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 – C. 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

Academic Writing 301 **Q(1.5-0)**

Academic Writing for Specialized Audiences (Intermediate)

Academic Writing 303 **H(3-0)**

Academic Writing for Specialized Audiences (Intermediate)

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

Accounting 317 **H(3-1T)**
(formerly Accounting 321)

Introductory Financial Accounting

Introduction to accounting for business organizations. Reporting of financial results of operations and financial position to investors, managers, and others. Emphasis on the use of accounting information for decision making.

Prerequisites: Second year standing and Management Studies 291.

Accounting 323 **H(3-1T)**

Introductory Managerial Accounting

An introduction to the use of accounting within an organizational context. Emphasis is placed on the development and dissemination of accounting information necessary for effective management including: planning, directing, motivating, and controlling activities and behaviours.

Prerequisite: Accounting 317 or 321.

Accounting 341 **H(3-1T)**

Intermediate Financial Accounting I

Financial accounting from a producer point of view. Topics include cash, receivables, inventories, short and long-term investments, intangible assets and capital assets including the appropriate financial statement considerations.

Prerequisites: Admission to the Haskayne School of Business, Accounting 317 (or 321), and 323; or consent of the business school.

Accounting 343 **H(3-1T)**
(formerly Accounting 441)

Intermediate Financial Accounting II

Financial accounting from a producer point of view. Topics include accounting for liabilities, shareholders equity, leases, future income taxes, pensions, accounting changes and earnings per share including the relevant financial statement considerations.

Prerequisite: Accounting 341.

Accounting 361 **H(3-1T)**

Cost Accounting

The production of accounting data for the purpose of decision-making, control and evaluation. Topics covered are in the cost classifications and methods of cost establishment; cost data appropriate for decision models, standards and controls.

Prerequisites: Admission to the Haskayne School of Business and Accounting 323.

Accounting 421 **H(3-1T)**

Taxation

Taxation levied on profits, sales, property and estates and its impact upon management decision. Consideration will be given to the biases and shifts implicit in any system of taxation.

Prerequisites: Admission to the Haskayne School of Business, third year standing and Accounting 317 or 321.

Accounting 425 **H(3-1T)**

Auditing

A conceptual study of audit evidence, basic audit techniques, professional ethics; audit reports.

Prerequisites: Third year standing and Accounting 343 or 441.

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 or 441.

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 or 441.

Accounting 465 **H(3-0)**

Managerial Control Systems

Case approach to Management Control Systems explaining the use of accounting data from a managerial perspective. Emphasis is placed on how managers use planning and control to accomplish a firm's strategies.

Prerequisites: Third year standing and Accounting 361.

Accounting 559 **H(3-0)**

Selected Topics in Accounting

Investigation of selected topics in Accounting.

Prerequisites: Third year standing and either Accounting 343 or 441 or consent of the business school.

MAY BE REPEATED FOR CREDIT

Graduate Courses

Accounting 601 **H(3-0)**
(formerly Management Studies 609)

Introductory Financial Accounting

Introduction to accounting for business organizations. Reporting of financial results of operations and financial position to investors, managers, and others. Emphasis on the use of accounting information for decision making.

Accounting 603 **H(3-0)**
(formerly Accounting 611)

Management Accounting

Breakeven analysis, activity-based costing and management, budgeting, productivity measures, and other tools and techniques that are part of a planning and control system that will help the manager make better economic decisions.

Prerequisite: Accounting 601.

Accounting 741 **H(3-0)**

Financial Statement Analysis

Covers the theories, concepts and practices of financial statement analysis with an emphasis placed on applications.

Prerequisite: Accounting 603 or 611.

Note: Credit for both Accounting 741 and 789.04 will not be allowed.

Accounting 789 **H(3S-0)**

Seminar in Accounting

Development of and solutions to current issues and problems in accounting.

Prerequisite: Accounting 611, 603 or consent of the business school.

MAY BE REPEATED FOR CREDIT

Accounting 797 **H(3S-0)**

Advanced Seminar in Accounting

Prerequisite: Consent of the business school.

MAY BE REPEATED FOR CREDIT

PhD Course

Accounting 799 **H(3S-0)**

Doctoral Seminars in Accounting

799.01. Seminar in Financial Accounting

799.02. Seminar in Managerial Accounting

799.03. Seminar in Auditing

799.04. Seminar in Taxation

Actuarial Science ACSC

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 also Applied Mathematics, Mathematics, Pure Mathematics, and Statistics.

Senior Courses

Note: The 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.

Actuarial Science 325 **H(3-1T)**

Theory of Interest/Mathematics of Finance

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.

Actuarial Science 327 **H(3-1T)**

Life Contingencies I

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 "C" or higher in Mathematics 321.

Note: Actuarial Science 325 is recommended.

Actuarial Science 427 **H(3-1T)**

Life Contingencies II

Benefit premiums, premium principles, fully continuous and fully discrete premiums. Benefit reserves, various reserve factors, analysis of benefit reserves. Multiple life functions, dependent and independent models, related annuities and insurances.

Prerequisites: Mathematics 323 and Actuarial Science 327.

Actuarial Science 525 **H(3-0)**

Mathematics of Graduation

Preparation and testing of graduations of mortality tables; graduation by the moving-weighted average, graphic, Whittaker, Bayesian, parametric and smooth-junction interpolation methods; use of statistical methods for graduation.

Prerequisites or Corequisites: Actuarial Science 327 and Mathematics 323.

Actuarial Science 527 **H(3-1T)**

Life Contingencies III

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.

Actuarial Science 533 **H(3-1T)**

Credibility Theory and Loss Distributions

Distributions useful for modelling insurance loss random variables. Approximations for and estimation of these loss distributions. Point and interval estimation, and tests of statistical hypotheses. Introduction to credibility theory, experience rating and claims reserving. Bayesian inferential techniques. Stochastic simulation and computational techniques.

Prerequisite: Actuarial Science 327.

Corequisite: Statistics 421.

Actuarial Science 535 **H(3-1T)**

Mathematics of Demography

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.

Actuarial Science 539 **H(3-1T)**

Special Topics in Actuarial Science

Offered under various subtitles.

Prerequisite: Actuarial Science 327.

Corequisite: Statistics 421.

MAY BE REPEATED FOR CREDIT

African Studies AFST

Instruction offered under the direction of the Faculty of Communication and Culture. For information contact the Program Co-ordinator or the Academic Programs Office, 220-6343.

Additional interdisciplinary courses are offered under the course headings Canadian Studies, Central and East European Studies, Communications Studies, Development Studies, East Asian Studies, General 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

African Studies 301 **H(3-0)**

Introduction to African Studies

An interdisciplinary perspective of the people and ecologies of the African continent. The major theme will be the processes and effects of social, religious, political, economic, historical and cultural change on the lives of Africans.

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.

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, Historical Studies 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.

Prerequisite: One of the following: Anthropology 201, Archaeology 203, Biology 205 or 307, Psychology 205, or consent of the Department.

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)

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)**

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 337 **H(3-0)(Area II)**

Indigenous Knowledge and Global Developments

Contemporary anthropological approaches to indigenous knowledge and peoples, particularly in their relationships to industrial and post-industrial societies.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 341 **H(3-0) (Area II)**

Medical Anthropology

A survey of anthropological approaches to disease, illness and the maintenance of health.

Prerequisite: Anthropology 203 or consent of the Department.

Note: Not open to students with credit in Anthropology 483.

Anthropology 351 **H(3-3)(Area III)**

Method and Theory in Primatology

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.

Prerequisite: Anthropology 201 or consent of the Department.

Note: Field trips required. Anthropology 307 or equivalent statistical course is highly recommended.

Anthropology 353 **H(3-3)(Area III)**

Primate Evolution

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.

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

Note: Anthropology 307 or equivalent statistical course is highly recommended.

Anthropology 355 **H(3-0) (Area II)**
(formerly Anthropology 255)

An Ethnographic Survey of Native North America

Selected North American Indian cultures in terms of the relationships among basic subsistence adaptations, social, ceremonial, and ideological structures.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 357 **H(3-0) (Area II)**

Applied Anthropology

Introduction to the practical use of anthropological knowledge and research methods. Includes discussion of the specific challenges of practicing anthropology outside of academia.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 363 **H(3-0)(Area II)**

Anthropological Perspectives on Religion

Contemporary anthropological theoretical perspectives on indigenous and world religions.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 365 **H(3-0)(Area II)**
(formerly Anthropology 360)

Anthropological Theory

Study of a variety of theories in Social and Cultural Anthropology, and their implications for research design and fieldwork.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 367 **H(3-0)(Area II)**

Ritual and Cultural Performance

Anthropological theories of political, social, symbolic and performative aspects of ritual and the role of ritual in the reproduction and contestation of cultural identities.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 371 **H(3-0)(Area II)**

Political Anthropology

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.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 375 **H(3-0)(Area II)**

Anthropology of Law

Systems of law and social control in both state and non-state societies.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 379 **H(3-0)(Area II)**

Urban Anthropology

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.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 383 **H(3-0)(Area II)**

The Nature of Ethnographic Writing

Paradoxes of the boundary between fiction and non-fiction, contrasting the poetics and "literary" 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.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 385 **H(3-0)(Area II)**

Economic Anthropology

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.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 387 **H(3-0)(Area II)**

Ethnography of Global-Local Dynamics

Changes in the international division of labour and resulting social, cultural, and political effects, with particular attention to the incorporation of small-scale societies.

Prerequisite: Anthropology 203, or consent of the Department.

Note: Not open to students with credit in Anthropology 485.

Anthropology 399 **H(3-0)(Area II)**

Ethnographic Survey of Selected World Areas

Arranged for various topics in the anthropology of world areas. Consult department for topics in any given year.

Prerequisite: Anthropology 203 or consent of the Department.

MAY BE REPEATED FOR CREDIT

Anthropology 402 **F(3-0) (Area II)**

Independent Study

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.

Prerequisite: Consent of the Department.

Anthropology 404 **F(3-0)(Area III)**

Independent Study

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.

Prerequisite: Consent of the Department.

Anthropology 405 **H(3-0)(Area II)**

Ecology of Tropical Forest Societies

Adaptation of indigenous societies to their tropical forest habitat, and their transformation under the impact of industrial society.

Prerequisite: Anthropology 203 or consent of the Department.

Anthropology 411 **H(3-0)(Area II)**

Methods and Analysis for Anthropology

An introduction to research design, data collection, and analysis as used in anthropology. Cross-cultural research design and methods, use of participant observation and personal documents will be emphasized.

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

Anthropology 419 **H(3-0)(Area II)**
(Archaeology 419)

Ethnography of the Great Plains

Comparative study of peoples and cultures of the Great Plains past and present.

Anthropology 421 **H(3-0)(Area II)**

Contemporary Latin American Society

An examination of selected issues in the anthropological study of contemporary Latin America.

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

Principles of evolution applied to the study of behaviour. An exploration of the biological bases for behaviour and the use of evolutionary and biological models for both human and animal behaviour.

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)**

Palaeoprimatology

Examination of the fossil primates, construction of evolutionary models and cladistic scenarios. Techniques for the reconstruction of ecological relationships, behaviour, 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 371 or consent of the Department.

Anthropology 463 **H(3-0)(Area II)**

Experiential Perspectives on Religion

Existential theoretical perspectives on indigenous, world and new religions.

Prerequisite: Anthropology 363 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 legitimization 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)**
(formerly Anthropology 377)

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, 335, 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 survey of ideas about the biological bases of human and non-human primate social behaviour. Impacts of the theoretical models of the modern synthesis, ethology, behavioural ecology, socio-ecology, and sociobiology or 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.

Corequisite: Anthropology 553 or consent of the Department.

Note: Normally offered during Spring Session of alternate years.

Note: Field schools operated by other universities may be accepted for credit under this number with prior arrangement.

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

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.

Note: Normally offered during Spring Session of alternate years.

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

Anthropology of Missions

Missionary endeavours, their interior logic, and their methodological and ethnographic contributions to anthropology.

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.

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.

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, biosociality, 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 331 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.

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

Orthogonal sets of functions, Fourier series, solution of potential equation, heat equation and wave equation. Numerical solution of 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

Examples of optimization problems. Quadratic forms, minimum energy and distance. Least squares, generalized inverse. Location and classification of critical points. Variational treatment of eigenvalues. Lagrange multipliers. Linear programming.

Prerequisites: Mathematics 311; and Mathematics 353 or Applied Mathematics 309 or Mathematics 331.

Applied Mathematics 433 **H(3-1T)**

Mathematical Methods in Physics

Complex analysis and residue integrals. Fourier analysis. Laplace transforms. Vector spaces. Eigenvalues and eigenvectors. Extensive physical applications.

Prerequisites: Applied Mathematics 307 or 311 or Physics 321 or 341, Applied Mathematics 309 or Mathematics 353 or 331.

Applied Mathematics 441 **H(3-1T)**

Linear Spaces with Applications

Linear operators and matrices. Jordan forms. Eigenvalue problems. Quadratic forms. Applications.

Prerequisites: Mathematics 311 and one of Mathematics 353, Applied Mathematics 309 or Mathematics 331.

Note: May not be offered every year. Consult the Department for listings.

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 and could include analysis of optimization algorithms, approximation theory, control theory, differential equations, mathematical physics.

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

Mathematical theories of space and time. Special Relativity. Electro-dynamics. General Relativity.

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 505 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

Linear systems, classification, genericity and structural stability. Nonlinear systems: Existence and uniqueness. Rectification Theorem. Flow and one parameter group of transformation. Stability theory. Hyperbolicity, Unstable/Stable/Center manifold theorems. Poincare-Bendixon. Two dimensional flows.

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 621 **H(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 year.

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 NaI 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

Quasi-static uniform atmosphere. Atmospheric optics. Scattering in the atmosphere. Atmospheric visibility and aerosols. Cloud physics. Atmospheric electricity. Radiative transfer. Atmospheric circulation. Hydrological cycling. Stable isotopic techniques. Pollutants. Energy transfer. Turbulence. Sky shortwave and visible radiation distribution. Near infrared sky radiation, cloud detection and estimation.

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

Applied Physics 575 **H(3-0)**

Optics and Electro-Optics

Geometrical optics. Illumination in optical systems including room illumination. Simple magnifier, camera, microscope, telescope, projector, spectrograph. Radiation detectors. Solar cells. Lasers, Gaussian beams. Polarised light. Photographic processes. Fibre optics. Fourier spectroscopy. Interferometers. Holography.

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. Hiebert

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.

Junior Course

Applied Psychology 205 H(3-0)
(formerly Applied Psychology 305)

Becoming an Effective Learner: Strategies for Adult Learners Theory and practice of learning and study strategies.

Senior Courses

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

Applied Psychology 301 H(3-2)
(formerly Educational Psychology 511)

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)
(formerly Educational Psychology 513)

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 Educational Psychology 511 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.

Applied Psychology 323 H(2-1)

Communicating Across Cultures

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

Applied Pschology 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)
(formerly Educational Psychology 321)

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 401 H(2-2)

Research Design and Program Evaluation in Applied Psychology

Research theory and practice for evaluating programs in applied psychology and education.

Applied Psychology 403 H(2-2)

Qualitative Research in Applied Psychology

Qualitative research design, data management and analysis for qualitative research in applied psychology.

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)
(formerly Educational Psychology 415)

Applied Psychology of Motivation

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

Applied Psychology 417 H(3-0)
(formerly Educational Psychology 417)

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)
(formerly Educational Psychology 419)

Communication Skills in Guidance and Counselling

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

Applied Psychology 421 H(3-0)
(formerly Educational Psychology 421)

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)
(formerly Educational Psychology 501)

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)
(formerly Educational Psychology 423)

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)
(formerly Educational Psychology 551)

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)
(formerly Educational Psychology 527)

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: Educational Psychology 321 or 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)
(formerly Educational Psychology 545)

Psychology and Education of Children with Learning Problems

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

Prerequisite: Educational Psychology 321 or Applied Psychology 361 or equivalent or consent of the Division.

Applied Psychology 571 H(3-0)
(formerly Educational Psychology 547)

Psychology and Education of Gifted and Talented Individuals

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

Prerequisite: Educational Psychology 321 or Applied Psychology 361 or equivalent or consent of the Division.

Applied Psychology 593 H(3S-0)
(formerly Educational Psychology 593)

Seminar: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 597 H(1-3)
(formerly Educational Psychology 597)

Planning and Implementing Programs for Small Group Instruction

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

Prerequisite: Educational Psychology 321, 423, or 431 or 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: Educational Psychology 321 or Applied Psychology 361, or Educational Psychology 423 or Applied Psychology 461, or Educational Psychology 431 or Applied Psychology 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)
(formerly Educational Psychology 629.03)

Psychological Assessment of Adults

Practicum and related seminars in the administration, scoring and interpretation of psychological tests with adults.

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

Applied Psychology 603 H(3-0)
(formerly Educational Psychology 693.07)

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)
(formerly Educational Psychology 687)

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)
(formerly Educational Psychology 631)

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 613 H(3-2)
(formerly Educational Psychology 633)

Research in Applied Educational Psychology: Distribution-Free Techniques

Experimental educational psychology with special reference to small sample techniques.

Prerequisites: Applied Psychology 301 and 303 or Educational Psychology 511 and 513, or equivalents.

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)
(formerly Educational Psychology 601)

Creating a Working Alliance

Theory and practice in developing skills contributing to working alliance and problem clarification. Ethical, 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)
(formerly Educational Psychology 603)

Theory in Counselling

History and systems involved in counselling psychology and client change.

Prerequisite: Consent of the Division.

Applied Psychology 625 H(3-0)
(formerly Educational Psychology 693.06)

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)
(formerly Educational Psychology 671)

Group Processes in Applied Psychology

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

Applied Psychology 629 H(3S-2)
(formerly Educational Psychology 629)

Theory and Applications: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 631 H(3-0)
(formerly Educational Psychology 617)

Theories of Career Development

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

Applied Psychology 633 H(2-2)
(formerly Educational Psychology 623)

Career Counselling

Practicum in career counselling. Laboratory and field experiences with related seminars.

Prerequisite: Applied Psychology 631.

Applied Psychology 637 H(3-0)
(formerly Educational Psychology 693.43)

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.

Note: Not open to students with credit in Educational Psychology 619 or 693.39.

NOT INCLUDED IN GPA

Applied Psychology 640 F(2-7)
(formerly Educational Psychology 650)

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.

Prerequisite or Corequisite: Applied Psychology 639.

Note: Not open to unclassified students.

NOT INCLUDED IN GPA

Applied Psychology 641 H(3-0)
(formerly Educational Psychology 693.01)

Development, Learning and Cognition - Child and Adolescence

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

Applied Psychology 643 H(3-0)
(formerly Educational Psychology 693.04)

Development, Learning and Cognition - Adult

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

Applied Psychology 645 H(3-0)
(formerly Educational Psychology 635)

Cognitive Processes

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

Applied Psychology 647 H(3-0)
(formerly Educational Psychology 693.05)

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)
(formerly Educational Psychology 611)

Advanced Study of Learning Theories

An analysis of contemporary learning theories relevant to school learning.

Applied Psychology 653 H(3-0)
(formerly Educational Psychology 661)

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)
(formerly Educational Psychology 665)

Applied Developmental Psychology: Adolescence

Theory and applications in human development during adolescence.

Applied Psychology 659 H(3-0)
(formerly Educational Psychology 651)

Applied Social Psychology

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

Applied Psychology 661 H(3-0)
(formerly Educational Psychology 693.24)

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.

Note: Not open to students with credit in Educational Psychology 602.

Applied Psychology 667 H(3-3)
(formerly Educational Psychology 685)

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: Educational Psychology 693.24 or Applied Psychology 661 or equivalent.

Applied Psychology 671 H(1-3)
(formerly Educational Psychology 694.63)

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: Educational Psychology 693.24 or Applied Psychology 661 or equivalent.

Applied Psychology 673 H(3-3)
(formerly Educational Psychology 679)

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)
(formerly Educational Psychology 683)

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)
(formerly Educational Psychology 693.08)

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)
(formerly Educational Psychology 677)

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.

Applied Psychology 687 H(1-5)
(formerly Educational Psychology 625)

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)
(formerly Educational Psychology 644)

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)
(formerly Educational Psychology 691)

Graduate Seminar: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 692 F(3S-0)
(formerly Educational Psychology 692)

Graduate Seminar: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 693 H(3S-0)
(formerly Educational Psychology 693)

Graduate Seminar: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 694 F(1S-3)
(formerly Educational Psychology 694)

Graduate Practicum: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 695 H(1S-3)
(formerly Educational Psychology 695)

Graduate Practicum: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Notes:

1. 700-level courses are normally available only to students in the Applied Psychology doctoral program.
2. Students seeking an internship can do so by registering in a 700-level Special Topics course, in consultation with their supervisor.

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)**
(formerly Educational Psychology 793.36)

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 Educational Psychology 693.24) 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)**
(formerly Educational Psychology 710)

Advanced Seminar in Counselling Psychology

Advanced study of counselling psychology theory and research.

Applied Psychology 742 **F(2-7)**
(formerly Educational Psychology 770)

Advanced Practicum in Counselling

Advanced practicum in counselling psychology, and related seminars.

NOT INCLUDED IN GPA

Applied Psychology 792 **F(3-0)**
(formerly Educational Psychology 792)

Advanced Seminar: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 793 **H(3S-0)**
(formerly Educational Psychology 793)

Graduate Seminar: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 794 **F(1S-3)**
(formerly Educational Psychology 794)

Advanced Practicum: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

Applied Psychology 795 **H(1S-3)**
(formerly Educational Psychology 795)

Advanced Practicum: Selected Topics

Prerequisite: Consent of the Division.

MAY BE REPEATED FOR CREDIT

In addition to the numbered and titled courses shown above, the division 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.

Archaeology ARKY

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

Department Head – M.A. Katzenberg

Junior Courses

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(3-2)(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.

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. Emphasis on the civilizations of the Olmecs, Zapotecs, Teotihuacanos, Toltecs and Aztecs.

Prerequisite: Archaeology 201 or 205 or consent of the Department.

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, cataloguing, processing and curating of museum specimens are explored in cooperation with city museums.

Archaeology 395 **H(3-0)(Area II)**

Archaeology of Tropical Africa

African archaeology from the earliest times to the ethnographic present. Emphasis will be placed on the last 10,000 years and the development and spread of food production, iron metallurgy and trade, and on their consequences.

Prerequisite: Consent of the Department.

Archaeology 399 **H(3-0)(Area II)**

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 (Geography 413) **H(3-2)(Area III)**

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)**

Zooarchaeology

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.

Archaeology 419 (Anthropology 419) **H(3-0)(Area II)**

Ethnography of the Great Plains

Comparative study of peoples and cultures of the Great Plains past and present.

Archaeology 421 **H(3-0)(Area II)**

Archaeology of the Great Plains

Comprehensive overview of the archaeology of the Plains area. Special emphasis on the Alberta and Northern Plains.

Prerequisite: Archaeology 201 or 205 or 303 or consent of the Department.

Archaeology 423 **H(3-0)(Area II)**

Archaeology of the Arctic

Prehistory/history of N. E. Asia, Alaska, Canada and Greenland. Emphasis will be placed on ecological and ethnographical data.

Prerequisite: Archaeology 201 or 205 or 303 or consent of the Department.

Archaeology 427 **H(3-0)(Area II)**

Archaeology of Southwestern North America

A comprehensive survey of the archaeology of the Greater Southwest.

Prerequisite: Archaeology 201 or 205 or 303 or consent of the Department.

Archaeology 431 **H(3-0)(Area II)**

Oceanic Prehistory

The prehistory of New Guinea, Australia, Melanesia, Micronesia and Polynesia. Reviews the Southeast Asian origin of Oceanic cultures; the early peopling

of New Guinea and Australia; the migration of people into the islands of the South Pacific and the development of Oceanic cultures to the end of the prehistoric period.

Prerequisite: Consent of the Department.

Archaeology 433 **H(3-0) (Area II)**

Archaeology of Eastern North America

Cultural developments in eastern North America from the earliest known human occupation to the advent of Europeans. Topics will include the changing adaptations of hunter-gatherers, the appearance of sedentism, the introduction/invention of horticulture, and the emergence of social complexity.

Prerequisite: Archaeology 303 or consent of the Department.

Archaeology 451 **H(3-0)(Area II)**

Introduction to Method and Theory

A survey of contemporary approaches to the study of archaeology emphasizing concepts from other disciplines.

Prerequisite: Archaeology 201.

Archaeology 453 **H(3-3) (Area III)**

Fundamentals of Geoarchaeology

Analytical methods used in geoarchaeology. The interpretation of site and regional context, provenance, and paleoenvironment, and the application of dating methods, chemical and isotopic methods, and remote sensing. Case studies and experiential learning through field examples.

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

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

Archaeology 471 **H(3-2)(Area III)**

Ceramic Analysis

The production of pottery: raw materials and techniques. Form, function and decoration. Ceramic ecology. Field processing and sampling. Classification: a survey of approaches. Ceramics and archaeological inference. Practical exercises.

Prerequisite: Consent of the Department.

Archaeology 493 **H(3-0)(Area III)**

Problems of Hominid Evolution

A detailed investigation of the major problems which confront scholars in terms of hominid evolution. Several sub-disciplines of physical anthropology are considered.

Prerequisite: Consent of the Department.

Archaeology 501 **H(3-0)(Area II)**

Practical Problems in Archaeological Interpretation

Exercises in the analysis and interpretation of a variety of archaeological data sets.

Prerequisite: Archaeology 201 or 205 or consent of the Department.

Archaeology 503 **H(3-0)(Area II)**

Gender in Prehistory

The theoretical background for feminist archaeology and some of the important advances in Old and New World gender studies. Topics include the relationship of gender hierarchy to the rise of the state; contrasts between the ideological representation of gender and culture practice; and an overarching theme of critical analysis relating the present to the past.

Prerequisite: Archaeology 451 or consent of the Department.

Note: Not open to students with credit in Archaeology 531.77 or 603.02.

Archaeology 505 **H(3-0)(Area II)**

Topics of Debate

Topics currently being debated in archaeology and human biology from a perspective that emphasizes philosophical, theoretical and methodological issues. Specific issues addressed will vary each session and generally correlate with on-going senior thesis research. Opportunities to discuss the research process will be provided. Designed to hone students' critical, analytical, and debating skills, and as preparation for graduate studies.

Prerequisite: Archaeology 451.

Note: Restricted to students admitted to the Honours program.

Archaeology 506 **F(0-7)(Area III)**

Advanced Archaeological Field Techniques

As a continuation of Archaeology 306, students are offered training in the more advanced aspects of fieldwork.

Prerequisites: Archaeology 201 and 306.

Note: Normally offered during the Spring and/or Summer Sessions.

Archaeology 509 **H(3-1)(Area III)**

Computer Applications in Archaeology

Computer concepts and applications of special interest to archaeologists. Use of programs for the manipulation and presentation of archaeological data including spreadsheets, databases, imaging and illustration, presentation programs, web page design and elements of GIS, CAD, mapping, and other software used by archaeologists.

Prerequisites: Archaeology 201 and consent of the Department.

Archaeology 511 **H(3-0)(Area II)**

Mesoamerican Writing Systems

Writing systems of Mesoamerica (especially the Maya), their origins and development, and including the Mesoamerican calendar and astronomical knowledge.

Prerequisites: Archaeology 341 and 343 or consent of the Department.

Archaeology 513 **H(3-0) (Area II)**

Comparative Writing Systems

A comparison of selected writing systems around the world. Attention will be paid to strategies used in various scripts for the transmission of spoken language to written form. Emphasis will be on scripts of the ancient world: their development, uses, and decipherment.

Prerequisite: Consent of the Department.

Archaeology 517 **H(3-0) (Area III)**
(formerly Archaeology 531.41)

Archaeometry

Analytical methods for reconstructing various aspects of life in the past based on analysis and interpretation of the material record. The structures of materials at the microscopic and macroscopic levels; raw materials and production technologies; provenance; dating; prospection; dietry reconstruction; sampling and measurement. Archaeological case studies are used throughout.

Prerequisite: Consent of the Department.

Archaeology 531 **H(3-0)(Area II)**

Special Topics in Archaeology

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

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Archaeology 533 **H(3-0)(Area III)**

Special Topics in Archaeology

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

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Archaeology 553 **H(3-0) (Area II)**
(Historical Studies 553)

Circum-Caribbean Archaeology and History

The prehistory and history of the indigenous peoples of the Caribbean from the first peopling of the islands to the early contact period.

Prerequisite: Consent of the Department.

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

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 Archaeology 613.

Note: Until August 15, preference in enrollment is given to students who have declared a Major in Archaeology or Anthropology.

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

Archaeology 591 **H(3-0)(Area II)**

Landscape Archaeology

Human perceptions and uses of the ecophysical and cultural environment. How societies humanize their environment by naming places, identifying resources, establishing paths, modifying and replicating the natural landscape thereby creating a tradition of land use that can be accessed archaeologically.

Prerequisite: Archaeology 451.

Note: Not open to students with credit in Archaeology 531.73 or 603.85.

Archaeology 593 **H(3-0)(Area II)**

Household Archaeology

Human perceptions and uses of the built environment, particularly residential architecture. The emphasis is on the structure and symbolism associated with the spatial arrangements of objects, activities, and social interactions.

Prerequisite: Archaeology 451.

Archaeology 595 **H(3-0)(Area III)**

Problems in Palaeopathology and Palaeonutrition

Patterns of disease in prehistoric human populations with consideration to the interaction of health and nutrition. Techniques for determining disease and nutrition from prehistoric remains are covered.

Prerequisite: Archaeology 203 or consent of the Department. Archaeology 555 is recommended.

Note: Until August 15, preference in enrollment is given to students who have declared a Major in Archaeology or Anthropology.

Archaeology 596 **F(3S-0)(Area III)**

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 597 **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

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

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 achaeological 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 Communication and Culture and Environmental Design. For information contact the Program Co-ordinator or the Academic Programs Office, 220-6343.

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.

Corequisites: Architectural Studies 451 and 455.

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.

Corequisites: Architectural Studies 453 and 461.

Note: Credit for both Architectural Studies 444 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(0-8)**

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 accommodate 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 451.

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 Settlements

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 architecture through the study of selected works of architecture and urbanism.

457.01. History of Architecture and Human Settlements I-Premodern Traditions of the World

457.02. History of Architecture and Human Settlements II-The Western Tradition 1400 to the Present

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. Geological, 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.

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.

Art ART

Instruction offered by members of the Department of Art in the Faculty of Fine Arts.

Department Head – G. Hushlak

Art 001 **(0-1)**

Graduating Exhibition

Submission of work to be considered for inclusion in the departmentally supervised exhibition of

graduating students' works.

Prerequisite: One of Art 437, 443, 453, 473, 483.

Prerequisite or Corequisite: One of Art 535, 541, 551, 571, 581.

NOT INCLUDED IN GPA

Art 003 **(0-1)**

Visiting Artists and Scholars

A series of presentations by visiting artists and scholars. Attendance is compulsory.

NOT INCLUDED IN GPA

Art 004 **(0-1)**

Visiting Artists and Scholars

A series of presentations by visiting artists and scholars. Attendance is compulsory.

Prerequisite: Art 003 or consent of the Department.

NOT INCLUDED IN GPA

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)**

Art Fundamentals: 2D

Two-dimensional activities and the structural, organizational, perceptual, social and psychological aspects of art.

Art 233 **H(3-3)**

Art Fundamentals: 3D

Three-dimensional activities and the structural, organizational, perceptual, social and psychological aspects of art.

Art 235 **H(3-3)**

Introduction to Photography

Black and white and colour photographic processes with emphasis on the potential for accuracy and realism in the photographic image.

35 MM manual camera required.

Note: Not open to students with 300-level credit or above in photography. Credit for both Art 235 and 335 will not be allowed.

Art 241 **H(3-3)**

Drawing I

Basic theory and practice of drawing, involving mainly still life and figure projects in monochromatic media.

Art 243 **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

Studio-based theory and methods of creating meaningful art experiences for children aged 6 to 12.

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: Art 231 or 241 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

Painting on a two-dimensional surface; the use of oils and acrylics.

Prerequisites: Art 231, 233 and 243.

Art 353 **H(3-3)**

Painting II

Further study and work in painting.

Prerequisite: Art 351.

Art 367 **H(3-3)**
(formerly Art 513.28)

Mould Making for Multiple Casts

Exploration of a variety of methodologies and materials for producing multiple cases in a variety of materials.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Art 369 **H(3-3)**
(formerly Art 513.29)

Further Study in Mould Making for Multiple Casts

Further exploration of a variety of methodologies and materials for producing multiple casts in a variety of materials.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Art 373 **H(3-3)**

Printmaking, Lithography I

Basic concepts and techniques of lithographic printing.

Prerequisites: Art 231, 233 and 243.

Art 377 **H(3-3)**

Printmaking, Serigraphy I

Basic concepts and techniques of silk-screen printing.

Prerequisites: Art 231, 233 and 243.

Art 379 **H(3-3)**

Printmaking, Relief and Intaglio

Basic concepts and techniques in relief and intaglio printmaking.

Prerequisites: Art 231, 233, and 243.

Art 381 **H(3-3)**

Sculpture I

Development and realization of sculpture with various techniques and materials.

Prerequisites: Art 231, 233 and 243.

Art 383 **H(3-3)**

Sculpture II

Further study and work in sculpture.

Prerequisite: Art 381.

Art 387 **H(3-3)**

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.

MAY BE REPEATED FOR CREDIT

Art 391 **H(3-3)**

Art for Intermediate and Senior Students I

Studio exploration of materials and concepts appropriate for working with 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 393 **H(3-3)**

Art for Intermediate and Senior Students II

Development of teaching rationales and strategies for students aged 12 to 18.

Prerequisite: Art 391 or consent of the Department.

Note: Not open to students with credit in Art 390.

Art 395 **H(3-3)**

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

Note: Not open to BFA (Art) or BFA (Developmental Art) students. Not open to students with credit in Art 231.

Art 397 **H(3-3)**

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.

Note: Note open to BFA (Art) or BFA (Developmental Art) students. Not open to students with credit in Art 233.

Art 399 **H(3-0)**

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 **H(3-0)**

Studies in Contemporary International Art

Study of recent international art practices from a range of perspectives in art criticism.

Art 431 **H(3-3)**

Contemporary Art Forms III

Studies in digital visualization involving multimedia software.

Prerequisite: Art 331.

Art 433 **H(3-3)**

Contemporary Art Forms IV

Continuing study in digital visualization and multimedia applications, with an emphasis on extended projects.

Prerequisite: Art 331.

Art 435 **H(3-3)**

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 **H(3-3)**

Photography IV

Continuing work in photography, with emphasis on hand-coated printing media.

Prerequisite: Art 435.

Art 439 **H(3-3)**

Introduction to Electronic Media

Theory and practice of art using electronic media; introduction to technical, aesthetic and conceptual aspects of video and audio art.

Prerequisites: One studio half course at the 300 level or consent of the Department.

Art 441 **H(3-3)**

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 **H(3-3)**

Drawing VI

Continuation of Art 441.

Prerequisite: Art 441.

Art 451 **H(3-3)**

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 **H(3-3)**

Painting IV

Continuation of Art 451.

Prerequisite: Art 451.

Art 461 **H(3-3)**

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 studio.

Art 463 **H(3-3)**

Honours Studio II

Directed studio research and production.

Prerequisites: Enrollment in the BFA Honours (Art) program and Art 461.

Art 471 **H(3-3)**

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 **H(3-3)**

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 **H(3-3)**

Sculpture III

Problems of three-dimensional form in a variety of materials and techniques.

Prerequisite: Art 383.

Art 483 **H(3-3)**

Sculpture IV

Continuation of Art 481.

Prerequisite: Art 481.

Art 485 **H(3-3)**

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 art teachers to all facets of planning and implementing meaningful art experiences for young people 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.

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(3-0)**

Designing Programs for Art

A seminar course devoted to analysis of program structures derived from current theory.

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-5)**

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 483

Art 583 **H(3-3)**

Sculpture VI

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 the implementation of art teaching strategies in a teaching laboratory situation.

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

Art 599 **H(3-0)**

Professional Aspects of Art

Examination and discussion of the issues associated with the professional aspects of surviving as an artist. Presentations by professional artists practicing in the field will form a major component of the course.

Prerequisite: Art 499 or consent of the Department.

Note: Restricted to BFA (Art), BA (Art History), and BFA (Developmental Art) students.

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

Art 631 **H(2T-10)**

Advanced Electronic Media

Individual study in electronically generated art forms, including digital media.

631.01. Advanced Electronic Media I

631.02. Advanced Electronic Media II

Prerequisite: Consent of the Department.

Art 635 **H(2T-10)**

Advanced Photography

Individual study in photography.

635.01. Advanced Photography I

635.02. Advanced Photography II

Prerequisite: Consent of the Department.

Art 641 **H(2T-10)**

Advanced Drawing

Individual study in drawing.

641.01. Advanced Drawing I

641.02. Advanced Drawing II

Prerequisite: Consent of the Department.

Art 651 **H(2T-10)**

Advanced Painting

Individual study in painting.

651.01. Advanced Painting I

651.02. Advanced Painting II

Prerequisite: Consent of the Department.

Art 661 **H(2T-10)**

Advanced Studio Practice

Individual study that is not limited to a single medium.

661.01. Advanced Studio Practice I

661.02. Advanced Studio Practice II

Prerequisite: Consent of the Department.

Art 671 **H(2T-10)**

Advanced Printmaking

Individual study in printmaking.

671.01. Advanced Printmaking I

671.02. Advanced Printmaking II

Prerequisite: Consent of the Department.

Art 681 **H(2T-10)**

Advanced Sculpture

Individual study in sculpture.

681.01 Advanced Sculpture I

681.02 Advanced Sculpture II

Prerequisite: Consent of the Department.

Art 691 **H(1-3)**

Practicum in Post-Secondary Art Instruction

Supervised practical application of techniques of planning and teaching art in a post-secondary curriculum.

Prerequisite: Consent of the Department.

Note: This course consists of three hours of supervised practicum per week and one hour of seminar every two weeks

Note: Not open to students in their first term of program.

MAY BE REPEATED FOR CREDIT

Art 699 **H(3-0)**

Graduate Seminar

A seminar in art criticism and theory.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Art History ARHI

Instruction offered by members of the Department of Art in the Faculty of Fine Arts.

Department Head – G. Hushlak

Junior Courses

Art History 201 **H(3-0)**

Survey of Western Art in its Cultural Context: Prehistory to the Later Middle Ages

A chronological examination of art and architecture in relation to significant historical and cultural events from Pre-history to about 1300 C.E.

Art History 203 **H(3-0)**

Survey of Western Art in its Cultural Context: Proto-Renaissance to Neo-Classicism

A chronological examination of art and architecture (with some reference to the other arts) in relation to significant historical and cultural events from about 1300 to about 1800.

Art History 205 **H(3-0)**

Survey of Western Art in its Cultural Context: The Nineteenth Century

A chronological examination of art and architecture in relation to significant historical and cultural events from about 1800 to about 1900.

Art History 207 **H(3-0)**

Survey of Western Art in its Cultural Context: The Twentieth Century

A chronological examination of art and architecture in relation to significant historical and cultural events from about 1900 to the present.

Senior Courses

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 201/203/205/207or 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.

Art History 311 **H(3-0)**

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 313 **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 315 **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 artistic personalities representing the High Renaissance and Mannerism in northern and southern Europe.

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

Art History 357 **H(3-0)**

Italian Baroque Art

A chronological examination of the art and architecture during the 17th Century. Special attention will be given to Rome.

Prerequisites: Art History203 and one of Art History 201/205/207or consent of the Department.

Art History 359 **H(3-0)**

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 **H(3-0)**

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 **H(3-0)**

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 **H(3-0)**

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 **H(3-0)**

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 **H(3-0)**

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 **H(3-0)**

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 **H(3-0)**

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.

411.01. Selected Topics in the History of Art I

411.02. Selected Topics in the History of Art II

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

Art History 413 **H(3-0)**

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 **H(3-0)**

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 **H(3-0)**

Photography in the Nineteenth Century

Origins of photography and its development as technology and art up to 1900.

Art History 423 **H(3-0)**

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 **H(3-0)**

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.

Note: Not open to students with credit in Environmental Design Architecture 525 or Environmental Design 683.15.

Art History 469 **H(3-3)**

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 **H(0-3T)**

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 **H(0-3T)**

Independent Research in Art History II

Continuation of Art 501.

Prerequisite: Art History 501 or consent of the Department.

Art History 509 **H(3-0)**

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 **H(3-0)**

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 **H(0-3T)**

Independent Research in Art History I

Students will select research topics in consultation with the instructor.

Prerequisite: Consent of the Department.

Art History 603 **H(0-3T)**

Independent Research in Art History II

Students will select research topics in consultation with the instructor.

Prerequisite: Consent of the Department.

Art History 611 **H(3-0)**
(formerly Art 611)

Seminar in Art History

Selected topics in art history.

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Art History 613 **H(3-0)**
(formerly Art 613)

Independent Study in Art History

Prerequisite: Consent of the Department.

MAY BE REPEATED FOR CREDIT

Art History 615 **H(3-0)**
(formerly Art 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 **H(3-0)**
(formerly Art 617)

Thesis Development

A reading and conference course in the student's research area.

Prerequisite: Consent of the Department.

Art History 620 **F(3-0)**
(formerly Art 620)

Methods in Art History

Seminar in selected research topics addressing the logic and practice of art history.

Prerequisite: Consent of the Department.

Astronomy 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, 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 physical science majors.

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

†Astronomy 211 **H(3-1T-1)**

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, and Physics 30.

†Astronomy 213 **H(3-1T-1)**

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 ASPH

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)**
(formerly Astrophysics 509)

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

Orbital mechanics and planetary observations. Mineralogy, structure, and evolution of the planets. Thermal, dynamic and chemical aspects of planetary interiors, atmospheres and ionospheres. Solar and planetary magnetism, magnetospheres, and activity cycles. Comets, asteroids, meteorites, and the origin of the solar system.

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(1-6)**

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 607 **H(3-3)**

Advanced Observational Astrophysics

Principles and tools of modern ground-based and space astronomy with an emphasis on astronomical measurement of ultraviolet, optical, infrared, and radio radiation. Topics will include astrometry, photometry, spectroscopy, imaging, and interferometry data acquisition and reduction techniques. Laboratory exercises using astronomical data analysis software will be a major component of the course.

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 staff 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.

Students should also see course listings under the headings Dance Education, Dance Education Activity/Theory, Kinesiology, Outdoor Pursuits, Outdoor Pursuits Activity/Theory, Physical Education, and Physical Education Activity/Theory.

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.

Note: Credit for both Athletic Therapy 471 and Kinesiology 591.71 will not be allowed.

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.

Junior Course

Bachelor of Accounting Science 202 **F(3-0)**

Canadian Society and the Contemporary World

Covers diversity, change, institutional structures and sociological dynamics of Canadian society in the context of world-wide historical developments, such as industrialization, growing global interdependency, growth, and erosion of western hegemony, from the mid eighteenth century to the present.

Note: Not open to students with credit in Historical Studies 307 or Sociology 205.

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

Senior Courses

Bachelor of Accounting Science 300 (Humanities 300) **F(3-0)**

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 (General Studies 304) **F(3-0)**

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 control, segment 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 the Department of Medical Biochemistry 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.

Senior Courses

Biochemistry 341 **H(3-3)**

Biochemistry of Life Processes

Lectures: An introduction to Biochemistry for students who do not plan to take further courses in Biochemistry. Particular emphasis is placed on a description of the chemistry of compounds of biochemical interest and how this relates to cell structure, proteins, carbohydrate and lipid metabolism and nucleic acids. Laboratory: Simple experiments illustrating the chemistry and biological function of molecules.

Prerequisite: Chemistry 341; or 354; or 351 and one of 353 or 355. (Chemistry 353 or 355 may be taken as a corequisite.)

Note: Credit for both Biochemistry 341 and either 393 or 443 will not be allowed.

Note: This course will not serve as a prerequisite for advanced chemistry, biochemistry or certain cellular, molecular and microbial biology courses.

Biochemistry 393 **H(3-4/2)**

Introduction to Biochemical Molecules

Lectures: Carbohydrates, amino acids, proteins, and enzymes. The structure and function of these molecules will be presented with an emphasis on protein sequence and conformation and on the nature of enzyme catalyses. Laboratory: Modern biochemical techniques for analysis of biochemical molecules: carbohydrates, amino acids, proteins, enzymes, protein purification.

Prerequisite: Chemistry 354; or 351 and one of 353 or 355. (Chemistry 353 or 355 may be taken as a corequisite.)

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

Biochemistry 443 **H(3-4)**

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, 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 **H(3-2T)**

Bioenergetics

A systematic study of the physical aspects of bioenergetics including the laws of thermodynamics as they apply to biological systems. The hydrophobic effect, properties of water and electrolyte solutions including biological redox processes. Colligative properties, ligand binding and phase equilibria. An introduction to UV/visible and IR absorption spectroscopy as applied to biological molecules.

Prerequisites: Biochemistry 393; one of Mathematics 249, 251 or 261 and one of Mathematics 253, 263, 211 or 221; one of Physics 211 or 221 and 213 or 223.

Prerequisite or Corequisite: One of Chemistry 350, 353 or 354.

Biochemistry 507 **H(3-3)**

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 **F(0-6)**

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 **F(0-8)**

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 531 **H(3-0)**

Protein Chemistry and Structure

Determination of protein structure by X-ray crystallography and electron microscopy; structure prediction by molecular modeling. Amino acid composition analysis and sequencing of polypeptides and structural characterization by mass spectrometry. Structural motifs, protein folding, lingand binding, conformational changes, chemical modification, post-translational modification and metalloproteins.

Prerequisite: Biochemistry 393.

Biochemistry 537 (Medical Science 537) **H(3-0)**

Nucleic Acids

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 **H(2-1T-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 **H (3-0)**

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.

Prerequisite: Biochemistry 393.

Biochemistry 547 **H(3-0)**

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 **H(3-0)**

Biological Spectroscopy

Applications of modern methods in the biological sciences. Structural studies of proteins and nucleic acids by NMR and electron microscopy. Optical spectroscopy methods: visible, ultraviolet, infra-red, fluorescence and circular dichroism. Non-invasive NMR studies of metabolism. Spectroscopic probe studies of membranes and other biomolecular complexes.

Prerequisite: Biochemistry 471.

Biochemistry 553 **H(3-0)**
(Medical Science 553)

Clinical Biochemistry

Correlation of the biochemistry of the different organs of the body with their structure and function; the control of production and mechanism of action of the different hormones; iron, calcium and lipoprotein metabolism; and biochemical measurements of body fluid constituents in the investigation of disease.

Prerequisite: Biochemistry 443.

Biochemistry 555 **H(3-0)**

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.

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 **H(3-0)**
(Medical Science 609)

Gene Expression

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 processing; and the activity of genes during development including stored messenger ribonucleoprotein particles and translational control in gametes, the switch from maternal to zygote genome control of development in early embryos and the molecular basis of morphogenesis and differentiation.

609.01 Gene Structure and Regulation of Transcription

609.02. Genes and Development

Prerequisite: Biochemistry 537 (Medical Science 537).

Note: Credit for both Biochemistry 609.01 and Medical Science 607.01 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)**

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

Biochemistry 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 BIOL

Instruction offered by members of the Department of Biological Sciences in the Faculty of Science.

Department Head – D.M. Reid

For other courses offered by the Department of Biological Sciences see Biochemistry; Biotechnology; Botany; Cellular, Molecular and Microbial Biology; Ecology; Marine Sciences; Zoology.

†Limited amounts of non-scheduled class time involvement will be required for these courses.

Biology 007 **Q(16 hours)**

Orientation to Biological Sciences

Introduction to multiple facets of the sciences and to the Department in particular.

Prerequisite: First-time registration in Department of Biological Sciences programs.

Note: Biology 007 and 009 normally should be completed within the same academic year.

NOT INCLUDED IN GPA

Junior Courses

Biology 205 **H(3-0)**

The Organization and Diversity of Life

A study of biological concepts and mechanisms illustrated by current examples of medical and environmental problems.

Note: Credit for both Biology 205 and 231 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.

Biology 231 **H(3-3)**

Introduction to Biology I

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: Biology 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.

Biology 233 **H(3-3)**

Introduction to Biology II

Continuation of Introduction to Biology I, this course centres on 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.

Prerequisite: Biology 231.

Senior Courses

Biology 305 **H(3-1T)**

The Human Organism

An introduction to human biology that analyzes the structure and function of systems in our bodies. This course will lead to an appreciation of how the human body maintains itself in the face of external and internal challenges. A course for non-majors that will develop their understanding of the foundations of human health and disease.

Prerequisite: One of Biology 30 or 205 or 231.

Note: Credit for Biology 305 and any of Kinesiology 261, Zoology 269, 361 or 363 will not be allowed.

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.

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.

Prerequisite: Second-year standing.

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.

†Biology 311 **H(3-3)**

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 233 (or second year standing in the Bachelor of Health Sciences program) and Chemistry 203.

Biology 313 **H(3-3)**

An 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 233.

Prerequisite or Corequisite: Biology 311.

Biology 315 **H(3-3)**

Quantitative Biology I

Data collection, presentation and analysis in the biological sciences. Basic design of biological experiments including concepts of control, replication, and interspersion. Analysis of biological data will include tests of statistical hypotheses and estimation techniques.

Prerequisites: Biology 233 and one of Mathematics 249, 251 or 261.

Biology 331 **H(3-1T)**

Introduction to Cellular and Molecular Biology

The principles of cellular structure and function. Molecular organization of membranes, organelles, nucleus 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.

Biology 335 **H(3-3)**

Biology of Fungi

Morphology, life history patterns and systematics of fungi. Fungal ecology including fungi as parasites, symbionts and decomposers. Basic molecular biology, genetics and physiology.

Prerequisite: Biology 233.

Biology 401 **H(3-1T)**

Evolutionary Biology

An introduction to the micro- and macro-evolutionary processes responsible for the diversity of organisms. Topics include heredity, genetic variation, population structure, genetic drift, natural selection and adaptation, sexual selection, evolution of interactions between species, speciation, phylogeny and biogeography.

Prerequisites: Biology 311, 313, 315.

Biology 451 **H(3-1T)**
(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 **H(3-0)**
(Medical Science 501)

The Physiological and Biophysical Basis of Pharmacology

Basic principles of pharmacology, and pharmacology of the peripheral nervous system.

Prerequisites: Consent of the Department and one of Zoology 463, Biochemistry 443, or Chemistry 354.

Biology 503 **H(3-0)**
(Medical Science 503)

Medicinal Chemistry - Drug Discovery and Design

Pharmaceutical development process, including the physiochemical and pharmacological principles of drug action. Historical and regulatory aspects of prescription drugs. Selected drugs of special interest discovered in the 20th century and new approaches in drug discovery and design for the 21st century - including expression cloning, gene therapy, transgenics and small molecule mimetics.

Prerequisite: Biochemistry 531 or Biology 501 (Medical Science 501) or Chemistry 451.

Biology 515 **H(3-0)**
(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 **F(3-3)**

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 **H (1-5**

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 **H(2S-0)**

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

Biology 603 **H(3-1)**
(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 **H(3-3)**

Special Problems in Biology

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

MAY BE REPEATED FOR CREDIT

Biology 619 **H(3-0)**

Advanced Evolutionary Biology

The theory of organic evolution. Historical development of evolutionary ideas. Darwin's contribution. The mechanism of natural selection; sexual, kin and group selection. The application of the theory in biogeography, ecology, ethology and other areas in biology.

Note: Offered in odd-even dated academic years.

Biology 703 **H(0-6)**

Recent Advances in Biology

Lectures, seminars and/or laboratories on special advanced topics in biological sciences. Each student should seek consent of a departmental faculty member who will supervise the chosen study.

MAY BE REPEATED FOR CREDIT

Biotechnology BTEC

Instruction offered by members of the Department of Biological Sciences in the Faculty of Science.

Department Head - D.M. Reid

Senior Course

Biotechnology 561 **H(2-3)**

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 231.

Botany BOTA

Instruction offered by members of the Department of Biological Sciences in the Faculty of Science.

Department Head – D.M. Reid

Senior Courses

Botany 303 **H(3-3)**

Introduction to Plant Physiology

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.

Prerequisite: Biology 233.

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

Botany 309 **H(3-0)**

Plants and People

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.

Botany 321 **H(3-3)**

Plant Anatomy

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.

Prerequisite: Biology 233.

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

Botany 327 **H(3-3)**

Morphology and Taxonomy of Plants

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.

Prerequisite: Biology 233.

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

Botany 441 **H(3-3)**

Taxonomy of the Seed Plants

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.

Botany 501 **H(3-0)**

Plant Molecular Biology and Biotechnology

Organization of the plant genome. Plant gene structure. Comparisons between plant and animal genomes. The chloroplast genome and its expression. Coordination of chloroplast-nuclear gene expression. Regulation of plant gene expression by light, temperature and chemical stimuli. Molecular basis of plant hormone action. Tissue and organ specific gene expression. Plant transposable elements. Plant viruses. Plant genetic engineering. Gene transfer in plants. Plant DNA vectors. Plant genetic transformation and its uses in plant physiology, biochemistry and applied biotechnology.

Prerequisites: One of Biochemistry 341, 393 or 441; Biology 233; Biology 331.

Botany 503 **H(3-3)**
(formerly Botany 403)

Biochemistry of Plant Metabolism

Biochemical, molecular, and cellular aspects of plant metabolism with an emphasis on the role of each pathway in plant growth and development. The focus of study is metabolic pathways that are unique to, or exhibit unique features in, plants: photosynthesis, respiration, fatty acid metabolism, nitrogen and amino acid metabolism, and secondary metabolism.

Prerequisites: One of Biochemistry 341, 393 or 441, Biology 331, and one of Chemistry 341, 350, 353 or 354.

Note: Offered in even-odd dated academic years.

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

Botany 507 **H(3-3)**

Special Problems in Botany

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

Botany 528 **F(0-6)**

Independent Studies in Botany

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

Botany 530 **F(0-8)**

Honours Research Project in Botany

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 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.

Botany 543 **H(3-3)**

Plant Developmental Biology

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.

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.

Botany 633 **H(3-3)**

Recent Advances in Plant Physiology

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 odd-even dated academic years.

MAY BE REPEATED FOR CREDIT

Botany 645 **H(3-2S)**

Dynamic Aspects of Plant Ultrastructure

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.

Botany 745 **H(0-6)**

Botanical Microtechniques

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.

Campus Alberta Applied Psychology CAAP

Instruction offered by members of the Division of Applied Psychology in the Faculty of Education and other members of the Campus Alberta partnership. For more information please refer to the Campus Alberta website http://www.abcounsellored.net

Associate Dean – B. A. Hiebert

Note: Campus Alberta Applied Psychology courses were developed for the Campus Alberta Master of Counselling program. Students not in the Master of Counselling program may take these courses only with consent of the Division of Applied Psychology and in specific cases additional requirements may be necessary (see below).

Campus Alberta Applied Psychology 601 H(3-0)

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.

Campus Alberta Applied Psychology 603 H(3-0)

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.

Campus Alberta Applied Psychology 605 H(2-2)

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.

Campus Alberta Applied Psychology 607 H(3-0)

Equity and Diversity Issues in Counselling

Focuses on increasing personal awareness, identification of conceptual frameworks, and development of in-depth knowledge of equity and 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 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.

Canadian Studies CNST

Instruction offered under the direction of the Faculty of Communication and Culture. For information contact the Program Director or the Academic Programs Office, 220-6343.

Additional interdisciplinary courses are offered under the course headings African Studies, Central and East European Studies, Communications Studies, Development Studies, East Asian Studies, General 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.

Junior Course

Canadian Studies 201 (formerly Canadian Studies 231) **H(3-0)**

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.

Senior Courses

Canadian Studies 309 **H(3-0)**

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 **H(3-0)**

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 culture. Interdisciplinary approach with a strong emphasis on historical events which have affected the Plains peoples.

Canadian Studies 313 **H(3-0)**

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.

Canadian Studies 315 **H(3-0)**

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 history, value systems and traditions of Canadian Plains First Nations and Metis people.

Note: Not open to students with credit in Educational Policy and Administrative Studies 519.04, 529 or General Studies 301.10.

Canadian Studies 331 **H(2-2)**

Studies in Canadian Film Culture

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.

Canadian Studies 333 **H(3-0)**

A Comparison of Canadian and American Cultures

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.

Canadian Studies 335 (formerly Canadian Studies 431) **H(3-0)**

Mass Communications and Canadian Society

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.

Note: Until July 15, preference in enrollment is given to Majors and Minors in Canadian Studies and Communications Studies.

Canadian Studies 337 **H(3-0)**

Introduction to Folklore: The Canadian Context

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.

Canadian Studies 339 **H(3-0)**

Canadian Humour and Culture

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.

Canadian Studies 341 **H(3-0)**

Canadian Animation

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.

Canadian Studies 351 **H(3-0)**

Literature and Identity: Aboriginal Peoples and Early Canadian Immigrants

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.

Canadian Studies 353 **H(3-0)**

Literature and Identity: Twentieth Century Canadian Immigrants

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.

Canadian Studies 355 **H(3-0)**
(formerly Canadian Studies 451)

Canadian Cities and Canadian Identity

Canadian urban life from an interdisciplinary perspective. The contribution of urban life to Canadian identity and to national, regional and provincial development and awareness.

Canadian Studies 361 **H(3-0)**

Gender, Race and Ethnicity in Canada

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.

Canadian Studies 401 **H(3-0)**

Special Topics in Canadian Studies

An examination of selected topics in Canadian Studies. See the Master Timetable for current topic(s).

MAY BE REPEATED FOR CREDIT

Canadian Studies 415 **H(3-0)**
(formerly Canadian Studies 515)

Canadian Native Art and Cultures: Oral and Written Traditions

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.

Canadian Studies 427 **H(3-0)**

Canadian Architecture in its Social and Historical Context

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.

Canadian Studies 433 **H(3-0)**

The Arts in Canada

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.

Canadian Studies 437 **H(3-0)**

Contemporary Issues and Canadian Society

This course will focus on contemporary issues in Canadian society from a multidisciplinary or interdisciplinary perspective.

Prerequisite: Canadian Studies 201.

Canadian Studies 501 **H(3-0)**

Research in Selected Topics

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

Canadian Studies 591 **H(3S-0)**

Senior Seminar in Canadian Studies

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.

Cellular, Molecular and Microbial Biology CMMB

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.

Senior Courses

Cellular, Molecular and Microbial Biology 343 **H(3-3)**

The Life of Bacteria

An introductory study of the systematics, ecology, physiology, molecular biology and role in pathogenesis of the major groups of prokaryotes.

Prerequisites: Biology 233 (or 231 and second year standing in the Bachelor of Health Sciences Program) and one of Chemistry 341, 350 or 351.

Prerequisite or Corequisite: One of Biochemistry 341 or 393; and Chemistry 353 or 354.

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.

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.

Prerequisite: Biology 311.

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 medical 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 427 H(3-3)

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, 313, 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 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 chromatin 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 528 F(0-6)

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 530 F(0-8)

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.

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

Cellular, Molecular and Microbial Biology 533 H(3-1T)

Advanced Eukaryotic Genetics

An exploration of selected areas of eukaryotic genetic analysis centred largely on those metazoan animal systems used in experimental genetic analysis. The first quarter will introduce the student to the use of computers and the Internet in modern genetic analyses. The rest of the course will focus on animals such as Caenorhabditis, Drosophila, and Mus. The topics considered will include developmental genetics, signal transduction, regulation of gene expression, sex determination, neurogenesis, the genetic analysis of meiosis, etc.

Prerequisite: Cellular, Molecular and Microbial Biology 411.

Cellular, Molecular and Microbial Biology 543 H(3-0)

Microbiology of Natural Systems

The principles of ecology will be applied to microbial communities. Emphasis will be placed on microbial populations in soil and water. Pathogens and symbionts of plants and animals will be discussed, as will microbial consortia and biofilms. Applications of microbial ecology to agriculture, industry and environment will be also be examined.

Prerequisite: Biology 313.

Prerequisite or Corequisite: Cellular, Molecular and Microbial Biology 443.

Cellular, Molecular and Microbial Biology 549 H(3-0)

Microbial Genetics

Genetic structure and mechanisms of genetic exchange in the micro-organisms emphasizing the bacteria, the viruses and the fungi. Transduction, conjugation, transformation, lysogeny, episomes, frequency and significance of recombination in micro-organisms.

Prerequisite: Cellular, Molecular and Microbial Biology 411.

Cellular, Molecular and Microbial Biology 561 H(3-0)
(Medical Science 561)

Cancer Biology

Advances in methodology and in theoretical concepts have permitted continuing breakthroughs in our understanding of the organismal, cellular and molecular biology of cancer cells, and in the development of novel strategies for cancer prevention, diagnosis and treatment. These advances will be presented in a comprehensive overview of cancer including issues of demographics and incidence, causation and detection, origins and progression and therapeutic approaches. Emphasis will be placed on the cell and molecular biology of cancer and on the interaction of the cancer cell with the host organism.

Prerequisites: Biochemistry 443, Biology 331, and Cellular, Molecular and Microbial Biology 411.

Central and East European Studies CEST

Instruction offered under the direction of the Faculty of Communication and Culture. For information contact the Program Co-ordinator or the Academic Programs Office, 220-6343.

Additional interdisciplinary courses are offered under the course headings African Studies, Canadian Studies, Communications Studies, Development Studies, East Asian Studies, General 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

Central and East European Studies 307 H(3-0)

Contemporary Issues

An interdisciplinary examination of the experience of Communism and post-Communism in the former USSR and Central and Eastern European countries. Topics include: the nature of Communist societies after 1945, the collapse of Communism, and contemporary political, social, economic, and cultural developments.

Central and East European Studies 313 H(3-0)

An Introduction to Cultural Traditions

A survey of Russian and Eastern European cultural history from the settlement of the Slavic peoples to the early twentieth century. Included will be such topics as the ethnic, linguistic, and cultural composition of the region; art and architecture of medieval Russia; the Enlightenment; national revival movements; literature, music and painting; modernism; the cultural efflorescence of the early Soviet period.

Note: Not open to students with credit in Historical Studies 335 or 493.19.

Chemical Engineering ENCH

Instruction offered by members of the Department of Chemical and Petroleum Engineering in the Faculty of Engineering.

Department Head – R.G. Moore

Associate Heads – A.A. Jeje, W.Y. Svrcek

Senior Courses

Chemical Engineering 315 H(3-2T-1)

Chemical Engineering Process Calculation

Material and energy balances of physical and chemical systems for steady state and transient conditions. Introduction to analysis and synthesis of chemical processes.

Corequisite: Engineering 311.

Chemical Engineering 331 H(3-3T-3/2)

Process Fluid Dynamics

Fluid Properties; Newtonian and non-Newtonian fluids. Fluid statics. Bernoulli equation; derivation and applications. Control volume and system representation. Differential analysis of Flows. The Navier-Stokes equation; applications. Dimensional analysis. Flow in conduits; laminar and turbulent flows; single-pipe and multiple-pipe systems. Forces on immersed bodies; fluidization. Metering.

Prerequisites: Engineering 201; one of Engineering 249 or 349; and Applied Mathematics 219.

Chemical Engineering 401 H(3-2T-1)

Analyses of Chemical, Oil and Gas Engineering Processes

Analysis and solution of steady state and transient diffusion dominated problems in Chemical and Petroleum Engineering including Fourier, Darcy and Fick's law analogies. Energy transfer in solids and pressure propagation in reservoirs. Introduction to convective processes and their formulation. Different boundary conditions and their meaning. Partial differential equations in different coordinate systems. Approximate and exact methods of solving equations - Similarity Transform, Separation of variables, Laplace transform. Fourier series and Sturm-Liouville systems.

Prerequisites: Chemical Engineering 331, 403 and Applied Mathematics 307.

Chemical Engineering 403 H(3-3T-4/2)

Heat and Mass Transfer

A study of concepts involved in heat and mass transfer. Applications of the continuity and energy equations. Boundary layer theory. Conduction, convection and radiation heat transfer. Boiling and condensation. Heat exchanger calculations. Molecular diffusion. Mass transfer rates.

Prerequisites: Applied Mathematics 307 and Chemical Engineering 331.

Chemical Engineering 405 H(3-2T-1)

Separation Processes I

Diffusion and convective mass transfer. Staged and continuous contacting. Leaching, distillation, absorption and extraction.

Prerequisites: Chemical Engineering 403, 427.

Chemical Engineering 421 H(3-1T-1)
(formerly Chemical Engineering 521)

Chemical Engineering Kinetics

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.

Prerequisites: Chemical Engineering 403 and Chemistry 357.

Corequisite: Chemical Engineering 405.

Chemical Engineering 423 H(3-2T-1)

Chemical Engineering Process Development

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.

Prerequisite: Chemical Engineering 315.

Note: Credit for both Chemical Engineering 423 and Petroleum Engineering 423 will not be allowed.

Chemical Engineering 427 H(4-2T-1)

Chemical Engineering Thermodynamics

Review of first and second law principles; application to the properties of fluids and solutions; vapour liquid equilibria; the third law; applications to chemical equilibrium and chemical reactions.

Prerequisites: Engineering 311 and Chemical Engineering 315.

Chemical Engineering 501 H(3-2T-1)

Transport Processes

Simplification, scaling and dimensional reasoning. Error estimation. Time-scale analysis. Transport Phenomena - heat, mass and momentum transfer analyses. Convective-Diffusive transport in open and porous media. Formulation of equations for problems typically encountered in industrial practice. Systems and process modelling. Analytical solutions by the lumped, integral and differential techniques. Classification of PDE's. Introduction to elliptic and hyperbolic equations. Industrial examples.

Prerequisite: Chemical Engineering 401 or Applied Mathematics 407.

Chemical Engineering 503 H(3-1)
(formerly Petroleum Engineering 503)

Upgrading and Refining Processes

Upgrading objectives; analysis and composition of non-distillable 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 designate.

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 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

Multicomponent system computations. Thermodynamic properties. Phase behaviour. Equations of state and liquid solution models. Characterization of petroleum fractions. Reacting systems equilibria. Applications to industrial process design.

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 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 605 H(3-0)

Multiphase Flow in Pipes

Calculation of fluid properties; overall approaches to pipeline design calculations; design calculations for single phase pipelines; basic concepts for simultaneous gas-liquid flow in pipes; design calculations for multiphase pipelines and gathering systems; design calculations for vertical pipes and wellbores.

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 Generic 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.

Chemical Engineering 617 H(3-0)

Modelling and Identification Advanced Control

Modelling and identification for the advanced control of chemical and process engineering systems. Decisions concerning causal relationships between process signals. Model purpose - prediction, simulation or control. Development and formulation of process models - theoretical and empirical. Linear regression models (e.g. ARX, ARMAX, Output-Error, Box-Jenkins).

Importance/incorporation of process knowledge. System identification. (Problem definition. Experimental design. Model set parameterisation. Identification criterion. Least Squares and Maximum Likelihood methods. Recursive computations). Model Validation. Closed Loop Identification. Real plant considerations. Application to chemical and process engineering systems.

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

Review of fundamentals of diffusive and convective transport of heat and momentum. Analytical and approximate solutions to steady state and transient conduction and convection problems. Superposition techniques. Forced convection of heat and momentum in laminar and turbulent regimes. Transport across boundaries. Moving-boundary problems involving phase change. Applications in numerous industrial problems.

Chemical Engineering 627 H(3-0)

Chemical Process Simulation

Synthesis. Analysis and Screening of Process Alternatives. Steady State Simulation. Material and Energy Balances for Systems of Process Units. Modular Approach. Heat Exchanger Network and Separation Processes.

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

Vector and tensor analysis. Development of the basic equations for the conservation of momentum, energy and mass. Constitutive equations. Formulation of mathematical models of transport phenomena processes. Applications to industrial problems.

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

Sources of air pollution. Risk assessment and the effects of pollutants. Air quality standards. Global warming, ozone layer. Meteorology. Regulation philosophies. Air pollution concentration models (box, 1-3D, dispersion models). Control of particulate matter (gravity settlers, cyclones, electrostatic devices, scrubbers and filtration). Control of VOCs, SOx, and NOx.

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 Operation and Design (Pre and Primary Treatment, Secondary Treatment and Tertiary Treatment processes), Disinfections.

Chemical Engineering 647 H(3-0)

Thermal Recovery Methods

Introduction to thermal oil recovery and EOR status. Heavy oil and oil sands: resources, reserves and recovery factor. Problems in heavy oil recovery and solutions. Comparison of recovery methods: non-thermal and thermal. Properties of rock, fluids, steam, steam additives, steam-gas mixtures. Heat transfer: conduction heating (linear and radial). Steam injection systems. Formation heating: hot water and steam. Steamflooding: theory, OSR, patterns and mechanisms. Cyclic steam stimulation (CSS): variations, mechanisms and simplified prediction methods. Surface equipment and operation. Numerical simulation of steam injection processes: methods and limitations. Steam assisted gravity drainage (SAGD): principles, variations, field experience and limitations. Air injection based IOR processes, stoichiometry and kinetics. Laboratory and field performance evaluation of air injection based IOR processes. Field experience in Canada and the world.

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; basic 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, and solution methods of moving boundary problems. Examples from thermal processes (e.g. hot waterflooding, SAGD), different recovery mechanisms (e.g. imbibition, expansion drive, solution-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, biomaterials, 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.

Note: Credit for both Chemical Engineering 619.26 and 677 will not be allowed.

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.

Corequisite: Chemistry 453.

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

NOT INCLUDED IN GPA

Junior Courses

Chemistry 201 **H(3-1T-3)**

General Chemistry I

Lectures: Atomic and molecular structure. Periodic table and the chemistry of selected elements. Chemical bonding. Structures and reactions of organic and inorganic compounds with examples from modern materials science. Laboratory: Experiments designed to illustrate the lecture material and to develop skill in using basic laboratory apparatus.

Prerequisites: Chemistry 30 (or Continuing Education - Introduction to Chemistry) and Mathematics 30. 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(3-1T-3)**

General Chemistry II

Lectures: Gas laws. Chemical kinetics and equilibria. Quantitative concepts of acids and bases. Elementary thermodynamics. Oxidation-reduction processes and electrochemistry. Basic environmental issues. Laboratory: Experiments designed to illustrate the lecture material and to develop skill in using basic laboratory apparatus.

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(3-1T-3/2)**

General Chemistry for Engineers

Basic chemical concepts. Atomic and molecular structure. Chemical bonding. Chemical kinetics and equilibria. Acid-base and solubility equilibria. Oxidation-reduction phenomena and electrochemistry. The chemistry of water. The chemistry of energy sources. Basic environmental issues.

Prerequisites: Chemistry 30 (or Continuing Education - Introduction to Chemistry) and Mathematics 30. 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

Lectures: Principles and practice of instrumental measurements for the quantitative determination of substances. Spectroscopic analysis. Analytical separations; liquid-liquid extraction, solid phase extraction, chromatography. Electrochemical methods: potentiometry, voltammetry, coulometry. Automated methods of analysis. Laboratory: Quantitative analysis of organic and inorganic materials using simple instrumental techniques.

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(3-3/2)**

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, 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.

Chemistry 355 **H(3-1T-3)**

Organic Chemistry II (for Chemists)

Lectures: The continuing study of the reactions of organic functional groups via substitution, elimination and addition reactions. Reactions and preparations of alkenes, alkynes, aromatics, aldehydes and ketones, carboxylic acids and derivatives. Laboratory : Methods of qualitative organic analysis, syntheses of organic compounds

Prerequisites: Chemistry 201/203, 351.

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

Note: This course is open to students in Honours or Major programs in Applied Chemistry and Chemistry and to students in the Honours programs in Chemical Physics and Biochemistry and to other students by consent of the Department.

Note: Students are advised to take Chemistry 351 and 355 in consecutive sessions.

Chemistry 357 **H(3-1T)**

Industrial Organic Chemistry for Engineers

The hybridization of the carbon atom and covalent bonding. Typical reactions of alkanes, alkenes, alkynes and industrial applications. Substitution; halogenation, nitration and oxidation of aromatic hydrocarbons; polymerization and industrial applications. Functional groups and their reactions; oxidation, reduction, addition and elimination reactions, industrial applications.

Prerequisite: Chemistry 209.

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

Chemistry 371 **H(3-1T-3)**

Physical Chemistry I

Lectures: A study of the states of matter. The basic laws of thermodynamics and their applications. Development of the concept of chemical potential. Changes of state and phase diagrams of pure substances and mixtures. Equilibrium electrochemistry. Laboratory: Experimental measurements, interpretations, and calculations relating to the topics discussed in lectures.

Prerequisites: Chemistry 201/203; Physics 213 or 223; Mathematics 253.

Note: Credit for both Chemistry 371 and any of Physics 347, 349, or 447 will not be allowed.

Chemistry 373 **H(3-1T-3)**

Physical Chemistry II

Lectures: Elementary quantum mechanical treatment of the energy levels of atoms and molecules. Atomic spectra. Symmetry elements, operations, and point groups. Laboratory: Experimental measurements, interpretations, and calculations relating to the topics discussed in lectures.

Prerequisites: Chemistry 201/203; Physics 213 or 223; Mathematics 253.

Note: Credit for both Chemistry 373 and Physics 443 will not be allowed.

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.

Prerequisites: Chemistry 353, 354, or 355 and 315 or 415.

Chemistry 453 **H(3-4)**

Advanced Organic Chemistry

Introduction to MO theory. Pericyclic reactions, the Woodward-Hoffmann rules. Photochemistry. Elucidation of reaction mechanism, reactive intermediates. Laboratory: Multi step synthesis and computer modelling of organic reactions.

Prerequisite: Chemistry 353, or 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

Lectures: Fundamental aspects of modern instrumental methods. Spectroscopic methods: UV-visible and atomic absorption spectroscopy, flame and plasma emission methods. Chromatographic methods; liquid and gas chromatography. Mass spectroscopy. Laboratory: Analysis of inorganic and organic samples using spectroscopic, electrochemical, and chromatographic instrumental methods.

Prerequisites: Chemistry 311/315 or 411/415.

Chemistry 531 **H(3-4)**

Physical Inorganic Chemistry

Lectures: Basic nuclear chemistry. Structural, spectroscopic, magnetic, thermodynamic and mechanistic aspects of the chemistry of the transition metals, including the lanthanides and actinides. Laboratory: Individually assigned projects.

Prerequisites: Chemistry 333 and 353 or 354 or 355.

Prerequisite or Corequisite: Chemistry 373.

Chemistry 533 **H(3-4)**

Advanced Inorganic Chemistry

Structure, bonding and reactivity of main group and organometallic compounds. Laboratory: Individually assigned laboratory projects.

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)**
(formerly Chemistry 455)

Advanced Organic Laboratory

Advanced laboratory techniques: methods of purification and identification of products, purification of reagents, experimental design, working with air/moisture sensitive reagents. Includes a short research project.

Prerequisite: Chemistry 453.

Chemistry 557 **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, polarizabilities and magnetism. Ionic crystal, insulators, conductors, semiconductors and super conductors. 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, ionic 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 homogeneous 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 spectroscopic 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

Stereochemical principles in organic chemistry, including: geometry, bonding, symmetry, molecular isomerism, conformational analysis, asymmetric and stereocontrolled reactions.

Chemistry 653 **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, chiroptic), 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 655 **H(3-0)**

Advanced Organic Synthesis

A review of modern synthetic reactions and methods in the field or organic chemistry with emphasis on the recent literature.

Chemistry 657 **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 659 **H(3-0)**

Selected Topics in Organic 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 669 **H(3-0)**

Selected Topics in Applied Chemistry

Courses are offered in such topics as electrochemistry, industrial catalysis, chemistry of energy sources, colloid and surface chemistry and polymer chemistry.

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, fluorescence 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 CHIN

Instruction offered by members of the Department of Germanic, Slavic and East Asian Studies in the Faculty of Humanities.

Department Head – X-J. Yang

Note: Chinese 317 and 355 are given in English and no knowledge of Chinese is required.

Enrollment in Chinese courses involves a formal placement process. All students seeking entry into Chinese courses who have not previously taken a course in Chinese at the University of Calgary must obtain, complete and return a Placement Application Form from the Department of Germanic, Slavic and East Asian Studies (Craigie Hall, Room C205).

Based on the information provided in the Placement Application Form (see above), students will receive notification from the Chinese Program Adviser to appear for an oral interview at a designated time, and/or the written placement test.

- Written placement tests are scheduled to take place in Craigie Hall at 13:30 on the last Thursday in April and the last Thursday in August. For information about placement tests call 220-5293.
- There is a $20.00 fee for writing the Placement Test.
- No one will be permitted to apply for placement more than once.
- No written placement tests will be administered outside this official schedule.

The Chinese Program Committee determines the appropriate course placement for each student. Placement results will be posted within the Department (or students may telephone 220-5293). Because registration approval is given after each test date, students should be aware that individual courses may be full before the August test date.

- Permission to register or remain in a particular language course can be refused if the Department judges that the student's knowledge exceeds the level of that course.
- Native speakers are not eligible to take language courses by special assessment or to receive advanced credit for them.
- Completion of Chinese 205 and/or 207 as a transfer course does NOT exempt a student from taking the GSEA placement test.

Junior Courses

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.

Senior Courses

Chinese 301 **H(3-1)**

Continuing Chinese I

Further acquisition of Chinese characters, and the development of conversational skills through reading and discussion of selected Chinese texts. Structural analysis of normal speech patterns. Preparation of written assignments. A continuation of Chinese 207.

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 313 or consent of the Department.

Chinese 333 **H(3-0)**

Intermediate Chinese II

A continuation of Chinese 331.

Prerequisite: Chinese 331 or consent of the Department.

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 313 or 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) **H(3-0)**

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: Either Japanese 303 or 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(1.5-3)**

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

Engineering properties, materials science and applications of the Civil Engineering materials: steel, Portland cement concrete, polymers and wood. Strength, elasticity, fracture, fatigue, creep, shrinkage, durability, thermal deformation. Microstructure and fundamental principles and processes underlying engineering performance.

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 structural 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)**

Mechanics of Materials

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 stress 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 (formerly Civil Engineering 371) **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

Production and use of concrete and masonry materials. Cements and aggregates: types, chemistry, microstructure. Fresh concrete, mortar and grout. Proportioning. Hardened concrete and masonry: strength, stiffness, time-dependent deformation, modelling, testing and quality control. Properties of brick and block. Durability of plain and reinforced concrete and masonry: transport processes, permeability, diffusion, modelling Mineral and chemical admixtures. Special cements and concretes. Reinforcement materials. Advanced composite materials.

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 dynamics; tunneling; geotechnical aspects of mining engineering; deep foundations; retaining structures; computer applications.

Prerequisites: Civil Engineering 423 and 523.

Civil Engineering 533 **H(3-1)**

Engineering Hydrology

Introduction to engineering hydrology; Meteorological factors in hydrology, radiation, 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 hydrology, probability distributions, frequency analysis; Hydrological design, design storms, design flows.

Prerequisite: Mechanical Engineering 341.

Civil Engineering 535 **H(3-1)**

Open Channel Hydraulics

Review of basic concepts of fluid flow, types of flow, states of flow, equations of motion; Energy principle in open-channel flow, transition problem, specific energy, non-rectangular channel sections; Momentum equation in open-channel flow, hydraulic jump, specific force; Critical flow, critical flow applications, flow measurement; Uniform flow, formulae, Manning's n, uniform flow computations for prismatic and compound irregular cross-sections; Design of channels for uniform flow, nonerodible channels, erodible channels; Gradually varied steady flow, classification and computation of flow profiles, the discharge problem, computer applications; Flow around bridge piers and flow through culverts; Storm sewer design; Unsteady flow, equations of motion, numerical solutions, kinematic wave approximation, the method of characteristics.

Prerequisite: Mechanical Engineering 341.

Civil Engineering 545 **H(3-1)**

Theory of Structures I

Structural analysis' role in design: idealized models. Review of analysis of statically determinate structures. Static indeterminacy; kinematic indeterminacy; principle of superposition; general methods for the analysis of statically indeterminate structures: the force (flexibility) method and the displacement (stiffness) method. Flexibility and stiffness matrices. Effects of moving loads. Strain energy and virtual work; calculation of displacements by virtual work. Use of computers for the analysis of plane frames and grids. Plastic analysis of continuous beams and frames. Visualization of deflection, bending moment and shearing force diagrams; comparison with diagrams generated by computers.

Prerequisite: Civil Engineering 461.

Civil Engineering 547 **H(3-1)**

Theory of Structures II

Energy theorems: application to transformation of forces, displacements, and stiffness and flexibility matrices. Application of the force method: column analogy. Application of the displacement method: moment distribution, Muller-Breslau principle; influence lines for beams and frames, arches, grids and trusses. Effects of axial forces on flexural stiffness of members. Plastic analysis of plates: yield line theory. Introduction to the finite element method; applications using available computer programs.

Prerequisite: Civil Engineering 545.

Civil Engineering 555 **H(3-1)**

Structural Concrete Design

Structural systems for buildings. Loads on structures. Analysis and design of continuous 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.

Corequisite: Civil Engineering 545.

Civil Engineering 557 **H(3-1)**

Structural Steel Design

Principles of limit states design of steel structures. Floor systems, resistance to horizontal forces. Properties of steel. Tension members. Eccentrically-loaded bolted and welded connections; connection details. Axially-loaded compression members. Laterally unsupported beams. Members subjected to bending and axial forces; beam-column effect. Composite beams. Plate girders. Use of available computer programs to assist in analysis and design of steel structures.

Prerequisites: Civil Engineering 451 and 545.

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.

Prerequisities: Civil Engineering 413, 423, 451, 461, 465, 473, 481 or Department approval

Note: Not open to students with credit in Civil Engineering 569.

Civil Engineering 573 **H(3-1)**

Highway Engineering

Introduction to highway planning and engineering; human factors; road vehicle performance characteristics; highway 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 components, 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 intersection 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 pavement: 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 processes for water and wastewater treatment: 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 planning and design, cost and time analysis, physical, chemical and biological remediation techniques, land treatment, soil vapour extraction and solidification.

Prerequisite: Civil Engineering 481.

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

Origin of bituminous materials. Production, composition, and internal structure. Natural and petroleum-refined bituminous materials. Characteristics of bituminous materials and their measurement. Basic material and rheological tests. Application of bituminous materials in asphalt paving technologies. Hot mixes and asphalt emulsions. Paving mix design, properties and testing. Main failure modes of asphalt pavements. Industrial asphalts. Environmental impacts of asphalt techologies.

Civil Engineering 615 **H(3-0)**
(formerly Civil Engineering 619.14)

Rheology of Engineering Materials

Elements of tensor calculus. Constitutive equations. Linear and nonlinear viscoelasticity. Dielectric properties of materials. Rheometry. Temperature and molecular mass dependencies of material functions. Relations between material functions. Microstructure and rheology of 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-Integral, 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; assemblage 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 627 **H(3-0)**

Serviceability of Concrete Structures: Advanced Topics

Material properties affecting serviceability: creep and shrinkage of concrete and relaxation of prestressed steel. Displacement method of analysis of strains and stresses due to temperature, creep and shrinkage; composite sections; cracked sections. Time-dependent internal forces; effects of loading, prestressing and construction in stages. Displacements of cracked members; crack spacing; stabilized cracks; force-induced and displacement-induced cracking. Deflections of beams, frames, slabs and floor systems. Non-linear effects of cracking on internal forces. Effects of temperature. Fatigue of cracked prestressed members. Corrosion; effects of cracking. Serviceability considerations of miscellaneous structures, e.g., bridges, water-retaining structures and pavements.

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 635 **H(3-0)**

Design and Behaviour of Prestressed Concrete Bridges and Other Structures

Forces due to prestressing in statically indeterminate structures, such as continuous beams, frames, slabs, using load balancing method, force method and prestressing influence coefficients. Limit analysis of continuous prestressed concrete structures. Initial and time-dependent deflections. Effect of creep and shrinkage in statically indeterminate structures; effect of differential settlement; creep behaviour of structures made continuous by cast-in situ concrete. Discussion of various types of prestressed concrete bridges; selection of cross-section, pier arrangement, abutments, approach slab, bearings. Loads. Design of skew and curved bridges. Cable layout in skew and curved bridges, methods of bridge construction. Aesthetic considerations in bridge design.

Civil Engineering 637 **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 639 **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)**
(formerly Civil Engineering 619.95)

Seismic Analysis and Design

Introduction to seismology, ground movements, typical accelograms. Response spectra for linear and non-linear responses, role of damping and inelastic behaviour. Equivalent lateral load for design, code requirements. Structural design concepts to mitigate seismic effects. Design of steel structures for earthquake motions. Design of concrete frames and walls for earthquake motions.

Prerequitsite: Civil Engineering 639.

Civil Engineering 643 **H(3-0)**

Structural Masonry

Materials and their properties; masonry properties; quality control; plain, reinforced and post-tensioned masonry; plain, fin and composite walls; arches; code provisions; differential movement; detailing.

Civil Engineering 645 **H(3-0)**
(formerly Civil Engineering 619.12)

Risk Analysis

The objective of this course in engineering risk analysis and risk assessment is to familiarise students with the principles and techniques of

quantitative risk analysis. Key focus points of the course are the treatment of uncertainties, the attitude of conservatism, risk perception, the careful use of quantitative risk measures, and a discussion of the dangers tasks facing risk-based decision makers. The course contents include: Hazards, risk, risk analysis, risk assessment; risk measures; probability, uncertainty modelling, stochastic variables; using and misusing data, reliability, tails; risk assessment frameworks, models in health and environmental risk analysis, models in engineering risk analysis; risk perception, risk comparison; and practical case studies.

Civil Engineering 647 **H(3-0)**
(formerly Civil Engineering 619.06)

Structural Reliability Techniques

This course focuses on the concepts of risk and reliability, uncertainties, and engineering decision making. It focuses on both aspects of uncertain systems, mainly structures, but also soils and environments, namely analysis and design. Techniques for structural reliability-based design and optimization are discussed and supplemented by practical applications.

Civil Engineering 649 **H(3-0)**
(formerly Civil Engineering 619.58)

Stochastic Dynamics

Basic topics in probability theory. Random processes: time and frequency domain characteristics, differentiation and integration, stationary and ergodic processes; review of basic structural dynamics; random structural vibrations on simple oscillators and multiple degree-of-freedom systems. Response of linear and nonlinear systems; examples; threshold crossing, extreme peaks, reliability; applications in earthquake and offshore engineering.

Civil Engineering 651 **H(3-0)**
(formerly Civil Engineering 619.84)

Finite Element Modelling

Terminology. Conceptual framework of method; shape function; continuity at nodes; numerical integration; matrix assembly; solution methods; sources of error and poor performance; mesh sensitivity; element types, their selection and behaviour; use of software.

Civil Engineering 653 **H(3-0)**
(formerly Civil Engineering 669)

Theory and Applications of the Finite Element Method

Theory of the finite element method with emphasis on applications to structural analysis. Scope of the method, use of basic equations of elasticity, displacement (stiffness) method of analysis, energy theorems applied to finite elements, element matrices; the isoparametric formulation; applications in structural analysis, heat conduction and other non-structural problems. Use of available finite element programs for analysis of space frames, plates subjected to in-plane forces, plates in bending, spatial structures and heat transfer.

Civil Engineering 655 **H(3-0)**
(formerly Civil Engineering 675)

Numerical Methods for Modelling Geomaterials

Methods of theoretical analysis for solving partial differential equations associated with Geotechnical and Structural Engineering. Variational Principles, Principle of Virtual Work and Galerkin Method. Theory of finite element and focus on its computer implementation for analysis of engineering problems. Typical applications include two- and three-dimensional stress analysis, seepage flow, and coupled fluid flow-solid deformation problems. Advanced topics: numerical strategies for solving material and geometric non-linearities (plasticity and large deformations), poro-elasticity and plasticity, strain localization, and presentation of other numerical techniques such as finite difference, boundary element, discrete element methods.

Civil Engineering 663 **H(3-3)**

Soil Improvement

Engineering properties of soils as related to their mineralogy; physical, chemical, and electro-chemical stabilization of soils including compaction, lime, cement, bituminous stabilization; In-situ stabilization or improvement of soils to increase stability of subgrades, slopes, embankments supporting railroad, roads and airport pavements; design and evaluation of stabilized soils; construction and quality control methods for earthwork and stabilization of soils. Laboratory and exercise problems.

Civil Engineering 665 **H(3-0)**

Fundamentals of Soil Behaviour

Principle of effective stress in saturated soil, unsaturated soil and clay. Engineering properties of soils. Shear strength and deformation characteristics of soils in static, cyclic, drained and/or undrained loading. Laboratory testing of soils. One-dimensional consolidation, poro-elastic deformation, swelling mechanism, time-dependent deformation and soil contamination in soils.

Civil Engineering 667 **H(3-0)**

Applied Rock Engineering

Engineering properties of intact rock and rock mass. Rock classification. Slope and underground excavation; groundwater flow in fractured rock; poro-elastic deformation analyses; hydraulic fracturing.

Civil Engineering 671 **H(4-0)**

Advanced Foundation Engineering

Design and analysis of foundations. Spread footings, rafts, piled foundations. Marine foundations. Foundations in difficult soils. Embankments, retaining walls, excavations. Soil improvement. Soil liquefaction. Design problems and computer applications in foundation engineering.

Civil Engineering 673 **H(3-0)**

Constitutive Laws for Geomaterials

Definition of a continuous medium. Description of deformable continuous media; concepts of stress, strain and their invariants. Constitutive equations geomaterials as a generic for soil, rock and concrete materials in civil engineering. Review of elasticity theory. Introduction to yielding, plastic flow and failure phenomena in geomaterials. Limit analysis with applications to both geotechnical and structural engineering. Stress-strain behaviour for both cohesive and granular materials. Constitutive models based on critical state theory will be presented. Other topics such as strain localization and fracture phenomena may be included as appropriate.

Civil Engineering 689 **H(3-0)**
(formerly Civil Engineering 619.90)

Advanced Project Management Practices and Principles

Advanced practices, tools and concepts in managing complex volatile or large projects. SMART(tm) project management based on best practices in diverse industries forms the basis of this course.

Prerequisites: Civil Engineering 691, 697 and consent of the Program Director.

Civil Engineering 691 **H(3-0)**
(Strategy and General Management 691)

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 aspects of a current major capital project and submit and defend a project report.

Prerequisite: Consent of Program Director.

Civil Engineering 693 **H(3-0)**

Project Engineering Management

Role of the engineering manager in the project management team. The engineering firm, its organization and function; project development, engineering project control; design control; scope and estimate control; engineering interfaces with procurement and construction; engineering responsibility in project commissioning start-up and operations.

Prerequisite: Consent of Program Director.

Civil Engineering 695 **H(3-0)**

Project Construction Management

Role of the construction manager in the project management team; project options for the management of construction; managing the contractor's business; labor relations; claims; contractor(s) responsibility in project commissioning start-up and operations.

Prerequisite: Consent of Program Director.

Civil Engineering 697 **H(3-0)**

Project Planning and Control

Strategic and tactical planning; planning for scope, quality, time and cost; selection and implementation of project management information system; economic and risk analysis; planning for construction labor relations.

Prerequisite: Consent of Program Director.

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 701 **H(3-0)**

Urban Transit Planning

Terminology, definitions, facts and trends; history of transit; general characteristics of transit modes; demand characteristics; surveys; demand models; costing of transit services; human factors in vehicle design; capacity; operations; types of service; networks and routes; technology; systems planning; stops and terminals; scheduling, monitoring and control; marketing; maintenance; goals, objectives, policies, and performance indicators; labour relations; accounting; financing.

Civil Engineering 703 **H(3-3)**
(formerly Civil Engineering 685)

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, platoon-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 coordination of signals; introduction to network controls.

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.

Note: Not open to students with credit in Civil Engineering 619.01, 619.85, or 619.96.

Civil Engineering 709 **H(2-4)**
(formerly Civil Engineering 619.47)

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 slow 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; the value of 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 717 **H(3-0)**

Transport and Land Use Interaction Analysis

Theories of land use; spatial interaction models and spatial economic models, including classical models by Von Thunen, Wingo, Alonso and Christaller; mathematical programming models; urban system models; urban and regional activity allocation; demand for movement; linked and integrated models of transport and land use interaction, including Garin-Lowry framework and formulations based on spatial disaggregation of input-output tables; evaluation of transport and land use policy.

Prerequisite: Civil Engineering 707 or consent of the Department.

Civil Engineering 721 **H(2-1)**

Modelling for Water Supply and Distribution

Planning and management of water supply systems. Components of water supply systems. Water supply systems. Water demand forecasting. Simulation modelling of water distribution systems. Design of water distribution systems. Operational control and pump scheduling. Reliability and security of supply. Water losses and leakage control. Water pricing and water conservation. Introduction to optimization.

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

Overview of physical and statistical hydrology. Theory of unsteady flow, simplified equations, applications in overland flow and channel flood routing using numerical techniques. Linear theory of hydrologic systems, instantaneous unit hydrograph. Precipitation analysis, probable maximum precipitation, design storms. Design flood hydrograph studies, application of the Soil Conservation Service method. Statistical analysis of hydrological variables, some probability distributions and their applications: regionalization, droughts, reservoir yield analysis and introduction to stochastic modelling.

Prerequisite: Civil Engineering 533 or equivalent.

Civil Engineering 741 **H(3-0)**
(formerly Civil Engineering 619.21)

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 wetlands, biological nutrient removal, sludge management, disinfection and membrane technologies.

Civil Engineering 743 **H(3-0)**
(formerly Civil Engineering 619.45)

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)**
(formerly Civil Engineering 619.60)

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)**
(formerly Civil Engineering 619.62)

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)**
(formerly Civil Engineering 619.80)

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)**
(formerly Civil Engineering 619.03)

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 slab failure and fracture propagation. Concepts of snow stability, avalanche forecasting and avalanche risk for recreationists.

Communications Studies COMS

Instruction offered under the direction of the Faculty of Communication and Culture. For information contact the Program Director or the Academic Programs Office, 220-6343.

Additional interdisciplinary courses are offered under the course headings African Studies, Canadian Studies, Central and East European Studies, Development Studies, East Asian Studies, General 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.

Junior Course

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 areas such as language philosophy, semiotics, rhetoric, visual communication, mass media research, and interpersonal, small group and organizational communication.

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. Tutorial sections provide extensive practice in producing various forms of discourse.

Prerequisite: Completion of the Effective Writing Requirement.

Communications Studies 363 **H(3-0)**

Fundamentals of Technical Communication

An introduction to effective communication in the most common genres of technical writing and speech. Students will learn the processes involved in planning, composition and delivery of technical communication for a variety of audiences. Guided practice and peer review will assist students to develop expertise in visual, electronic, print, and face-to-face communication.

Prerequisites: Second year standing and 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.

Note: Students taking this course should have some background in Fine Arts.

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(3-1T)**

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 communications technology, including orality, literacy, printing, mass media, telecommunications and information technology. The theories of McLuhan, Innis, 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 either General Studies 341 or Communications Studies 471 will not be allowed.

Note: Restricted to students in the Communications Studies Major and Minor programs. Until August 15, preference in enrollment is given 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 441 **H(3-0)**
(formerly Communications Studies 321)

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, preference in enrollment is given to Majors in Communications Studies.

Communications Studies 451 **H(3-0)**
(formerly Communications Studies 421)

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 307, Applied Psychology 301, Political Science 399, Psychology 312, Sociology 311/315 or 312) or consent of the Faculty.

Note: Restricted to students in the Communications Studies Major program.

Communications Studies 461 **H(2-2T)**

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, preference in enrollment is given to Majors in Communications Studies.

Communications Studies 463 **H(3-0)**

Theory and Application of Advanced Technical Communication

An inquiry-based course that engages students in investigating technical communication theories and situations and applying their research to the process of composing and presenting a major project. Through analysis of technical documents and situations and the study of rhetorical theories, students will develop the ability to adapt technical content to a variety of communication modes and audiences.

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)

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.

Prerequisites: Admission to the BCS program; Communications Studies 361, 380, 441, General Studies 300, all S.A.I.T first and second semester Journalism Arts, Cinema, Television, Stage and Radio or Multimedia courses, 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 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 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 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 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 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 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 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 Program Director.

Communications Studies 625 H(3-0)

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 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 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 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 Program Director.

Communications Studies 711 H(3S-0)

Directed Studies

A research project under the direction of a faculty member.

Prerequisite: Consent of 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 Program Director.

MAY BE REPEATED FOR CREDIT

Communications Studies 790 F(0-6)

Master's Project

A full year course required of all MCS students. Students develop a major research project under the supervision of a faculty member, on the basis of their particular interest.

Prerequisite: Consent of Program Director.

Community Rehabilitation
CORE

Instruction offered by members of the Community Rehabilitation and Disability Studies interdisciplinary team.

Director – N.J. Marlett

Junior Courses

Community Rehabilitation 205 H(2-1)
(formerly Educational Psychology 205)

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)
(formerly Educational Psychology 207)

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.

Senior 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. Disabling 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

Community Rehabilitation 307 Q(1-1)

Community Rehabilitation Practice Strategies

307.01. Life Span Approach to Disabling Conditions

307.02. Assessment Approaches in Community Rehabilitation

307.03. Intervention Models and Strategies in Community Rehabilitation

307.04. Individualized Planning

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.

589.01. Development of Services and Programs

589.02. Supervision in Community Practice

589.03. Reflective Practice for Community of Learners

589.04. Integrative Research Practice for Community of Learners

589.05. Becoming an Ally: New approaches to case management

589.06. Block Practicum in Community Rehabilitation

Note: 589.06 is generally offered in Spring/Summer Session 4-6 week period.

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.

Community Rehabilitation 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, Moliere, Ibsen, Chekov, Brecht, theatre of the absurd, existentialist drama, contemporary drama.

MAY BE REPEATED FOR CREDIT

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.

MAY BE REPEATED FOR CREDIT

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.

MAY BE REPEATED FOR CREDIT

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 notion 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. Sesay (Graduate)

Director of Undergraduate Program for Electrical Engineering – L.E. Turner

Director of Undergraduate Program for Computer Engineering – S.A. Norman

Director of Undergraduate Program for Software Engineering – A. Eberlein

Computer Engineering 007 H(20 hours)

Computer Engineering Fourth-Year Block Course

This block course is intended to provide the necessary background material to prepare students for the fourth year Team Design Project. Topics covered include: personal responsibilities and interpersonal relationships involved in a team project; team projects from a current industrial perspective; tools to automate project management, e.g. PERT charts, critical path analysis, resource management, report generation and project tracking. Prerequisite: Fourth year standing in the Department of Electrical and Computer Engineering.

NOT INCLUDED IN GPA

Senior Courses

Computer Engineering 339 H(3-1T-1.5)
(formerly Electrical Engineering 339)

Programming Fundamentals

Pointers and references, memory models and memory management. Manipulation of text files and binary files. Abstract data types (ADTs): implementation of ADTs as classes. Introduction to recursion.

Prerequisite: Engineering 233.

Computer Engineering 369 H(3-1T-1.5)
(formerly Electrical Engineering 369)

Computer Organization

Organization of a simple stored-program computer: CPU, busses and memory. Instruction sets, machine code, and assembly language. Conventions for assembly language generated by compilers. Floating-point number representation. Hardware organization of simple processors. Address translation and virtual memory. Very introductory examples of input/output devices, interrupt handling and multi-tasking systems.

Prerequisites: Computer Engineering 339 and Electrical Engineering 353.

Computer Engineering 415 H(3-1T-3/2)
(formerly Electrical Engineering 415)

Assembly Language Programming and Interfacing

Review of computer architecture; comparison of RISC and CISC microprocessors, microcontrollers and their instruction sets; interfacing using common input/output devices, debugging and other software engineering practices, strategies for interrupt handling and bus arbitration; Interfacing using a high level language; software and hardware optimizations to achieve real time operations; number representations; real time operating systems concepts; DSP co-processors and microcontrollers.

Prerequisite: Computer Engineering 369.

Computer Engineering 467 H(3-1T-3/2)
(formerly Electrical Engineering 467)

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)
(formerly Electrical Engineering 491)

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 and Software Engineering students: Computer Science 457 and Computer Engineering 415.

Prerequisites for Computer Science students: Computer Science 455 and 457.

Computer Engineering 493 H(3-1T-1.5)
(formerly Electrical Engineering 359)

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.

Prerequisite: Computer Engineering 339.

Computer Engineering 501 H(3-1T-3/2)

Principles of Computer Architecture

Input/output, processors, intra-system communication, busses, caches. Addressing and memory hierarchies. Microprogramming, parallelism, and pipelining. Classification and taxonomy of computer architectures. Reduced instruction set computers, pipelining, vector processing, dataflow computers, architecture description languages, firmware engineering.

Prerequisites: Computer Engineering 369 or Electrical Engineering 369 and Computer Engineering 415 or Electrical Engineering 415.

Computer Engineering 503 H(3-2)

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 H(3-2)

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 H(3-1T-3/2)

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.

Prerequisite: Computer Engineering 415 or Electrical Engineering 415.

Note: Credit for both Computer Engineering 515 and Electrical Engineering 515 will not be allowed.

Computer Engineering 519 H(3-2)

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 H(2-4)
(formerly Electrical Engineering 519.03)

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 H(2-4)
(formerly Electrical Engineering 519.04)

Fourth Year Computer Engineering Team Design Project, Part B

Continues upon the foundations of theory, experience and practice of project management established in Part A. The detailed low-level project design developed by the team in Part A will be implemented, unit tested, integrated and system tested before undergoing customer trials. The project is executed and progress is 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 H(2-4)

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 F(2-4)

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 H(2-4)

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 E(6 hours)

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 "tcsh"); 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 002 **Q(12 hours)**

Advanced Unix

Unix signals, processes, and file system; interprocess communication; advanced shell programming; program profiling.

Prerequisite: Computer Science 233 or 235.

Note: This course is highly recommended as preparation for Computer Science 355.

NOT INCLUDED IN GPA

Computer Science 031 **E(6 hours)**

Mathematics Review for Computer Science 413

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

Junior Courses

Computer Science 203 **H(3-1T-2)**

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 **H(3-IT-2)**

Introduction to Programming

Introduction to algorithm design and implementation using a structured programming language. Discussion of, and practice with, elementary programming techniques with emphasis on good style.

Note: Credit for more than one of Computer Science 215, 231, 255, 257, 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(3-1T-2)**

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.

Note: Credit for more than one of Computer Science 211, 215, 231, 255, 257, Engineering 333 and 335 will not be allowed.

Note: Computer Science 001 is strongly recommended.

Note: This course does not require prior programming background but does assume a mathematical/science inclination.

Note: This is a required course for majors in Computer Science.

Computer Science 233 **H(3-1T-2)**

Introduction to Computer Science II

Continuation of Introduction to Computer Science I. The implementation of abstract data structures using objects, with emphasis on modularity and software design.

Prerequisite: Computer Science 231 or a "D" or "D+" in Computer Science 235.

Note: Credit for more than one of Computer Science 233, Computer Science (Electrical Engineering) 497, Electrical Engineering 315 and 339 will not be allowed.

Computer Science 235 **H(3-2T-2)**

Inquiry-based Introduction to Computer Science

Problem solving. Algorithms and (object-oriented) programming. Control structures. Pre/Postconditions. Simple data structures. Recursion. Pointers. Abstract data types. Inheritance. Polymorphism. Modularity. Software Design. Project-based assignments.

Prerequisite: Consent of the Department.

Note: Credit for both Computer Science 235 and 231 will not be allowed.

Note: Computer Science 001 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.

Senior Courses

Computer Science 305 **H(3-1T-2)**

COBOL and Business Systems

Introduction to business data processing with applications. Programming in COBOL. Reliability of business systems and programs, backup and recovery. Report generation.

Prerequisite: One of Computer Science 215, 231, 255, 257 or 235.

Computer Science 313 **H(3-1T-2)**

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 and one of Computer Science 233 or 235.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 321 **H(3-2)**

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, Electrical Engineering 353 and 411 will not be allowed.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 331 **H(3-1T-2)**

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.

Prerequisite: Computer Science 233 or 235 or admission to Software or Computer Engineering degree programs.

Note: Credit for more than one of Computer Science 331, 495 (Electrical Engineering 495), 595 (Electrical Engineering 595), and Electrical Engineering 349 will not be allowed.

Note: Registration priority is given to students who have been admitted to Computer Science or to Software or Computer Engineering degree programs.

Computer Science 333 **H(3-1T-2)**

Foundations of Software Engineering

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. An introduction to one or more informal methods (focusing on object-oriented approaches) currently in widespread use.

Prerequisite: Computer Science 331.

Note: Credit for both Computer Science 333 and Software Engineering 311 will not be allowed.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 335 **H(3-1T-2)**

Information Structures II

A continuation of Computer Science 331. Collision resolution in hash tables, search algorithms, advanced tree structures, strings. Advanced algorithmic tools for storing and manipulating information. A comparison of programming paradigms.

Prerequisite: Computer Science 331.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 355 **H(3-1T-2)**

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 233 or 235.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 401 **H(3-2)**

Computer Structure I

Technology of memories, processors and peripherals. Architecture of computer systems. Discussion and comparison of several modern machines.

Prerequisites: Computer Science 321 and 355.

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 331.

Note: Computer Science 313 is strongly recommended.

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 Mathematics 249, 251 or 261. Mathematics 253 is highly recommended but not mandatory. Computer Science 031 is also recommended.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 417 **H(3-1T-2)**

Foundations of Functional Programming

Theoretical foundations of functional programming: the λ-calculus, β-reduction, confluence, and reduction strategies. Programming syntax: solving recursive equations with the Y-combinator, let and letrec, types, datatypes, and patterns. Programming in a functional language: recursion patterns, useful combinators, maps, and folds, for datatypes. Example applications: recursive descent parsing, unification, combinatorial algorithms, theorem proving.

Prerequisites: Computer Science 313 and 331.

Computer Science 421 **H(3-3)**

Digital Systems Design

State machine design. Use of LSI circuits including PLAs; ROM and RAM design. Simulation and testing of digital circuits.

Prerequisite: Computer Science 321.

Computer Science 441 **H(3-2T)**

Computer Communications

Principles and practice in modern telecommunications, computer communications and networks. Layered communication protocols and current physical, data link, network and internet protocol layers. Circuit switching, packet switching, and an introduction to broadband multimedia networking.

Prerequisite: Computer Science 333 or 355 or Computer Engineering 369.

Computer Science 449 **H(3-1T-2)**

Principles of Programming Languages

Examination of the principal features of major types of programming languages including procedural, logic, functional, and object-oriented. Features examined will typically include parameter passing mechanisms, control structures, typing mechanisms, data types, and binding rules.

Prerequisite: Computer Science 333 or Software Engineering 311.

Computer Science 451 **H(3-3)**

Practical Software Engineering

This course emphasizes a large-group project. Topics will include lifecycle models, project phases, software standards; data gathering techniques, human factors (including documentation and manuals), software quality assurance, cost models; social, ethical, and professional issues.

Prerequisites: Computer Science 333 or Software Engineering 311 and Philosophy 279 or 377.

Note: Credit for both Computer Science 451 and Software Engineering 411 will not be allowed.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 453 **H(3-1T-2)**

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 331, 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(3-1T-2)**

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: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 457 **H(3-1T-2)**

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 455 .

Note: Credit for both Computer Science 457 and 597 will not be allowed.

Note: Registration priority is given to students who have been admitted to Computer Science or Software or Computer Engineering degree programs.

Note: Computer Science 455 is waived as a prerequisite for students concurrently enrolled in Computer Engineering 415.

Computer Science 461 **H(3-1T-2)**

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 355.

Computer Science 471 **H(3-1T-2)**

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(3-2)**

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.

Prerequisites: Computer Science 313 and 457.

Computer Science 502 **F(1-5)**

Project

A substantial research project 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 503, 593 or 595.

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, 593 or 595.

Computer Science 509 **H(3-0)**

History of Computation

The history of computation from the earliest times to the modern era.

Prerequisite: One full-course equivalent in Computer Science at the 300 level or above.

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, 331, 355 and 411.

Computer Science 511 **H(3-1T)**

Introduction to Complexity Theory

Time and space complexity; the classes P, LOGSPACE, PSPACE and their nondeterministic counterparts; containments 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.

Computer Science 523 **H(3-2)**

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.

Prerequisite: Computer Science 455 and 457.

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 533 **H(3-2)**

Artificial Intelligence

An examination of the objectives, key techniques and achievements of work on artificial intelligence in Computer Science.

Prerequisites: Computer Science 313, 331 and Philosophy 279 or 377.

Computer Science 535 **H(3-2)**

Introduction to Image Analysis and Computer Vision

Standard methods used in the analysis of digital images. Image acquisition and display: visual perception; digital representation. Sampling and enhancement. Feature extraction and classification methods. Object recognition.

Prerequisite: One of Mathematics 311, 331, 353, Applied Mathematics 307, 311, or Pure Mathematics 331, or consent of the Department .

Computer Science 547 **H(3-1T)**

Advanced Information Systems

An overview of the next generation of information systems and the role of new technology in business. Topics will change as technology changes. Topics may include but are not limited to multimedia, visual languages, networked information services, object oriented systems, enterprise models, computer supported cooperative work, rule based systems, and web technologies.

Prerequisites: Computer Science 451 or Software Engineering 411.

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 559 **H(3-2)**

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.

Corequisite: Computer Science 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 attempted.

Prerequisite: Computer Science 457.

Note: Offered in odd-even dated academic years.

Computer Science 571 **H(3-2)**

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)**
(formerly Computer Science 599.81)

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(3-2)**
(formerly Computer Science 601.94)

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, metamorphosis, implicit animation techniques, animating liquids, gases and cloth, motion capture.

Prerequisite: Computer Science 453.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 589 **H(3-2)**

Modelling for Computer Graphics

Parametric Modelling. B-splines and NURBS. Subdivision schemes. Surface subdivision.

Multiresolution. Wavelets. Implicit modelling. Blends. Polygonization. Blobtree. Precise contact modelling. Solid modelling. CSG. Procedural modelling.

Special topics, e.g. Differential geometry. Graph based modelling. Topology.

Prerequisite: Computer Science 453.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 591 **H(3-2)**

Rendering

Physical foundations of illuminations techniques. Color. Radiometry and photometry. Reflection models. The rendering equation. Ray tracing. Monte Carlo techniques. Sampling and antialiasing. Texturing. Radiosity. Photon tracing. Volume rendering. Image-based rendering. Real-time shading.

Prerequisite: Computer Science 453.

Note: Registration priority is given to students who have been admitted to Computer Science.

Computer Science 593 **H(1-5)**

Software Engineering Project I

A software engineering project conducted under the guidance of a faculty member.

Prerequisite: Consent of the Department.

Note: Not open to students with credit in Computer Science 502 or 503.

Computer Science 595 **H(1-5)**

Software Engineering Project II

A software engineering project conducted under the guidance of a faculty member.

Prerequisites: Computer Science 593 and consent of the Department.

Note: Not open to students with credit in Computer Science 502 or 503.

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

Graduate Courses

Note: Registration in all courses requires the approval of the Department of Computer Science. Computer Science students should also see courses listed under Software Engineering.

Computer Science 601 **H(3-0)**

Special Topics in Computer Science

A study of problems of particular interest to graduate students in Computer Science.

MAY BE REPEATED FOR CREDIT

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.

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.

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 attempted.

Note: Lectures may run concurrently with Computer Science 567.

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; axiomatic 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. Functors, 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

Standard methods used in the analysis of digital images. Image acquisition and display: visual perception; digital representation. Sampling and enhancement. Feature extraction and classification methods. Object recognition.

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

Modelling, simulation and visualization of plants for computer graphics and biological purposes. Modelling of plants as an example of interdisciplinary research including computer science, biology, mathematics and physics. L-systems as a formal basis for model construction. Modelling languages. Information flow in plants. Symmetry, self-similarity and allometry of plants. Descriptive models of plant architecture. Models integrating plant structure and function. Simulation of plant development. Case studies: competition for space, phyllotaxis, tropisms, and biomechanical considerations. Reaction-diffusion models of morphogensis. Genotype-to-phenotype mapping. Modelling of plant ecosystems. Rendering and visualization of the models. A survey of applications and research directions.

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, multidatabases, object-oriented databases and advanced system issues.

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

Parametric Modelling. B-splines and NURBS. Subdivision schemes. Surface subdivision. Multiresolution. Wavelets. Implicit modelling. Blends. Polygonization. Blobtree. Precise contact modelling. Solid modelling. CSG. Procedural modelling. Special topics, e.g. Differential geometry. Graph based modelling. Topology.

Note: Lectures may run concurrently with Computer Science 589.

Computer Science 691 **H(3-0)**

Rendering

Physical foundations of illuminations techniques. Color. Radiometry and photometry. Reflection models. The rendering equation. Ray tracing. Monte Carlo techniques. Sampling and antialiasing. Texturing. Radiosity. Photon tracing. Volume rendering. Image-based rendering. Real-time shading.

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.

Continuing Education CTED

Instruction offered by members of the Faculty of Continuing Education.

Graduate Courses

Continuing Education 601 **H(3-0)**

Adults as Learners

Theoretical models, perspectives, research and issues surrounding adult learning in formal, organizational and informal settings; the contexts of adult learning; characteristics of adult learners; adult learning processes.

Note: Open only to students in the MCE degree program.

Continuing Education 603 **H(3-0)**

Facilitating Individual Learning

Models of facilitation; complexities of the teaching-learning transaction; assumptions, values and beliefs which underlie learning facilitation decisions; applications and implications of both formal and non-formal approaches to influencing adult learning and change.

Note: Open only to students in the MCE degree program.

Continuing Education 605 **H(3-0)**

Facilitating Development Projects

Fundamental skills and processes to improve group learning and effectiveness. Examines the background, context, theory, conditions, and processes of group learning to address how group development, and group learning, can be facilitated.

Note: Open only to students in the MCE degree program.

Continuing Education 607 **H(3-0)**

Theory of Groups

Current theoretical models for learning in groups and group learning; group development, processes, roles and leadership; factors shaping the use of groups and teams in organizations; groups and organizational learning; types of groups.

Note: Open only to students in the MCE degree program.

Continuing Education 609 **H(3-0)**

Research Methods

Assists students in developing a critical view of research perspectives and methods, as it applies to requirements in the workplace, particularly in relation to learning and human development. Topics include the scope and nature of the research enterprise, the relationship between theory and research, varying purposes for research, data collection methods, data analysis techniques, the dissemination and presentation of findings and research ethics.

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.

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 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)**
(formerly Continuing Education 681.01)

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)**
(formerly Continuing Education 681.05)

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 underpinning 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.

Note: Not open to students with credit in Continuing Education 691.01 or 691.02.

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.

Note: This course will involve the student, in consultation with his/her supervisor, selecting a research issue, problem or question to be examined, writing a project proposal outlining the guidelines for conducting the research and, if involving human subjects, obtaining approval from the Research Ethics Board.

NOT INCLUDED IN GPA

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

Career Services Director – C. Fortner

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

501.05. Co-operative Placement in Actuarial Science V

NOT INCLUDED IN GPA

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

503.05. Co-operative Placement in Applied Chemistry V

NOT INCLUDED IN GPA

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

NOT INCLUDED IN GPA

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

NOT INCLUDED IN GPA

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

NOT INCLUDED IN GPA

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

NOT INCLUDED IN GPA

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

525.05. Co-operative Placement in Communications Studies V

NOT INCLUDED IN GPA

Co-operative Education 527 H(4 months)

Co-operative Placement in Development Studies

527.01. Co-operative Placement in Development Studies I

527.02. Co-operative Placement in Development Studies II

527.03. Co-operative Placement in Development Studies III

527.04. Co-operative Placement in Development Studies IV

527.05. Co-operative Placement in Development Studies V

NOT INCLUDED IN GPA

Co-operative Education 529 H(4 months)

Co-operative Placement in Religious Studies

529.01. Co-operative Placement in Religious Studies I

529.02. Co-operative Placement in Religious Studies II

529.03. Co-operative Placement in Religious Studies III

529.04. Co-operative Placement in Religious Studies IV

529.05. Co-operative Placement in Religious Studies V

NOT INCLUDED IN GPA

Co-operative Education 535 H(4 months)

Co-operative Placement in Statistics

535.01. Co-operative Placement in Statistics I

535.02. Co-operative Placement in Statistics II

535.03. Co-operative Placement in Statistics III

535.04. Co-operative Placement in Statistics IV

535.05. Co-operative Placement in Statistics V

NOT INCLUDED IN GPA

Co-operative Education 539 H(4 months)

Co-operative Placement in Physics and Astronomy

539.01. Co-operative Placement in Physics and Astronomy I

539.02. Co-operative Placement in Physics and Astronomy II

539.03. Co-operative Placement in Physics and Astronomy III

539.04. Co-operative Placement in Physics and Astronomy IV

539.05. Co-operative Placement in Physics and Astronomy V

NOT INCLUDED IN GPA

Co-operative Education 543 H(4 months)

Co-operative Placement in Ecology

543.01. Co-operative Placement in Ecology I

543.02. Co-operative Placement in Ecology II

543.03. Co-operative Placement in Ecology III

543.04. Co-operative Placement in Ecology IV

543.05. Co-operative Placement in Ecology V

NOT INCLUDED IN GPA

Co-operative Education 549 H(4 months)

Co-operative Placement in Geology and Geophysics

549.01. Co-operative Placement in Geology and Geophysics I

549.02. Co-operative Placement in Geology and Geophysics II

549.03. Co-operative Placement in Geology and Geophysics III

549.04. Co-operative Placement in Geology and Geophysics IV

549.05. Co-operative Placement in Geology and Geophysics V

NOT INCLUDED IN GPA

Co-operative Education 551 H(4 months)

Co-operative Placement in Social Sciences

551.01. Co-operative Placement in Social Sciences I

551.02. Co-operative Placement in Social Sciences II

551.03. Co-operative Placement in Social Sciences III

551.04. Co-operative Placement in Social Sciences IV

551.05. Co-operative Placement in Social Sciences V

NOT INCLUDED IN GPA

Co-operative Education 552 H(4 Months)

Co-operative Placement in Health and Society

552.01. Co-operative Placement in Health and Society I

552.02. Co-operative Placement in Health and Society II

552.03. Co-operative Placement in Health and Society III

552.04. Co-operative Placement in Health and Society IV

552.05. Co-operative Placement in Health and Society V

NOT INCLUDED IN GPA