crystal X-ray diffraction method. Separation techniques will be covered, particularly those combining separations and spectroscopic analysis.

Chemistry 659 H(3-0)
Advanced Organic Synthesis
A review of modern synthetic reactions and methods in the field of organic chemistry with emphasis on the recent literature.

Chemistry 667 H(3-0)
Theoretical Organic Chemistry
Theoretical principles of organic chemistry including stereochemistry, molecular orbital calculations, pericyclic processes (Woodward-Hoffmann rules), and PMO theory.

Chemistry 669 H(3-0)
Selected Topics in Inorganic Chemistry
Courses are offered in major branches of organic chemistry, including: carbohydrate chemistry, steroids and terpenoids, semiochemistry, heterocyclic chemistry, biosynthesis of secondary metabolites, as well as other topics of current interest.
MAY BE REPEATED FOR CREDIT

Chemistry 571 H(3-0)

Advanced Organic Stereochemistry
Stereochemical principles in organic chemistry, including: geometry, bonding, symmetry, molecular isomerism, conformational analysis, asymmetric and stereoccontrolled reactions.

Chemistry 655 H(3-0)

Organic Spectroscopy
Advanced spectroscopic techniques for the determination of organic molecular structure. Techniques include Nuclear Magnetic Resonance Spectroscopy (NMR), Infrared and Raman Spectroscopy, Ultraviolet and Visible Spectroscopy; (absorption, fluorescence, chiroptics), Mass Spectrometry, and an outline of the single-crystal X-ray diffraction method. Separation techniques will be covered, particularly those combining separations and spectroscopic analysis.

Chemistry 659 H(3-0)

Advanced Organic Synthesis
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Chemistry 667 H(3-0)

Theoretical Organic Chemistry
Theoretical principles of organic chemistry including stereochemistry, molecular orbital calculations, pericyclic processes (Woodward-Hoffmann rules), and PMO theory.

Chemistry 669 H(3-0)

Selected Topics in Inorganic Chemistry
Courses are offered in major branches of organic chemistry, including: carbohydrate chemistry, steroids and terpenoids, semiochemistry, heterocyclic chemistry, biosynthesis of secondary metabolites, as well as other topics of current interest.
MAY BE REPEATED FOR CREDIT
Chemistry 679  H(3-0)
Selected Topics on the Chemistry of Condensed Phases
Courses are offered on such topics as the physical chemistry of polymers, surface phenomena, and the chemistry of colloids and interfaces.

MAY BE REPEATED FOR CREDIT

Chemistry 681  H(3-0)
Crystallography
A general introduction to X-ray analysis of single crystals. Topics include: Geometry of the crystalline state; diffraction of X-rays; Fourier synthesis; methods of structure solution; accuracy and precision of derived parameters.

Chemistry 685  H(3-0)
Infrared and Raman Spectroscopy
Topics to be covered include: symmetry and group theory applied to molecular vibrations, molecular force field calculations, resonance Raman spectroscopy, Fourier transform infrared spectroscopy, and the vibrational spectra of different phases, especially gaseous and solid phases.

Chemistry 687  H(3-0)
Nuclear Magnetic Resonance Spectroscopy
Basic theory of NMR using the Bloch equations and product operator formalism. Discussion of NMR and the periodic table with particular emphasis on 1H, 13C, and other common nuclei. The chemical shift phenomenon, scalar coupling, relaxation times, principles of Fourier transform NMR, various one- and two-dimensional pulse sequences, nuclear Overhauser effects, dynamic NMR and solid state NMR will be discussed.

Chemistry 689  H(3-0)
Selected Topics in Physical Chemistry
Courses are offered in such topics as dielectric properties, kinetics, molecular vibrations, fluorescent spectroscopy, X-ray diffraction.

MAY BE REPEATED FOR CREDIT

Chemistry 699  H(3-0)
Selected Topics in Theoretical Chemistry
Courses are offered in such topics as thermodynamics, statistical mechanics, quantum mechanics and group theory.

MAY BE REPEATED FOR CREDIT

Chemistry 701
Independent Study
Independent study outside a student’s thesis area under the direction of a staff member and approved by the student’s supervisor or in the case of PhD students the supervisory committee and Department Head. A report must be submitted on completion of the course.

MAY BE REPEATED FOR CREDIT

Chinese 205  H(3-2)
Beginners’ Chinese I
Basic concepts of the Chinese National Language. Reading and writing of characters, essentials of grammar, basic vocabulary, and oral drills on normal speech patterns.

Prerequisite: Consent of the Department.

Chinese 207  H(3-2)
Beginners’ Chinese II
Continuation of Chinese 205.

Prerequisite: Chinese 205 or consent of the Department.

Chinese 229  H(2-2)
Intensive Beginners’ Chinese
Intensive development of conversational skills and the pronunciation of the Chinese National Language. Enhanced training in vocabulary acquisition, grammar and writing. For students with a background in a Chinese dialect.

Prerequisite: Consent of the Department.

Chinese 279  H(1-2)
Reading and Writing Chinese
Introduction to the Chinese language for students who have a background in Mandarin and other Chinese dialects, but limited reading and writing ability. Students will learn to read and write characters, and acquire the essentials of basic vocabulary and grammar.

Prerequisite: Consent of the Department.

Note: Not open to students with credit in Chinese 205 or 207.

Senior Courses

Chinese 301  H(3-1)
Continuing Chinese I

Prerequisite: Chinese 207 or consent of the Department.

Note: Not open to students with credit in Chinese 229.

Chinese 303  H(3-1)
Continuing Chinese II
Continuation of Chinese 301.

Prerequisite: Chinese 301 or consent of the Department.

Note: Not open to students with credit in Chinese 229.

Chinese 311  H(3-1)
Chinese Language and Culture in an Immersion Setting I
A course in Chinese stressing the oral skills and cultural understanding in an immersion environment. This course is given during Spring/Summer Sessions in the People’s Republic of China.

Prerequisite: Consent of the Department.

Chinese 313  H(3-1)
Chinese Language and Culture in an Immersion Setting II
A continuation of Chinese 311. This course is given during Spring/Summer Sessions in the People’s Republic of China.

Prerequisite: Chinese 311 or consent of the Department.

Chinese 317  H(3-0)
Chinese Civilization
Discussion of the principal trends in the development of the Chinese civilization and its place in the Asian setting.

Note: This course is taught in English; no knowledge of Chinese is required.

Chinese 331  H(3-0)
Intermediate Chinese I
An intermediate course giving equal emphasis to receptive and productive language skills.

Prerequisite: Chinese 303 or consent of the Department.

Note: Not open to students with credit in Chinese 229.
Chinese 333 H(3-0)
Intermediate Chinese II
A continuation of Chinese 331.
Prerequisite: Chinese 331 or consent of the Department.
Note: Not open to students with credit in Chinese 229.

Chinese 355 H(3-0)
Chinese Literature in Translation
Introduces the literary tradition of China by means of reading the English translations of representative works. Examines the historical and cultural background, as well as literary forms and aesthetics.
Note: This course is taught in English; no knowledge of Chinese is required.

MAY BE REPEATED FOR CREDIT

Chinese 421 H(3-0)
Advanced Chinese Composition and Conversation
Analysis of selected literary texts, Syntactic, structural and stylistic characteristics of Modern Chinese. Individualized composition and oral reports.
Prerequisite: Chinese 333 or consent of the Department.

Chinese 431 H(3-0)
Selected Topics in Chinese Literature
Topics studied are listed in the Master Timetable.
Prerequisite: Chinese 333 or consent of the Department.

MAY BE REPEATED FOR CREDIT

Chinese 461 (Japanese 461)
Japanese-Chinese Cultural Relations
Discussion of cultural relations and influences between Japan and China. Topics may include cultural identities and cross-influences, literary and artistic traditions, writing systems, and will be listed in the Master Timetable.
Prerequisite: Chinese 303 or consent of the Department. Knowledge of the other language would be beneficial.

Civil Engineering ENCI

Instruction offered by members of the Department of Civil Engineering in the Faculty of Engineering.
Department Head - T.G. Brown
Associate Heads - R.C.K Wong, R. Wan

Senior Courses

Civil Engineering 337 H(3-2)
Computer Tools for Engineering Design
A laboratory-based course utilizing common computer tools for problem solution, design and communication in engineering. Projects will involve the use of several tools, including spreadsheets, databases, computer graphics, computer programming and specialized applications for analysis and design. Topics will be derived from real engineering problems and may vary from year to year as technology changes.
Prerequisite: Engineering 233.

Civil Engineering 413 H(3-5/2)
Introduction to Civil Engineering Materials
Prerequisite: Engineering 201.

Civil Engineering 423 H(3-1-2)
Soil Mechanics
Identification and classification of soils; soil structure; soil compaction; seepage; effective stress concept; settlement; one dimensional consolidation; shear strength; selected laboratory and design exercises with computer applications.
Prerequisite: Geology 471.

Civil Engineering 451 H(3-2)
Basic Structural Design
Introduction to structural design. Steel: tension; compression; laterally braced beams; discussion of steel structure systems. Reinforced concrete: flexure; shear; anchorage; introduction to column design; discussion of reinforced concrete structural systems. Masonry walls: axial and lateral load. Timber and glue laminates: compression; tension; flexure; bearing; combined bending and axial load; fasteners; purlins; decking; pitched tapered beams; arches.
Prerequisite: Engineering 317.

Civil Engineering 461 H(3-1.5T)
Materials of Civil Engineering
Analysis of statically determinate structures: reactions, member forces in trusses, bending moment, shearing force and axial force diagrams for beams and frames. Displacements due to bending moment area theorems. Strain energy and virtual work. Displacements by virtual work. Normal stresses in nonsymmetrical sections; principal axes. Shear stresses in beams, shear centre; shear stress in circular sections; torsion in non-circular sections. Principal stresses, Failure theories. Buckling of columns, inelastic buckling, plate buckling.
Prerequisite: Engineering 317.

Civil Engineering 465 H(3-2T)
Engineering and Construction Management
Introduction to engineering and construction management: planning, scheduling, estimating, cost control; project organization, human resource management; specifications; construction processes; manpower requirements; disputes and their resolution, social, economic and environmental impacts; regulatory requirements; project completion and commissioning.
Prerequisite: Civil Engineering 471.

Civil Engineering 471 H(3-2)
Introduction to Project Management
Introduces system engineering techniques that can be used to analyze and provide rational solutions to a range of problems encountered in engineering and the related management decision-making process. The emphasis is on applications. Students are also expected to gain a detailed understanding of some of the techniques and tools available and their application in planning and managing engineering and construction projects. The course covers scheduling, Gantt chart and CPM, cash flow diagram forecasting, forecasting, linear programming, and decision analysis.

Civil Engineering 473 (Transportation Science 473) H(3-2)
Introduction to Transportation Planning
Goals and objectives of urban and regional transportation planning; the transportation planning process, trip generation, trip distribution, modal split, traffic assignment; transportation surveys and data collection; fundamentals of traffic flow; capacity and level of service; urban transportation technology; computer simulation models of urban transportation; environmental impacts; transportation systems management; energy consideration; pedestrian movement systems; urban goods movement; impact of transportation system on city growth; urban transportation policy and financing in Canada.
Prerequisite: Transportation Science 301 or Engineering 319 or consent of the Instructor.

Civil Engineering 481 H(3-2)
Introduction to Environmental Engineering
The application of science and engineering principles to minimize adverse effects of human activity on the environment; physical and organic chemistry; environmental microbiology; characteristics of natural waters and how pollution impacts water quality and use; parameters for measuring water quality, sources of water pollution and characteristics of wastewater; sustainable development; environmental management systems including environmental impact assessments; water and wastewater technologies; coagulation, flocculation, filtration, primary and secondary wastewater treatment; sludge treatment and disinfection; solid and hazardous waste processing and disposal technologies.
Prerequisites: Chemistry 209, Mechanical Engineering 341.

Civil Engineering 513 H(3-1)
Properties of Concrete and Masonry
Prerequisite: Civil Engineering 413.

Civil Engineering 523 H(3-1T-2/2)
Soil Mechanics and Foundation Engineering
Earth embankments; sub-surface investigations; compaction; seepage analysis and slope stability; lateral earth pressures and retaining structures; shallow and deep foundations in sands and clays; bearing capacity and settlement of structures; selected laboratory, design exercises, solution to slope stability and other problems using computer programs.
Prerequisite: Civil Engineering 423.

Civil Engineering 525 H(3-1)
Applied Geotechnical Engineering
Selected topics from: soil improvement; foundations in permafrost; machine foundation analysis and soil
Courses of Instruction

Civil Engineering 533  H(3-1)

**Engineering Hydrology**

Introduction to engineering hydrology; Meteorological factors in hydrology, rainfall, temperature, humidity, wind; Physical hydrology, measurement and estimates of precipitation, evaporation and transpiration, groundwater flow, rainfall-runoff relation; Hydrometry, stream flow measurement, stage-discharge relations; gauging stations; Linear theory of hydrological systems, hydrograph analysis, groundwater recession, unit hydrograph; Hydrology of floods, reservoir and river flood routing; Statistical hydraulic flowability distributions, frequency analysis; Hydrological design, design storms, design flows.

**Prerequisite:** Mechanical Engineering 341.

Civil Engineering 555  H(3-1)

**Structural Concrete Design**

Structural systems for buildings. Loads on structures. Analysis and design of concrete beams and one-way slabs using moment coefficients as well as analysis and design by computer. Shear and torsion (general method). Two-way slabs and flat plates by direct design method, punching shear; long columns, laterally loaded walls, bearing walls, shear walls; wall footings, isolated footings. Prestressed concrete; elastic analysis, prestress losses, deflections, flexural and shear strength, bond and anchorage. Use of computer programs where applicable.

**Prerequisite:** Civil Engineering 451.

Corequisites: Civil Engineering 454.

Civil Engineering 557  H(3-1)

**Structural Steel Design**


**Prerequisites:** Civil Engineering 451 and 454.

Civil Engineering 570  F(0-4)

**Group Design Project**

A team design project applying engineering and project management principles to prepare a multidisciplinary design and bid document for a civil engineering project. Students are expected to consult with local industry and professors in the Department. Teams will prepare a final report and will present this report to a committee, comprising of representatives from the Department and industry. Proposals should document and discuss the project development, design and execution plan with an emphasis on the technical, human resources and business aspects of the project. Initial engineering design for all Civil Engineering design aspects including: Environmental, Geotechnical, Hydraulics, Materials, Structural and Transportation. Preparation of design documents and specifications and presentation of competitive bids.

**Prerequisites:** Civil Engineering 413, 423, 451, 461, 465, 473, 481 or Department approval.

Civil Engineering 573  H(3-1)

**Highway Engineering**

Introduction to highway planning and engineering; human factors; road vehicle performance characteristics; roadway capacity and level of service; highway classification; design consistency; alignment elements, cross section elements; intersections, interchanges, traffic barriers; road safety audits. Planning and design of bicycle facilities. Environmental impact of highways. Explicit evaluation of safety in road design.

Civil Engineering 575  H(3-1)

**Traffic Engineering and Operations**

Introduction to traffic engineering, traffic stream characteristics, traffic studies, data collection, speed, travel time and delay studies, speed limits and advisory speeds, accident studies, parking studies, traffic barriers, traffic noise, capacity and level of service, warrants for traffic control devices, principles of interaction signalization, actuated and pretimed signals, signal control systems, progression, traffic systems management, local area traffic management studies, intelligent transportation systems, road safety audits.

**Prerequisite:** Engineering 319 or equivalent.

Civil Engineering 577  H(3-1)

**Modelling of Transportation Systems**

Approaches to mathematical and computer-based modelling for transportation planning; trip generation models, trip distribution models, mode split processes, assignment models; direct demand models; discrete-choice behavioural models; simplified transportation demand models; use of models in design and evaluation.

**Prerequisite:** Civil Engineering 473.

Civil Engineering 579  H(3-1)

**Asphalt Pavement Design and Management**

Planning, designing, constructing and maintaining asphalt pavements: physical parameters, economic considerations and governing specifications; optimum design based on: design loads, subgrade soil mechanics and aggregates; asphalt mix selection and preparation; construction methods; pavement failure mechanisms; prediction of long-term performance based on field and laboratory tests; performance criteria and the implementation of rehabilitation and recycling programs.

**Prerequisites:** Civil Engineering 423, Geology 471.

Civil Engineering 581  H(3-1)

**Water and Wastewater Engineering**

Water and wastewater quantities and quality, water distribution and wastewater collection systems, hydraulic considerations, flow through pipes and networks, design of sanitary sewers, storm drainage systems, physical, chemical, and biological considerations, sampling and analysis, water quality and water supply; aeration, coagulation, flocculation, sedimentation, single and multi-media filtration, disinfection, activated sludge system and trickling filter, design considerations, sludge processing and disposal.

**Prerequisites:** Civil Engineering 481 and Mechanical Engineering 341.

Civil Engineering 587  H(3-1)

**Site Assessment and Remediation**

Environmental impact assessments, environmental audit protocols and plans, pre-assessment planning and preliminary assessment of contaminated sites, site investigation, field techniques and program implementation, remedial investigations, cost and time analysis, physical, chemical and biological remediation techniques, land treatment, soil vapour extraction and solidification.

**Prerequisite:** Civil Engineering 481.
Courses of Instruction

Civil Engineering 589 H(3-1)

Air and Water Pollution
Sources of air and water pollution, acute and chronic health effects of pollution, environmental quality standards and compliance criteria, monitoring environmental quality, sampling techniques, fate and transport of pollutants in environmental media, particulates and gaseous pollutants in air medium, dissolved and suspended solids in water medium, air and water quality modelling, introduction to software.

Prerequisite: Civil Engineering 481.

Civil Engineering 591 H(3-1)

Solid and Hazardous Waste Engineering
Integrated waste management, solid and hazardous waste characterization and classification, reduce, reuse, recycle, waste collection and transport, resource recovery and utilization, life cycle assessment of waste, composting, physical and chemical treatment methods, landfill disposal, landfill design and operation, gas recovery and control at landfills.

Prerequisite: Civil Engineering 481.

Civil Engineering 595 H(3-1)

Special Topics
Current topics in Civil Engineering.

Prerequisite: Consent of the Department Head.

MAY BE REPEATED FOR CREDIT

Civil Engineering 597 H(0-5)

Civil Engineering Project I
Individual work on an assigned Civil Engineering topic under the supervision of a faculty member. The project will normally involve a literature review, theoretical and laboratory or field work. Submission of a mid-term progress report defended orally and a final report.

Note: Open to students who have completed the third year Civil Engineering program with a GPA of 3.00 or better and/or Department Heads approval.

Civil Engineering 599 H(0-5)

Civil Engineering Project II
Individual project intended for students who have completed a suitable Civil Engineering Individual Project and wish to continue the assigned research project by completing a more extensive investigation. A comprehensive written report is required which is defended and presented orally in a Department seminar.

Prerequisites: Civil Engineering 597 and formal approval from the project supervisor and course coordinator(s).

Graduate Courses
Registration in all courses requires the approval of the Department of Civil Engineering.

Civil Engineering 611 H(3-1)

Bituminous Materials

Civil Engineering 615 H(3-0)

Rheology of Engineering Materials

Civil Engineering 617 H(3-0)

Fracture of Civil Engineering Materials
Cohesive strength; plasticity. Fracture mechanics in relation to structural steel, stress intensity, fracture toughness, energy release rate, LEFM, COD, J-Integrated, R-Curve, fatigue. Compressive fracture of concrete, masonry and rocks; cracking patterns, fracture theories, damage models, test methods and effects.

Civil Engineering 619 H(3-0)

Special Problems
Designed to provide graduate students, especially at the PhD level, with the opportunity of pursuing advanced studies in particular areas under the direction of a faculty member. Students would be required to consider problems of an advanced nature.

MAY BE REPEATED FOR CREDIT

Civil Engineering 621 H(3-0)

Computer Analysis of Structures
Review of matrix methods of structural analysis by the force and displacement methods. Energy theorems. Transformation of forces and displacements. Stiffness and transformation matrices for individual members of plane and space trusses or frames and grids. Computation techniques; assembling of stiffness matrices; boundary conditions; solution of simultaneous equations. Structural symmetry; anti-symmetry; cyclic symmetry. Analysis of large structures by substructuring. Introduction to the finite element method; displacement functions; stiffness matrix formulation; consistent load vectors; analysis for the effects of temperature. Isoparametric elements for the analysis of space frames with curved members of variable cross sections; thermal loading; prestressing forces. Applications using available computer programs.

Civil Engineering 623 H(3-0)

Behaviour and Design of Reinforced Concrete Members
Behaviour and strength of reinforced concrete members; materials; safety; design of members subjected to flexure, compression, compression and flexure including biaxial bending, shear, torsion; bond and anchorage; slender columns; deep beams; serviceability; rotation capacity; relation between results of research and current design codes.

Civil Engineering 625 H(3-0)

Behaviour and Design of Prestressed Concrete Bridges
Concrete Bridges and Other Structures
Behaviour and Design of Prestressed Concrete Bridges

Civil Engineering 629 H(3-0)

Computational Modelling of Concrete Structures
Discussion of linear finite element analysis; nonlinear analysis and iterative techniques; constitutive relations and failure theories; modelling of reinforcement and prestressing; cracking models and post-cracking behaviour; tension stiffening and strain softening; models for shear transfer; time-dependent effects of creep, shrinkage and temperature; behaviour under cyclic loading and dynamic effects; numerical examples and computer applications on analysis of beams, frames, slabs, shear panels and walls, thin shells, axisymmetric solids and three dimensional structures.

Civil Engineering 631 H(3-0)

Design and Behaviour of Prestressed Concrete Bridges and Other Structures

Civil Engineering 633 H(3-0)

Behaviour and Design of Prestressed Concrete Members
Flexural analysis and design of prestressed and partially prestressed concrete members based on stresses, deflections and strength. Design of members subjected to shear, torsion, compression or tension. Fire resistance. Composite members. Bond and anchorage zones. Prestressing losses and time-dependent deformations. Discussion of current design standards.

Civil Engineering 635 H(3-0)

Structural Dynamics
Numerical analysis of simple systems; rigorous analysis of one-degree systems; lumped mass multi-degree systems and structures with distributed mass and load; approximate analysis and design methods; earthquakes, blast-resistant design, beams subjected to moving loads; calculation of results by analog and digital computer.

Civil Engineering 641 H(3-0)

Seismic Analysis and Design
Introduction to seismology, ground movements, typical accelerograms. Response spectra for linear and non-linear responses, role of damping and inelastic behaviour. Equivalent lateral load for
Courses of Instruction

Civil Engineering 699  H(3-0)  Law for Project Managers
   Legal issues related to the effective management of projects. Introduction to the legal system and processes; environmental law; intellectual property nondisclosure; professional liability; contract law; strategic alliances; employment law; the builder’s lien act. Cases are reviewed and students are expected to complete a number of assignments requiring research into case law.
   Prerequisite: Consent of the Program Director.
   Note: This course may not be taken for credit towards the LLB or LLM degrees.

Civil Engineering 703  H(3-3)  Urban and Regional Transportation Planning
   The urban transportation planning process. Data collection and sampling techniques. Elements of travel forecasting; trip generation, trip distribution, modal split and traffic assignment. Road and transit systems testing and evaluation. Urban transport technology. Long range forecasting.

Civil Engineering 705  H(3-0)  Traffic Engineering
   Traffic stream characteristics, related field surveys; advanced probability distributions of headway, flow and speed under peak, off-peak, plateau-flow conditions; analysis of density contours; the generalized car-following model, related macro-models of traffic streams, practical applications; Traffic incident analysis; Two-lane highways: actuated and pretimed traffic signals; two-way communication of signals; introduction to network controls.
   Prerequisite: Consent of the Department.

Civil Engineering 707  H(3-0)  Theory of Transport Demand Modelling
   Modelling for transport planning; data in transport modelling; trip generation modelling; trip distribution modelling; modal split modelling; direct demand models; traffic assignment; equilibrium in transport modelling; discrete-choice models; specification and estimation of logit models; aggregation issues; simplified transport demand models; model updating and transferability.
   Prerequisite: Consent of the Department.

Civil Engineering 709  H(2-4)  Practice of Transport Demand Modelling
   Sample enumeration modelling; practical aspects of logit model estimation and calibration; disaggregate choice behaviour data; practical 4-step transport demand modelling using conventional software packages; application of computer-based network assignment models.
   Prerequisite: Civil Engineering 707 or consent of the Department.

Civil Engineering 713  H(3-1)  Mountain Highway Engineering
   Road vehicle performance in mountainous terrain; the design-moving vehicle problem; highway capacity and level of service; terrain classification; alignment elements, cross section elements, intersections, traffic barriers; planning and design of passing lanes, climbing lanes, truck escape ramps, turnouts, and low-volume roads; traffic management in avalanche zones; environmental impact of highways in mountainous terrain. Vehicle operating costs; engineering evaluation of mountain highway projects.

Civil Engineering 715  H(3-0)  Transport Economics
   Economic characteristics of transport; movement and location; transport demand; direct costs of transport; travel time; external costs of transport; shadow prices; pricing of transport services; containment of external costs of transport; private and public sector investment analysis in transport; transport and economic development; transport policy.
   Prerequisite: Consent of the Department.

Civil Engineering 721  H(2-1)  Modelling for Water Supply and Distribution
   Prerequisite: Civil Engineering 581 or consent of the Department.
   Note: Not open to students with credit in Civil Engineering 619.52 or 719.

Civil Engineering 723  H(3-3)  Hydrological Theory and Design
   Prerequisite: Civil Engineering 533 or equivalent.

Civil Engineering 741  H(3-0)  Advanced Wastewater Treatment
   Processes to remove impurities from wastewaters. These impurities include nutrients, residual organics, dissolved inorganics, residual suspended solids, bacteria and viruses. The processes include treatment processes, biological nutrient removal, sludge management, disinfection and membrane technologies.

Civil Engineering 743  H(3-0)  Numerical Methods for Environmental Modelling
   Taylor Series, ordinary introduction to differential equations, initial value and boundary value problems, partial differential equations, finite difference and finite element methods, explicit and implicit methods, flow and transport through porous media, advection, dispersion sources, sink, simulation of flow and transport equation, discussion of some available software.

Civil Engineering 745  H(3-0)  Hazardous Waste and Contaminated Sites Management
   Introduction to waste management and risk management at contaminated sites; properties of hazardous contaminants; contaminant fate and behaviour; fundamentals of risk assessment and risk management as applied to contaminated sites; methods of hazardous waste treatment and contaminated site remediation; land disposal of hazardous waste.

Civil Engineering 747  H(3-0)  Contaminated Soil Remediation
   Overview of remediation engineering, physical and chemical treatment processes, soil vapour extraction, air sparging, soil washing, solidification and stabilization, vitrification, biological treatment processes, bioremediation kinetics, ex situ and in situ techniques, and liquid phase bioremediation as it pertains to soil remediation.

Civil Engineering 749  H(3-0)  Environmental Aspects of Waste Disposal Systems
   Soil-chemical interactions and implications in waste disposal system design; landfill design principles; leachate production, leachate migration in the unsaturated/saturated zones; analytical and numerical solution of flow and transport equations; applications and case studies of groundwater contamination; design and construction of barrier systems; bioreactor landfills; landfill closure issues; greenhouse gas control systems.

Civil Engineering 751  H(3-0)  Snow Avalanche Dynamics and Hazard Mitigation
   Avalanche motion and protection including avalanche terrain, frictional flow, impact pressures, avalanche risk for fixed structures, elements of structural defence and run-out estimation based on statistical models, dynamic models, studies of vegetation and historical records.

Civil Engineering 753  H(3-0)  Snow Avalanche Formation and Release
   Snowpack properties and processes including meteorological and ground effects on the snowpack, energy balance at the snow surface, snowpack stratigraphy, metamorphism of snow grains, bonding, as well as spatial and temporal variability of the snowpack. Avalanche initiation including deformation and failure of weak layers, models of slabs failure and fracture propagation. Concepts of snow stability, avalanche forecasting and avalanche risk for recreationists.

Communications Studies 201  H(2-1)  Introduction to Communications Studies
   An overview of the major theoretical and methodological traditions in the field and key concepts in
Courses of Instruction

Senior Courses

Communications Studies 361 H(2-2T)  
**Spoken and Written Discourse**
An introduction to the principles of written and spoken discourse as informed by both classical and modern rhetorical theory. Tutorials provide extensive practice in producing various forms of discourse.

**Prerequisite:** Completion of the Effective Writing Requirement.

Communications Studies 365 H(3-0)  
**Writing About the Fine Arts**
This course is designed to help fine arts students formulate and justify in lucid prose their appraisals of works of art. The study of prose models will be integrated with extensive practice in writing.

**Prerequisite:** Completion of the Effective Writing Requirement.

Communications Studies 367 H(3-0)  
**Introduction to Visual Culture**
An examination of visual modes of communication. Students will be introduced to the concepts of visual literacy and will learn to evaluate visual media as communication. Topics will include the elements of visual messages, the relation of visual communication to language, and the role of images in shaping culture.

Communications Studies 380 F(2-1T)  
**History of Information and Communication Technology**
A study of the technologies of communication from a historical perspective. The course will consider the influences on society of developments in communication technology, including orality, literacy, printing, mass media, telecommunications and information technology. The theories of McLuhan, Inver, Ong and related theories of technology and history will be studied. Tutorials will be conducted through electronic networking.

**Prerequisite or Corequisite:** Communications Studies 201.

**Note:** Credit for both Communications Studies 380 and any of General Studies 341, Science Technology and Society 341 or Communications Studies 471 will not be allowed.

**Note:** Restricted to students in the Communications Studies Major and Minor programs. Until August 15, enrollment is restricted to Majors in Communications Studies.

Communications Studies 401 H(3-0)  
**Special Topics in Communications Studies**
See Master Timetable for current topic(s).

**May be repeated for credit**

Communications Studies 403 H(3-0)  
**Special Topics in Media Studies**
See the Master Timetable for current topic(s).

**Prerequisite:** Communications Studies 441

**May be repeated for credit**

Communications Studies 405 H(3-0)  
**Special Topics in Rhetoric and Discourse**
See the Master Timetable for current topic(s).

**Prerequisite:** Communications Studies 461

**May be repeated for credit**

Communications Studies 407 H(3-0)  
**Cultural Studies in Communications**
A survey of major approaches to the study of human communication in the cultural and critical traditions, including semiotic models of communications processes and interpretive methods of research. The course considers the intellectual context in which these research traditions emerge and are applied.

**Prerequisite:** Communications Studies 201

**Note:** Restricted to students in the Communications Studies Major and Minor and Film Studies Minor programs. Until August 15, enrollment is restricted to Majors in Communications Studies.

Communications Studies 410 H(3-0)  
**Research in Communications**
A survey of major approaches to the study of human communication in the empirical traditions, including models of communications processes and methods of applied research. The course considers the intellectual context in which these research traditions emerge and are applied.

**Prerequisite:** Communications Studies 201

**Prerequisite or Corequisite:** Any full or half course in statistics (including but not limited to Anthropology 331, Psychology 312, Sociology 311 or consent of the Faculty).

**Note:** Students taking this course should have some background in Fine Arts.

Communications Studies 441 H(3-0)  
(formerly Communications Studies 321)

Communications Studies 441 H(3-0)  
(formerly Communications Studies 421)

Communications Studies 461 H(3-0)

**History and Applications of Rhetoric**
A study of key rhetorical theories from their roots in the classical period to the modern age, with an emphasis on the development of theories in response to changes in social, political and philosophical climate. Theories will be applied to the production of both spoken and written discourse.

**Prerequisites:** Communications Studies 201 and 361

**Note:** Restricted to students in the Communications Studies Major and Minor programs. Until August 15, enrollment is restricted to Majors in Communications Studies.

Communications Studies 463 H(3-0)  
**Advanced Professional and Technical Communication**
An inquiry-based course in which students apply rhetorical theory and communication research in professional and/ or technical contexts. Topics include persuasion and argumentation, editing, and the use of technology. The main term project involves producing documents for clients or organizations outside of the classroom.

**Prerequisites:** Third year standing and Communications Studies 363

Communications Studies 483 H(3-0)  
**Introduction to Public Relations**
The role of public relations in group communication within and among various sectors of society, including business, government, educational and cultural organizations. Alternative approaches to public relations theory and practice. Canadian examples and case studies will be used where possible, and ethical standards in public relations will be emphasized.

**Prerequisite:** Communications Studies 201 or consent of the Faculty.

Communications Studies 501 H(3-0)  
**Research in Selected Topics**
Supervised individual study of a special topic.

**Prerequisites:** Consent of the Communications Studies Director and the Associate Dean (Academic).

**Note:** Students should contact the Office of the Associate Dean (Academic) prior to the first day of classes to arrange an independent study course.

**May be repeated for credit**

Communications Studies 537 H(2-2T)  
**Visual Research and New Media Production**
Provides an introduction to new media production with an emphasis on the digitization of still, slide and video material for multimedia presentation. Students are encouraged to have source material in advance.

**Prerequisite:** Communications Studies 367 or consent of the Faculty.

Communications Studies 567 H(3-1T)  
(Anthropology 567)

Communications Studies 567 H(3-11)  
**Advanced Studies in Visual Culture**
Advanced studies in visual communication with special attention to historical and theoretical aspects of visual practices. Students will explore diverse expressions of visuality and undertake applied visual research and production. Topics may include the social production of visual discourse, visual media and social change, visual anthropology, and strategies for visual research.

**Prerequisite:** Communications Studies 367 or Anthropology 411 or consent of the Faculty of Communication and Culture.

Communications Studies 580 F(0-3)  
**Advanced Communications Project**
An advanced research project incorporating both newsgathering and scholarly bibliographic techniques. The project will be produced in documentary format in a medium appropriate to the student’s specialization: print (with full desktop publishing and photographic illustration), radio, television, video or multimedia production.
Courses of Instruction

Prerequisite: Admission to the Bachelor of Communications Studies program.

Prerequisites or Corequisites: Communications Studies 381, 380, 441, General Studies 300, second year of the relevant Southern Alberta Institute of Technology diploma program, or equivalent transfer credit.

Note: Offered jointly by the University of Calgary and the Southern Alberta Institute of Technology. Open to students in the Bachelor of Communications Studies Major only.

Communications Studies 591 H(3S-0)
**Senior Seminar in Communication**
With reference to a special topic, this course explores the variety of ways in which communication builds social and cultural values. Students will undertake a major project that will integrate their understanding of communication theory, history and methodology. See individual course outlines for current topics.

Prerequisites: Communications Studies 380, 451 and 461, or consent of the Faculty.

Note: Restricted to students in the Communications Studies Major program.

Graduate Courses

Note: Courses numbered 615-789 will be offered on the basis of student needs and contingent upon the availability of staff resources.

Communications Studies 601 H(3S-0)
**Interdisciplinary Approaches to Communications Studies**
A foundation seminar that provides an introduction to the field of communication theories and approaches.

Prerequisite: Consent of the Program Director.

Communications Studies 603 H(3S-0)
**Critical Perspectives on Television and Film**
A seminar that explores theories and perspectives with regard to television and film.

Prerequisite: Consent of the Program Director.

Communications Studies 605 H(3S-0)
**Organizational Communication**
An examination of the application of theory and methodology of administrative communication processes in complex organizations.

Prerequisite: Consent of the Program Director.

Communications Studies 609 H(3S-0)
**Communication Law**
An examination of the operation of Canadian law as it relates to the areas of telecommunications, broadcasting and other media.

Prerequisite: Consent of the Program Director.

Communications Studies 613 H(3S-0)
**Communication Theory**
An examination of the major perspectives in communication theory through a historical analysis of classic works and an overview of contemporary approaches and applications.

Prerequisite: Consent of the Program Director.

Communications Studies 615 H(3S-0)
**Communication Research Methods**
Designed to provide a fundamental understanding of empirical research in communication. Focus will be on published, data-based research.

Prerequisite: Consent of the Program Director.

Communications Studies 619 H(3S-0)
**Communication and Cultural Industries: Policy and Development**
An analysis of the governmental and social contexts which inform the current development of telecommunications, communications, cultural industries and new media in Canada.

Prerequisite: Consent of the Program Director.

Communications Studies 623 H(3S-0)
**Social and Economic Impacts of Communication and Information Technologies**
An examination of the social context of information and communication technologies with regard to patterns of knowledge, power and social relationships.

Prerequisite: Consent of the Program Director.

Communications Studies 625 H(3S-0)
**Interpersonal and Small Group Communication**
An examination of the theory and research concerning communication processes in face-to-face and small group interaction. Provides opportunities to develop effective practical skills.

Prerequisite: Consent of the Program Director.

Communications Studies 627 H(3S-0)
**Mass Media and Democracy in North America**
A discussion of how politicians use the media to campaign for office and retain power. Also considers the effects of communication technologies on the nature of democratic politics.

Prerequisite: Consent of the Program Director.

Communications Studies 629 H(3S-0)
**Communication Management**
An examination of communication management in business organizations. Looks at topics such as marketing, public relations and advertising in the context of rapidly changing business environments.

Prerequisite: Consent of the Program Director.

Communications Studies 641 H(3S-0)
**Intercultural and International Communication**
An examination of cultural/communication issues and practices in Canadian and international contexts. Examines the role of media systems in processes of culture, development and identity formation.

Prerequisite: Consent of the Program Director.

Communications Studies 711 H(3S-0)
**Directed Studies**
A research project under the direction of a faculty member.

Prerequisite: Consent of the Program Director.

Note: May be repeated for credit once.

Communications Studies 717 H(3S-0)
**Selected Topics in Communication**
A variety of communication topics based on faculty expertise.

Prerequisite: Consent of the Program Director.

COMMUNITY REHABILITATION

Community Rehabilitation 205 H(2-1)
**History and Systems in Community Rehabilitation**
The social, political, economic, health and advocacy systems that support and empower persons with disabilities and their families.

Community Rehabilitation 207 H(2-1T-2)
**Introduction to Community Rehabilitation Practice**
Assessments, interventions and working partnerships within a life span perspective. Students are mentored by senior students.

Community Rehabilitation 209 H (3-0)
**Disability in Theory and Everyday Life**
Life span exploration of theory, research directions, and lifeworks of those affected by disability.

Junior Courses

Community Rehabilitation 301 Q(1-1)
**Topics in Health Foundations**

301.01. Developmental Disabling Conditions (On-Line)
301.02. Adult Onset Disabling Conditions (On-Line)
301.03. Disability Conditions Associated with Aging (On-Line)

Prerequisite: Consent of Community Rehabilitation Studies.

NOT INCLUDED IN GPA

Community Rehabilitation 305 Q(1-1)
**History and Systems in Community Rehabilitation**

305.01. Service Systems for Persons with Disabilities in Community Rehabilitation
Courses of Instruction

**Community Rehabilitation 307** Q(1-1)
*Community Rehabilitation Practice Strategies*

**Community Rehabilitation 307.01** Life Span Approach to Disabling Conditions

**Community Rehabilitation 307.02** Assessment Approaches in Community Rehabilitation

**Community Rehabilitation 307.03** Intervention Models and Strategies in Community Rehabilitation

**Community Rehabilitation 307.04** Individualized Planning

**Community Rehabilitation 307.05** Ethics and Issues for Canadian Rehabilitation Professionals

**Community Rehabilitation 415** H(3-0)
*Rehabilitation Management*

Management and leadership issues within private, non-profit and public community based organizations and businesses.

**Community Rehabilitation 425** H(3-0)
*New Psychologies of Disability*

Interdisciplinary use of narrative psychology in empowerment and community practice.

**Community Rehabilitation 471** H(3-0)
*Community Rehabilitation Practice for Children with Special Needs and Their Families*

Cognitive, social and emotional development of children with disabilities in the context of their families, schools and communities.

**Community Rehabilitation 473** H(3-0)
*Community Rehabilitation Practice in Career Development and Disability*

Adult development and transition issues for persons encountering adult onset disabilities.

**Community Rehabilitation 475** H(3-0)
*Community Rehabilitation Practice and the Aging Process*

Theoretical and practical issues as they relate to rehabilitation and community services for seniors with disabilities.

**Community Rehabilitation 485** H(1T-10)
*An Introduction to Community Rehabilitation Practice and Professional Conduct*

The practical application of basic principles of assessment and intervention with individuals.

**Community Rehabilitation 487** H(1T-10)
*Practicum in Rehabilitation Practice*

Practicum in group settings under supervision of qualified personnel.

**Community Rehabilitation 525** Q(1-1)
*New Psychologies of Disability*

**MAY BE REPEATED FOR CREDIT**

**Community Rehabilitation 531** Q(1-1)
*Topics in Inclusive Practice*

Quarter courses are offered as part of a Summer Institute in Inclusive Education and an Inclusive Education 4 course specialization.

**MAY BE REPEATED FOR CREDIT**

**Community Rehabilitation 535** H(3-0)
*Topics in Inclusive Practice*

**MAY BE REPEATED FOR CREDIT**

**Community Rehabilitation 541** H(3-0)
*Special Topics in International Disability Research and Policy*

Selected topics in disability research and policy whereby the student learns to understand and compare the perspective as developed in two or more countries.

**Community Rehabilitation 569** H(2-3)
*Emotional Disturbance Related to Disability*

A person-in-environment centered approach to emotional/behavioural concerns for persons with disabilities spanning issues of addiction, abuse, brain injury, mental illness.

**Community Rehabilitation 573** H(3-0)
*Disability and the Law*

Foundations of Canadian legal principles and practices as they affect community rehabilitation.

**Community Rehabilitation 581** H(3-1)
*Professional Practice Issues and Professional Ethics in Community Rehabilitation*

Ethical decision-making issues and practices for community rehabilitation service providers, researchers, interdisciplinary teams, agencies and policy developers.

**Community Rehabilitation 583** H(3-1)
*Community Development in Community Rehabilitation*

A study of practice issues for professionals working in community development and interdisciplinary teams. The course is designed to acknowledge that partnership and community action are key components of rehabilitation practice.

**Community Rehabilitation 589** H(1T-10)
*Advanced Practice in Community Rehabilitation*

Senior level program and management skills in partner agencies, associations and systems. Specifics to be negotiated with the student.

**Community Rehabilitation 591** H(2-1)
*Advanced Study Topics in Community Rehabilitation*

**MAY BE REPEATED FOR CREDIT**

**Community Rehabilitation 593** Q(1-1)
*Advanced Study Topics in Community Rehabilitation*

**MAY BE REPEATED FOR CREDIT**

**Graduate Courses**

**Community Rehabilitation 601** Q(1-1)
*Professional Foundations of Community Rehabilitation*

Graduate challenge units enable experienced professionals from a number of disciplines to challenge professional practice competencies in Community Rehabilitation.

**MAY BE REPEATED FOR CREDIT**

**Community Rehabilitation 603** H(2-3)
*Professional Foundations in Community Rehabilitation*

In-depth study of theory and practice in community rehabilitation domains.

**MAY BE REPEATED FOR CREDIT**

**Community Rehabilitation 611** Q(1-1)
*New Alliances in Community Rehabilitation*

A series of quarter courses delivered during the Pan Canadian Summer Institute. Introduces new practices for change.

**MAY BE REPEATED FOR CREDIT**

**Community Rehabilitation 620** F(2-6)
*Individual Specialization Contracts*

Individual specialization contract (2-3 full-course equivalents) includes theory, research practice and project. To be signed by the Graduate Division of Educational Research, Community Rehabilitation Studies and partner university.

**620.01. Individual Specialization Contract I**

**620.02. Individual Specialization Contract II**

**620.03. Individual Specialization Contract III**

Note: Students taking Community Rehabilitation 620 through the University of Calgary can enroll in Community Rehabilitation 624 or Educational Research 690 or appropriate alternatives. Students enrolled in this contracted course will take part in regular internet seminars.

**NOT INCLUDED IN GPA**

**Community Rehabilitation 624** F(2-3)
*Specialization Theory and Practice in Community Rehabilitation*

An individual study of both theory and practice in one specialization domain. Normally taken concurrently or consecutively with Community Rehabilitation 620.

**MAY BE REPEATED FOR CREDIT**

**Community Rehabilitation 641** H(3-0)
*Special Topics in International Disability Research and Policy*

Selected topics in disability research and policy whereby the student learns to understand and compare the perspective as developed in two or more countries.
Courses of Instruction

Comparative Literature 676  F(2-3)
Consultation and Evaluation in Human Services and Systems
The study of qualitative and quantitative evaluation research methods will inform the design and implementation of collaborative evaluations of a community service program, policy or system.

Community Rehabilitation 691  H(2-3)
Graduate Specialization Topics in Community Rehabilitation
MAY BE REPEATED FOR CREDIT

Community Rehabilitation 693  Q(1-1)
Graduate Specialization Topics
MAY BE REPEATED FOR CREDIT

Comparative Literature  COLT
Instruction offered by members of the Faculty of Humanities.

Junior Courses
Comparative Literature 201  H(3-0)
Comparative World Literature to 1650
Formative texts of world literature to 1650.

Comparative Literature 203  H(3-0)
Comparative World Literature from 1650
Formative texts of world literature from 1650 to the present.

Senior Courses
Comparative Literature 301  H(3-0)
Comparative Drama
Selected plays from different cultures, originally written in different languages. May include some of the following: classical Greek Drama, Molieres, Ibsen, Chekov, Brecht, theatre of the absurd, existentialist drama, contemporary drama.

Comparative Literature 303  H(3-0)
Comparative Fiction
Selected novels and short stories from different cultures, originally written in different languages. Emphasis will be on the variety of themes, points of view, senses of the self, and styles of writing.

Comparative Literature 307  H(3-0)
Women and Literature
Selected texts by and on women from different cultures, originally written in different languages. Examines textual representations of the variety of women’s concerns and experiences.

Comparative Literature 321  H(3-0)
Comparative Literatures of Canada
Comparative study of themes and issues in literary productions from English-Canadian, French-Canadian, Québécois and other Canadian traditions. Topics may include: tradition and innovation, nationalism and culture, cross-cultural expression, ethnic identity and language, regionalism, or a literary genre. While texts will be selected mainly from literary works written in French or English, the course may also include some works originally written in other languages. All course texts will be studied in English.

MAY BE REPEATED FOR CREDIT

Comparative Literature 399  H(3-0)
Studies in Comparative Literature
MAY BE REPEATED FOR CREDIT

Comparative Literature 405  H(3-0)
Topics in Comparative Literature
Prerequisites: Two full-course equivalents of senior-level literature courses or consent of the Associate Dean (Student Affairs), Faculty of Humanities.

MAY BE REPEATED FOR CREDIT

Comparative Literature 517  H(3-0)
Theory and Criticism for Comparatists
Introduction to some central issues and concepts of literary criticism as practiced in various cultural and linguistic traditions. Topics may include: the linguistics of literature, the relation of literature to criticism, critical analysis and evaluation, the making of literary canons, as well as formative approaches to modern theory such as feminism, formalism, Marxism, phenomenology, poststructuralism, psychoanalysis, and structuralism. All course texts will be studied in English.

Prerequisites: Two full-course equivalents of senior level literature courses or consent of the Associate Dean (Student Affairs), Faculty of Humanities.

MAY BE REPEATED FOR CREDIT

Computer Engineering  ENCM
Instruction offered by members of the Department of Electrical and Computer Engineering in the Faculty of Engineering.

Department Head - L.J. Leon
Associate Heads - S.A. Norman (Undergraduate), A. Sessay (Graduate)

Computer Engineering 415  H(3-1T-3/2)
Introduction to tools, components and processes of software and hardware development for computer systems. Covers basic programming paradigms; hardware and multi-tasking concepts. Topics may include: design and testing of real time systems; DSP co-processors and multi-core microprocessors.

Prerequisites: Computer Engineering 339 and 415.

Computer Engineering 467  H(3-1T-3/2)
Digital Electronics for Computer Engineers
MOS transistor fundamentals (D.C. characteristics, large signal model, transient behaviour). Transistor level implementation of standard MOS logic gates. Other MOS logic blocks. MOS memory (static and dynamic). Interfacing various logic families. Introduction to integrated circuit design.

Prerequisites: Electrical Engineering 343 and 353.

Computer Engineering 491  H(3-2/2)
Real-Time Systems Design
Requirements for real-time systems. Design of embedded systems. Development of applications to run on real-time operating systems.

Prerequisites for Computer Science students: Computer Science 457 and 459.

Prerequisites for Computer Science students: Computer Science 455 and 457.

Software Development for Computer Engineers
Introduction to tools, components and processes used in analysis, design, development and testing of software applications. Features of object-oriented languages. Introduction to object-oriented design.

Prerequisites: Computer Engineering 339.
Courses of Instruction

Computer Engineering 401

Principles of Computer Architecture

Input/output, processors, intra-system communications, buses, caches. Addressing and memory hierarchies, microprogramming, parallelism, and pipelining. Classification and taxonomy of computer architectures. Reduced instruction set computers, pipelining, vector processing, datapath, architected description languages, firmware engineering.

Prerequisites: Computer Engineering 369 or Electrical Engineering 415 or Computer Engineering 415.

Computer Engineering 453

Digital Video Processing

Introduction to the fundamentals of digital video representation, filtering and compression. Topics include: popular algorithms for 2-D and 3-D motion estimation, object tracking, frame rate conversion, deinterlacing, image enhancement, emerging international standards for image and video compression, applications as digital TV, web-based multimedia, videoconferencing, videophone and mobile image communications.

Prerequisites: Electrical Engineering 327 and one of Electrical Engineering 409, Computer Engineering 493 or Software Engineering 411.

Note: Credit for both Computer Engineering 503 and any of Computer Engineering 519.33, Electrical Engineering 519.33 or Software Engineering for Engineers 519.33 will not be allowed.

Computer Engineering 505

Parallel Computer Architectures

An examination of Design and Performance trade-offs in modern parallel computer architectures. Includes an introduction to the basic concepts of parallel computing including message passing and shared memory programming models. An examination of a number of parallel architectures, including pipeline architectures, shared memory multiprocessor systems including both bus based and CC NUMA distributed memory systems, message passing systems, focusing on interconnect issues will also be examined. Also covers cache architectures and strategies to ensure cache coherency in shared memory systems.

Prerequisites: One of Computer Engineering 369 or Electrical Engineering 369 and one of Computer Engineering 493 or Software Engineering 443.

Note: Credit for both Computer Engineering 505 and either Computer Engineering 519.27 or Software Engineering for Engineers 519.27 will not be allowed.

Computer Engineering 515

Digital Signal Processors

Review of microprocessor fundamentals. Comparison of basic system architectures for RISC, CISC and DSP processors, recent architectural innovations. Processor characteristics needed to match the requirements for typical DSP applications. Hardware and software optimization techniques including multiple busses, register windows, superscalar and other highly parallel instruction sets, critical timing paths, optimizing compilers and multiprocessor operation. Fundamental comparison of custom and current commercial single chip DSP processor architectures. Elements of Hardware-Software co-design and development processes. Practical applications and laboratories.

Prerequisites: Computer Engineering 415 or Electrical Engineering 415.

Computer Engineering 519

Special Topics in Computer Engineering

Current topics in computer engineering.

Prerequisite: Consent of the Department.

Note: Consult Department for announcement of topics.

MAY BE REPEATED FOR CREDIT

Computer Engineering 583

Fourth Year Computer Engineering Team Design Project, Part A

Introduction to the theory, experience and practice of project management. Theory includes generally accepted project management principles, the structure of both project and team, together with ancillary topics that commonly affect project outcome. The experience is gained from a series of guest lectures by industrial practitioners with engineering background. The practice is obtained through the performance of a "customer suggested" team project through the stages of project requirement and specification analysis, high level and detailed low level designs. The project is executed, and progress measured against a plan developed by the team participants.

Prerequisite: Computer Engineering 007.

Computer Engineering 589

Fourth Year Computer Engineering Team Design Project, Part B

Continues upon the foundations of theory, experience and practice of project management. Theory includes generally accepted project management principles, the structure of both project and team, together with ancillary topics that commonly affect project outcome. The experience is gained from a series of guest lectures by industrial practitioners with engineering background. The practice is obtained through the performance of a "customer suggested" team project through the stages of project requirement and specification analysis, high level and detailed low level designs. The project is executed, and progress measured against a plan developed by the participants.

Prerequisite: Computer Engineering 583.

Note: Computer Engineering 007, 583 and 589 are a required three-course sequence that shall be completed in the same academic year.

Computer Engineering 591

Individual Computer Engineering Project, Part II

This individual project is intended for students who have completed a suitable Computer Engineering 599 Individual Project and wish to continue the assigned research project by completing a more extensive investigation. A comprehensive written report is required which is defended and presented orally in a department seminar.

Prerequisites: Computer Engineering 599 and formal approval from the project supervisor and course coordinator(s).

Computer Engineering 598

Individual Computer Engineering Research Project

The project involves individual work on an assigned Computer Engineering research topic under the supervision of a Departmental faculty member. Submission and defense of a mid-year written report is required. A final comprehensive written report is required which is defended and presented orally in a departmental seminar format.

Prerequisites: Fourth year standing and formal approval from the project supervisor and course coordinator(s).

Note: Credit for both Computer Engineering 598 and either 591 or 599 will not be allowed.

Computer Engineering 599

Individual Computer Engineering Project

This project involves individual work on an assigned Computer Engineering topic under the supervision of a faculty member. The topic would normally involve a literature review, theoretical and experimental or computer work. Submission and defence of a written formal report is required.

Prerequisite: Formal approvals from the project supervisor and course coordinator(s).

Computer Science CPSC

Instruction offered by members of the Department of Computer Science in the Faculty of Science Department Head - K. Barker

Note: Computer Science students should also see courses listed under Software Engineering.

Computer Science 001

Introduction to Unix

An introduction to the Unix operating system, including the text editor "emacs," its programming modes and macros; shell usage (including "sh" and "tsh"); and some advanced Unix commands.

Note: This course is highly recommended as preparation for Computer Science 215 or 231.

NOT INCLUDED IN GPA

Computer Science 031

Mathematics Review for Computer Science

A review of topics in calculus and discrete mathematics that have applications in the analysis of computer algorithms.

Prerequisites: Mathematics 249, 251 or 261, and 271.

Note: This course is highly recommended as preparation for Computer Science 413.

NOT INCLUDED IN GPA

Computer Science 203

Introduction to Computers

Computer system fundamentals, personal computer applications software, and computer communications both on campus and using the internet. Students will use personal computers to complete assignments in word processing, spreadsheet analysis, database management and other applications.

Note: This course is not available for credit for Computer Science majors.

Computer Science 215

Introduction to Programming

Introduction to algorithm design and implementation using a structured programming language.

Courses of Instruction
Discussion of, and practice with, elementary programming techniques with emphasis on good style.

**Note:** Credit for more than one of Computer Science 215, 231, 237, Engineering 213 and 233 will not be allowed.

**Note:** This course is not available for credit for Computer Science majors.

**Note:** This course does not assume prior programming background.

### Computer Science 231 H(3-2T-1)
**Introduction to Computer Science I**

Problem solving and programming in a structured language. Data representation, program control, basic file handling, the use of simple data structures and their implementation. Pointers. Recursion. Discussion of, and practice with, elementary programming techniques with emphasis on good style.

**Prerequisite:** Computer Science 231 or a “D” or “D+” in Computer Science 235. 

**Note:** Not open to students who have completed Computer Science 235 with a grade of “C” or better.

### Computer Science 235 H(3-2T-2)
**Inquiry-based Introduction to Computer Science**


**Prerequisite:** Consent of the Department.

**Note:** Credit for both Computer Science 235 and 231 will not be allowed.

**Note:** Computer Science 231 is strongly recommended.

**Note:** This course does not require prior programming background but does assume a strong mathematical/science inclination.

**Note:** Limited to highly qualified students.

### Computer Science 265 H(3-2T-1)
(Formerly Computer Science 355)
**Computer Architecture and Low-Level Programming**

Organization and operation of the functional units in a stored program computer, internal data representation and programming at the architectural level establishing the link between high level language programming and machine operation.

**Prerequisite:** Computer Science 231 or consent of the Department.

**Note:** Registration priority is given to students who have been admitted to Computer Science or Mathematics.

### Senior Courses

#### Computer Science 313 H(3-2T)
**Introduction to Computability**

Abstract machines: finite automata, push down automata, and Turing machines. An introduction to formal languages; the hierarchy of languages (regular, context-free, and recursive) recognized by these machines; applications of these languages.

**Prerequisites:** Mathematics 271, one of Philosophy 279 or 377, and one of Computer Science 233 or 235.

**Computer Science 321 H(3-2T)**
**Introduction to Logic Circuit Design**

Boolean algebra. Design of combinational circuits and their implementation using primitive logic gates. Design and implementation of synchronous and asynchronous sequential circuits.

**Prerequisites:** Mathematics 271 and one of Computer Science 233 or 235.

**Note:** Credit for more than one of Computer Science 321, 325, Electrical Engineering 353 and 411 will not be allowed.

**Note:** This course will be offered for the last time in the academic year 2004/2005.

#### Computer Science 325 H(3-2T-1)
**Hardware/Software Interface**


**Prerequisites:** One of Computer Science 265 or 355 and one of Philosophy 279 or 377.

**Note:** Credit for Computer Science 325 will not be allowed together with credit for Computer Science 321 and 455.

#### Computer Science 331 H(3-2T-1)
**Information Structures I**

Algorithms: searching, sorting, graph navigation. Data structures: arrays, lists, stacks, queues, graphs, trees, hash tables; time and space efficiency of associated algorithms.

**Prerequisites:** One of Computer Science 233 or 235 or Computer Engineering 339.

**Note:** Mathematics 271 is recommended highly as preparation for Computer Science 331; students in Computer Engineering or Software Engineering programs should take Mathematics 271 and Computer Science 331 concurrently.

#### Computer Science 333 H(3-2T-1)
**Foundations of Software Engineering**

Inquiry-based introduction to software development problems and to the processes and methods used to address them. Software life cycle models. Software process improvement. Goals and methods for requirements analysis and specification, software design, implementation, integration and testing of software.

**Prerequisites:** Computer Science 331 and consent of the Department.

**Note:** Credit for both Computer Science 333 and Software Engineering 311 will not be allowed.

**Note:** Only open to students who have been admitted to Computer Science.

**Note:** Limited to highly qualified students.

### Computer Science 335 H(3-2T-1)
**Information Structures II**


**Prerequisite:** Computer Science 331.

### Computer Science 349 H(3-2T-1)
(Formerly Computer Science 449)
**Programming Paradigms**

Examination of the basic principles of the major programming language paradigms. Focus on declarative paradigms as functional and logic programming. Data types, control expressions, loops, types of references, lazy evaluation, different interpretation principles, information hiding.

**Prerequisites:** Computer Science 331 and one of Philosophy 279 or 377.

**Note:** Credit for both Computer Science 349 and 449 will not be allowed.

### Computer Science 401 H(3-2T)
**Computer Structure I**

Technology of memories, processors and peripherals. Architecture of computer systems. Discussion and comparison of several modern machines.

**Prerequisites:** Computer Science 325 or both 321 and 455.

### Computer Science 409 H(3-0)
(Formerly Computer Science 509)
**History of Computation**

The history of computation from the earliest times to the modern era.

**Prerequisite:** Computer Science 313.

### Computer Science 411 H(3-2T)
**Compiler Construction I**

Introduction to compilers, interpreters, and the tools for parsing and translation. Lexical analysis, context free grammars and software tools for their recognition. Attribute grammars and their applications in translation and compiling.

**Prerequisite:** Computer Science 313.

### Computer Science 413 H(3-2T)
**Design and Analysis of Algorithms I**

Techniques for the analysis of algorithms, including counting, summation, recurrences, and asymptotic relations; techniques for the design of efficient algorithms, including greedy methods, divide and conquer, and dynamic programming; examples of their application; an introduction to tractable and intractable problems.

**Prerequisites:** Computer Science 313, 331, and one of Mathematics 249, 251 or 261.

**Note:** Mathematics 253 is highly recommended but not mandatory. Computer Science 303 is also recommended.

### Computer Science 417 H(3-2T-1)
**Foundations of Functional Programming**

Courses of Instruction

Prerequisites:

Computer Science 331 and one of 349 or 449.

Computer Science 421  H(3-3T)

Digital Systems Design

State machine design. Use of LSI circuits including PALs, ROM and RAM design. Simulation and testing of digital circuits.

Prerequisite: One of Computer Science 321 or 325.

Computer Science 433  H(3-2T)
(formerly Computer Science 533)

Artificial Intelligence

An examination of the objectives, key techniques and achievements of work on artificial intelligence in Computer Science.

Prerequisites: Computer Science 313 and one of 349 or 449.

Computer Science 441  H(3-2T)

Computer Communications


Prerequisites: Computer Science 331 and one of 325, 455 or Computer Engineering 369.

Computer Science 453  H(3-2T-1)

Introduction to Computer Graphics

Introduction to computer graphics. Principles of raster image generation. Example of a graphics API. Graphics primitives. Coordinate systems, affine transformations and viewing of graphical objects. Introduction to rendering including shading models and ray tracing. Introduction to modelling including polygon meshes, subdivision, and parametric curves and surfaces.

Prerequisites: Computer Science 313, Mathematics 221 and one of Mathematics 253 or Applied Mathematics 219.

Note: Credit for both Computer Science 453 and either 407 or Electrical Engineering 555 will not be allowed.

Computer Science 455  H(3-2T-1)

The Software/Hardware Interface

Low and intermediate level support software necessary to access I/O devices and interfaces, to manage information and to provide a software interface between a single-user microcomputer environment and its hardware. Emphasis on I/O, interrupt handling, file systems and systems programming concepts. An introduction to process interaction.

Prerequisites: Computer Science 331 and 355.

Note: Credit for both Computer Science 325 and 455 will not be allowed.

Note: This course will be offered for the last time in the academic year 2005/2006.

Computer Science 457  H(3-2T-1)

Principles of Operating Systems

An introduction to operating systems principles. Performance measurement; concurrent programs; the management of information, memory and processor resources.

Prerequisites: Computer Science 331 and one of 325 or 455.

Note: Computer Science 325/455 is waived as a prerequisite for students concurrently enrolled in Computer Engineering 415.

Computer Science 461  H(3-2T-1)

Information Structures III

File architecture and manipulation techniques for various file types. Physical characteristics of current mass storage devices. Advanced data structures and algorithms for implementing various sequential and hierarchical file structures. File organization and design for various applications, file systems and other storage management techniques including web site design.

Prerequisites: Computer Science 331 and one of 265 or 355.

Computer Science 471  H(3-2T-1)

Data Base Management Systems

Conceptual, internal and external data bases. Relational data base systems and SQL. The normal forms, data base design, and the entity-relationship approach.

Prerequisite: Computer Science 331.

Computer Science 481  H(3-2T)

Human-Computer Interaction I

Fundamental theory and practice of the design, implementation, and evaluation of human-computer interfaces. Topics include: principles of design; methods for evaluating interfaces with or without user involvement; techniques for prototyping and implementing graphical user interfaces.

Prerequisite: Computer Science 333 or Software Engineering 311.

Computer Science 491  H(3-2T)

Techniques for Numerical Computation

Elementary techniques for the numerical solution of mathematical problems on a computer, including methods for solving linear and non-linear equations, numerical integration, and interpolation.

Prerequisites: Computer Science 331, and Mathematics 251 or 261.

Note: Not open to students with credit in Applied Mathematics 491 or 493.

Computer Science 501  H(3-2T)

Advanced Programming Techniques

Theory and application of advanced programming methods and tools. Recent issues as well as those of an enduring nature will be discussed. Topics may include the Fourier transform; wavelets; functional programming; genetic algorithms, simulated annealing and neural networks; parallel and distributed programming; images and graphical user interface programming.

Corequisite: Computer Science 457.

Computer Science 502  F(1-5)

Honours Thesis

A substantial research project under the guidance of a faculty member. A report must be written and presented on completion of the course.

Prerequisite: Consent of the Department.

Note: Not open to students with credit in Computer Science 503.

Note: This course is normally only available to students enrolled in the honours program or to students with an equivalent standing.

Computer Science 503  H(1-5)

Project

A research project conducted under the guidance of a faculty member. A report must be presented on completion of the course.

Prerequisite: Consent of the Department.

Note: Not open to students with credit in Computer Science 502.

Computer Science 510  F(3-2T)

Compiler Construction II

Theory and implementation of assemblers, compilers, and interpreters. Projects will include the writing of substantial segments of such programs.

Prerequisites: Computer Science 313, 411 and one of 265 or 355.

Note: Includes a research, writing and presentation component.

Computer Science 511  H(3-1T)

Introduction to Complexity Theory

Time and space complexity; the classes P, LOGSPACE, PSPACE and their nondeterministic counterparts; containing and separations between complexity classes; intractability and the theory of NP-completeness; complexity theories for probabilistic algorithms and for parallel algorithms.

Prerequisite: Computer Science 413.

Computer Science 513  H(3-1T)

Computability

Computable functions; decidable and undecidable problems; Church’s thesis and recursive functions.

Prerequisite: Computer Science 313.

Computer Science 517  H(3-2T)

Design and Analysis of Algorithms II

Advanced techniques for the design and analysis of deterministic and probabilistic algorithms; techniques for deriving lower bounds on the complexity of problems.

Prerequisite: Computer Science 413.

Computer Science 519  H(3-1T)

Introduction to Quantum Computation

Quantum information, quantum algorithms including Shor’s quantum factoring algorithm and Grover’s quantum searching technique, quantum error correcting codes, quantum cryptography, nonlocality and quantum communication complexity, and quantum computational complexity.

Prerequisites: Computer Science 413 and Mathematics 311.
### Courses of Instruction

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>Computer Science 523</td>
<td>H(3-2T)</td>
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</table>
**Computer Structure II**  
Continuation of Computer Science 401.  
Prerequisite: Computer Science 401. |
| Computer Science 525 | H(3-2) |  
**Embedded Systems**  
Advanced techniques for the design of modern embedded systems. Modelling and characterization of embedded computer systems; real-time operating system issues; methods to evaluate design tradeoffs between alternative technologies. Hardware and software components integration.  
Prerequisites: Computer Science 421 and Computer Engineering 491. |
| Computer Science 531 | H(3-2T) |  
**Systems Modelling and Simulation**  
An introduction to the modelling and simulation of stochastic systems; programming language issues; model and tool design; input data modelling; simulation experiments; and the interpretation of simulation results.  
Prerequisite: Computer Science 457. |
| Computer Science 535 | H(3-2T) |  
**Introduction to Image Analysis and Computer Vision**  
Prerequisite: One of Mathematics 311, 331, 353, Applied Mathematics 307, 311, or Pure Mathematics 331, or consent of the Department. |
| Computer Science 550 | F(2-1T-3) |  
**Systems Administration**  
Topics and practices in systems administration and management. Required and optional administration duties and responsibilities. Moral and ethical conundrums, and legal responsibilities, in systems operation. Configuration and installation of operating systems and network and systems services.  
Prerequisites: Computer Science 457 and consent of the Department. |
| Computer Science 557 | H(3-1T) |  
(formerly Computer Science 599.49)  
**Applied Cryptography and Network Security**  
Primitives for applied cryptographic applications, including hash functions, pseudorandom number generation, public-key infrastructures; systems and protocols for providing security services including secure email, internet protocol security, and web security; threats to network and computer security and countermeasures including intrusion detection, virus countermeasures, access control and firewalls.  
Prerequisite: Pure Mathematics 329 or 321.  
Corequisite: Computer Science 441. |
| Computer Science 559 | H(3-2T) |  
**Introduction to Distributed Systems**  
Essential issues in modern distributed systems. Network topologies, communication schemes and distributed system structures. Distributed file systems and distributed coordination problems. Open systems architectures and dejure/default standard methodologies will be discussed, and reliability and system performance issues will also be introduced.  
Prerequisite: Computer Science 457. |
| Computer Science 565 | H(3-1T) |  
**Emergent Computing**  
An insight into a new mindset for programming as an emergent and evolutionary process of "breeding," rather than constructing. Programs can evolve to perform specific tasks in a bottom-up fashion rather than being manually coded. Topics will include: decentralized agent-based programming, massive parallelism and interaction, evolution, swarm intelligence.  
Prerequisite: Computer Science 433 or 533.  
Note: Offered in even-odd dated academic years. |
| Computer Science 567 | H(3-1T) |  
**Multi-Agent Systems**  
Modelling of agents and properties of multi-agent systems. Communication issues, including interaction and coordination concepts, forming and maintaining organizations, and competitive agent environments. Example systems; the implementation of a multi-agent system will be performed as the assignment.  
Prerequisites: Computer Science 457 and one of 433 or 533.  
Note: Offered in odd-even dated academic years. |
| Computer Science 571 | H(3-2T) |  
**Design and Implementation of Database Systems**  
Implementation and design of modern database systems including query modification/optimization, recovery, concurrency, integrity, and distribution.  
Prerequisites: Computer Science 461 and 471. |
| Computer Science 581 | H(3-2) |  
**Human-Computer Interaction II**  
Interaction Design. Advanced topics and applications in human computer interaction, with emphasis on developing skills for designing highly interactive human-computer interfaces.  
Prerequisites: Computer Science 481 and consent of the Department. |
| Computer Science 585 | H(3-2) |  
**Games Programming**  
Standard techniques for the implementation of computer games. Standard multimedia programming environments and high performance multimedia. Special purpose rendering engines. Interactive control and feedback; modelling.  
Prerequisites: Computer Science 453 and consent of the Department. |
| Computer Science 587 | H(3-2T) |  
**Fundamentals of Computer Animation**  
Principles of traditional animation, key framing, parametric and track animation, free form deformation, inverse kinematics, dynamics, spring mass systems, particle systems, numerical integration, Lagrangian constraints, space time constraints, collisions, human animation, behavioural animation, morphogenesis, implicit animation techniques, animating liquids, gases and cloth, motion capture.  
Prerequisite: Computer Science 453. |
| Computer Science 589 | H(3-2T) |  
**Modelling for Computer Graphics**  
Prerequisite: Computer Science 453. |
| Computer Science 591 | H(3-2T) |  
**Rendering**  
Prerequisite: Computer Science 453. |
| Computer Science 594 | F(1-5) |  
**Software Engineering Project**  
A software engineering project conducted under the guidance of a faculty member.  
Prerequisite: Consent of the Department.  
Note: Includes a research, writing and presentation component. |
| Computer Science 599 | H(3-0) |  
**Special Topics in Computer Science**  
New areas in Computer Science. This course will be offered only as required. Before registration consult the Head of the Department of Computer Science for topics offered.  
Prerequisite: Consent of the Department.  
MAY BE REPEATED FOR CREDIT |
| Computer Science 601 | H(3-0) |  
**Special Topics in Computer Science**  
A study of problems of particular interest to graduate students in Computer Science.  
Note: Research topics course. May be repeated for credit with consent of the Department. |
| Computer Science 605 | H(3-0) |  
(Medical Science 605)  
(formerly Computer Science 601.64)  
**Information Storage and Processing in Biological Systems**  
Examination of complex biological systems; concepts and fundamentals of biological solutions to information storage and processing; modelling and computer simulation of biological systems; information storage in biological molecules; genetic networks; hierarchical organization of biological information processing in signal transduction, development, evolution, and ecology; biological control systems.  
Prerequisite: Computer Science 453. |
Computer Science 607 H(3-0)  

**Biological Computation**

Examination and modelling of biological networks; focus on the latest developments in biological computing and their theoretical backgrounds, such as: DNA computing; genomic algorithms; artificial chemistries; complex adaptive systems, chaos and fractals; immune system computing; gene regulatory networks; swarm intelligence systems.

**Note:** Lectures may run concurrently with Computer Science 567.

Computer Science 609 H(3-0)

**Multi-Agent Systems**

Modelling of agents and properties of multi-agent systems. Communication issues, including interaction and coordination concepts, forming and maintaining organizations, and competitive agent environments. Example systems; the implementation of a multi-agent system will be performed as the assignment.

**Note:** Computer Science 413 is recommended as preparation for this course.

Computer Science 611 H(3-0)

**Complexity Theory**

Deterministic and non-deterministic time and space complexity; complexity classes and hierarchies; NP-complete problems and intractable problems; automata complexity theory.

**Note:** Computer Science 413 is recommended as preparation for this course.

Computer Science 613 H(3-0)

**Program Specification, Proof and Transformation**

Program proving techniques; approaches to partial and total correctness. Operational abstraction and data abstraction, Mechanical transformation of programs. Machine assisted proof.

**Note:** Computer Science 515 is recommended as preparation for this course.

Computer Science 617 H(3-0)

**Category Theory for Computer Science**

Introduction to category theory with applications in computer science. Functions, natural transformations, adjoints and monads, initial and final algebras. Introduction to 2-categories and fibrations.

**Note:** Computer Science 513 or 515 is recommended as preparation for this course.

Computer Science 619 H(3-0)

**Quantum Computation**

Quantum information, quantum algorithms including Shor’s quantum factoring algorithm and Grover’s quantum searching technique, quantum error correcting codes, quantum cryptography, nonlocality and quantum communication complexity, and quantum computational complexity.

**Note:** Lectures may run concurrently with Computer Science 519.

Computer Science 635 H(3-0)

**Image Analysis and Computer Vision**


**Note:** Lectures may run concurrently with Computer Science 535.

Computer Science 641 H(3-0)

**Performance Issues in High Speed Networks**

An overview of current research in high speed networks. Topics covered will include the current Internet, the future Internet, wireless networks, optical networks, Asynchronous Transfer Mode (ATM), TCP/IP, network traffic measurement, Web server performance, and mobile computing. Emphasis will be placed on network performance issues for next-generation Internet protocols and applications.

Computer Science 653 H(3-0)

**Computational Geometry**

Geometric searching, hull proximity and intersection data structures and algorithms and their complexity.

**Note:** Computer Science 415 or 517 is recommended as preparation for this course.

Computer Science 657 H(3-0)  
(formerly Computer Science 601.11)

**Modelling And Visualization of Plants**


**Note:** Computer Science 453 or 553 is recommended as preparation for computer science students taking this course.

Computer Science 661 H(3-0)

**Algorithms for Distributed Computation**

Basic problems in distributed systems such as symmetry breaking, consensus, resource allocation, and synchronization. The impact of system characteristics, such as models of communication, timing and failure, and of solution requirements, such as correctness and complexity criteria and algorithmic constraints, on the computability and complexity of these problems. Techniques for solving problems under different models will be emphasized.

**Note:** Computer Science 413 is recommended as preparation for this course.

Computer Science 663 H(3-0)

**Design and Analysis of Parallel Algorithms**

Models of parallel computation; measures of efficiency for parallel algorithms. Efficient parallel algorithms for the classical computational problems: selection, merging, sorting, and expression evaluation. Emphasis is on common techniques and recurrent subproblems. Inherently sequential problems; P-completeness.

**Note:** Computer Science 413 is recommended as preparation for this course.

Computer Science 667 H(3-0)

**Symbolic and Algebraic Computation**

Representations of integers and polynomials for symbolic computation. Asymptotically fast algorithms for arithmetic, including the Schonhage-Strassen algorithm for integer multiplication. Efficient algorithms for the factorization of polynomials over fields. Additional topics, such as matrix multiplication, algebraic simplification, symbolic integration.

**Note:** Computer Science 413 and 491 are recommended as preparation for this course.

Computer Science 669 H(3-0)  

**Cryptography**

An introduction to the fundamentals of cryptographic systems, with emphasis on attaining well-defined notions of security. Public-key cryptosystems; examples, semantic security, One-way and Trapdoor functions; hard-core predicates of functions; applications to the design of cryptosystems.

**Note:** Computer Science 413 and Mathematics 321 are recommended as preparation for this course.

Computer Science 673 H(3-0)  
(formerly Computer Science 601.25)

**Distributed Database Systems**

Introduction to distributed database systems. Topics covered include: architecture, data design, query processing, transaction management, multibases, object-oriented databases and advanced system issues.

**Note:** Computer Science 413 and Mathematics 321 are recommended as preparation for this course.

Computer Science 675 H(3-0)  
(formerly Computer Science 601.65)

**Datawarehouse Systems**

Design, development and deployment of datawarehouses. Schemas, models, data organization, OLAP, tuning, data mining and architectural models may be discussed.

Computer Science 681 H(3-0)

**Research Methods in Human-Computer Interaction**

Application of the theory and methodology of human-machine studies to real systems; theory and practice.

**Note:** Computer Science 481 is recommended as preparation for this course.

Computer Science 683 H(3-0)

**Information Visualization**

The theory and development of interactive visual representations of abstract data for the purpose of amplifying cognition. Topics covered can include representational issues, perceptual issues, visual literacy, spatial abstraction, and interaction issues.

Computer Science 687 H(3-0)

**Computer Animation**

Principles of traditional animation, key framing, parametric and track animation, free-form deformation, inverse kinematics, dynamics, spring mass systems, particle systems, numerical integration, Lagrangian constraints, space time constraints, collisions, human animation, behavioural animation, metamorphosis, implicit animation techniques, animating liquids, gases and cloth, motion capture.

**Note:** Lectures may run concurrently with Computer Science 587.

Computer Science 689 H(3-0)

**Modelling for Computer Graphics**

Courses of Instruction


Note: Lectures may run concurrently with Computer Science 589.

Computer Science 691 H(3-0)
Rendering

Note: Lectures may run concurrently with Computer Science 591.

Computer Science 699 H(3-0)
Research Methodology in Computer Science
An introduction to and survey of research areas and methods in Computer Science. Professional skills in computer science research such as reviewing, critical evaluation, and the preparation of research proposals.

Computer Science 701 H(3-0)
Research Topics in Computer Science
In depth course on a focused current research topic in Computer Science. Involves a significant research component and requires substantial background knowledge.

Note: Research topics course. May be repeated for credit with consent of the Department.

Computer Science 767 H(3-0)
(formerly Computer Science 601.79)
Advanced Topics in Multiagent Systems
An in-depth study of a selected subfield of multiagent systems including state-of-the-art research. This is a project-driven course.

Prerequisite: Computer Science 567 or 609.

Computer Science 771 H(3-0)
(formerly Computer Science 601.80)
Current Trends in Database Technology
Advanced topics chosen from Bioinformatics, Data mining, Mobile Databases, Spatial Databases and Web Databases. There is a large project component.

Computer Science 781 H(3-0)
(formerly Computer Science 601.56)
Advanced Topics in Human-Computer Interaction
The topics covered will change year by year depending on current advances in human computer interaction.

Prerequisite: Computer Science 481.

Note: Computer Science 581 or 681 or equivalent is highly recommended before taking this course.

Computer Science 785 H(3-0)
(formerly Computer Science 601.29)
Implicit Modelling
A detailed look at modelling using implicit and iso-surface techniques taking an in depth review of the literature. Algebraic methods will be followed by skeletal models, field function design, modelling techniques, rendering and texture mapping.

Polynomial algorithms, ray tracing implicit, techniques for animation, meta-morphosis, precise contact modelling, deflection and warping. Algorithms and data structures and implementation details will be presented. Students will be expected to make a new contribution in their project and term paper.

Computer Science 789 H(3-0)
(formerly Computer Science 601.74)
Advanced Geometric Modelling
Current research topics including spline modelling, Subdivision Surfaces, multisresolution, wavelets, analysis of the subdivision surfaces and reverse subdivision.

Note: Open only to students in the MCE degree program.

Continuing Education 613 H(3-0)
Learning, The Workplace, and Society
A macro-level examination of the place of individual, group and organizational learning in the community and contemporary society; perspectives on societal change, work and learning; philosophical and ideological perspectives.

Note: Open only to students in the MCE degree program.

Continuing Education 617 H(3-0)
Program Planning and Evaluation
Planning and evaluation of educational programs for adult learners. A number of models of planning educational programs will be reviewed. Classical and current descriptions of the program planning process will be drawn from across a variety of contexts - business and industry, colleges and universities, health care, extension programs and government. Processes and models for evaluating educational programs will also be covered, including evaluation planning, data gathering and analysis. Particular emphasis will be given to process and outcome evaluation utilizing participative approaches involving relevant stakeholders.

Note: Open only to students in the MCE degree program.

Continuing Education 619 H(3-0)
Organizational Change and Learning
A "case study" course designed to engage students in dealing with the many challenges - organizational and personal - of managing change. The cases include many well-known companies and topical areas.

Note: Open only to students in the MCE degree program.

Continuing Education 621 H(3-0)
Leadership in Organizations
The role of the leader in organizations; strategies through which the leader can effect organizational change and learning; developing leadership skills throughout the organization; power, politics and decision making; leading through influence; developing individual leadership skills.

Note: Open only to students in the MCE degree program.

Continuing Education 623 H(3-0)
Foundations of Human Resource Management
Critically examines and evaluates the nature and significance of the "new" HRM model for Canadian workplaces. Some of the key techniques including recruitment and selection, appraisal, reward systems, training and development and international aspects of HRM are examined.

Note: Open only to students in the MCE degree program.

Continuing Education 625 H(3-0)
Leadership Development
Examines the conceptual understanding of the elements of leadership development. Examines the expansion of an individual's capacity to be effective.
Courses of Instruction

in leadership roles and processes. Provides practical ideas about how to enhance leadership capacity and offers strategies that organizations can employ to contribute to leadership development of their staff.

Note: Open only to students in the MCE degree program.

Continuing Education 641 H(3-0)  Facilitating On-line Learning
Reviews the theory and practice of facilitating learning in virtual environments. Course materials and activities will be facilitated through various technologies of the Internet.

Continuing Education 643 H(3-0)  Career Development in Organizational Settings
Key concepts and current practices in career planning and development from both an individual and an organizational perspective; coordinating institutional career management processes, and individual career planning processes; application of theory to practice by developing an organizational career development program, using students’ own organizational settings.

Continuing Education 645 H(3-0)  Multicultural Issues in Adult Education
Focuses on multicultural issues and their impact on education practice, examines the role of culture in learning, appreciation of the socio-cultural and the political nature of education, and the relationship of power in the teaching/learning transaction.

Continuing Education 647 H(3-0)  Evaluation in Organizations
Using practical models and methods in assessing the effectiveness of workplace programs and organizations; evaluation design, data collection and analysis; making recommendations to assist decision makers.

Continuing Education 649 H(3-0)  Management Learning
Defining the field of management learning; understanding what is distinctive about how and what managers learn; exploring the linkage between the development of management thought and management learning; survey of issues that are critical to management education and management development.

Note: Open only to students in the MCE degree program.

Continuing Education 653 H(3-0)  Strategic Human Resource Management
Examines organizational design, performance, learning and change, examines the underpinnings of normative HRM; the interconnection between strategy, organizational design, HRM and leadership.

Prerequisite: Continuing Education 623.

Continuing Education 657 H(3-0)  Independent Study
Individual directed study course; content and requirements are to be negotiated with the Faculty member agreeing to direct the study. Allows students to self design a study that is specific to an area of interest that they may not find in the regular elective(s) being offered in the MCE program. Students must begin planning the study prior to the term in which they wish to enroll.

Prerequisite: Consent of the Faculty.

MAY BE REPEATED FOR CREDIT

Continuing Education 659 H(3-0)  Technology in Workplace Learning
Examines the possibilities and pitfalls of new technologies for learning including internet-based instruction, video and audio conferencing, computer-mediated communication and emerging delivery modes.

Continuing Education 693 H(3-0)  Master’s Project I
The project could involve an in-depth scholarly study, using secondary sources, of a chosen area of workplace learning. Alternatively, it could involve case study analysis of a specific workplace issue or problem. The project will enable the adult learner to develop and demonstrate competence in conducting an investigation at an organizational level. This phase of the master’s project typically involves the preparation and approval of a research proposal and an ethics application, if the research involves human subjects.

Prerequisite: Consent of the Faculty.

Note: Open only to students in the MCE degree program.

Continuing Education 695 H(3-0)  Master’s Project II
This phase involves the written portion of the master’s project.

Prerequisite: Continuing Education 693.

Note: Open only to students in the MCE degree program.

NOT INCLUDED IN GPA

Continuing Education 702 F(3-0)  Doctoral Seminar on Workplace Learning
To provide doctoral students with a contemporary focus on significant issues in workplace learning, and leadership and development.

Prerequisite: Admission into Doctoral program.

Co-operative Education COOP

Senior Courses

Co-operative Education 501 H(4 months)  Co-operative Placement in Actuarial Science
501.01. Co-operative Placement in Actuarial Science I
501.02. Co-operative Placement in Actuarial Science II
501.03. Co-operative Placement in Actuarial Science III
501.04. Co-operative Placement in Actuarial Science IV

Co-operative Education 503 H(4 months)  Co-operative Placement in Applied Chemistry
503.01. Co-operative Placement in Applied Chemistry I
503.02. Co-operative Placement in Applied Chemistry II
503.03. Co-operative Placement in Applied Chemistry III
503.04. Co-operative Placement in Applied Chemistry IV

Co-operative Education 515 H(4 months)  Co-operative Placement in English
515.01. Co-operative Placement in English I
515.02. Co-operative Placement in English II
515.03. Co-operative Placement in English III
515.04. Co-operative Placement in English IV
515.05. Co-operative Placement in English V

Co-operative Education 517 H(4 months)  Co-operative Placement in French
517.01. Co-operative Placement in French I
517.02. Co-operative Placement in French II
517.03. Co-operative Placement in French III
517.04. Co-operative Placement in French IV
517.05. Co-operative Placement in French V

Co-operative Education 519 H(4 months)  Co-operative Placement in Philosophy
519.01. Co-operative Placement in Philosophy I
519.02. Co-operative Placement in Philosophy II
519.03. Co-operative Placement in Philosophy III
519.04. Co-operative Placement in Philosophy IV
519.05. Co-operative Placement in Philosophy V

Co-operative Education 523 H(4 months)  Co-operative Placement in Business
523.01. Co-operative Placement in Business I
523.02. Co-operative Placement in Business II
523.03. Co-operative Placement in Business III
523.04. Co-operative Placement in Business IV

Co-operative Education 525 H(4 months)  Co-operative Placement in Communications Studies
525.01. Co-operative Placement in Communications Studies I
525.02. Co-operative Placement in Communications Studies II
525.03. Co-operative Placement in Communications Studies III
525.04. Co-operative Placement in Communications Studies IV
### Courses of Instruction

525.05. Co-operative Placement in Communications Studies V
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