231.173 Maintaining Registration, M REG

University of Alberta

Graduate Courses

M REG 800 Maintaining Registration
★0 *(fi 6)* (either term, unassigned). Maintaining registration in a graduate program and status as a graduate student. Graduate students who do not plan to register either in courses or in Theses or a project course but who wish to maintain their position in a program and their status as graduate students can register in M REG.

231.174 Maîtrise ès sciences de l'éducation, M EDU

Faculté Saint-Jean

Cours de 2e cycle

M EDU 500 Langue, culture et éducation
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude interdisciplinaire (anthropologie, sociologie, psychologie sociale) des théories scientifiques contemporaines sur la nature de la culture, ses rapports avec la langue et ses mécanismes de transmission et de modification. La problématique locale sera examinée dans le contexte de la communauté scientifique internationale. L'histoire de la science de l'éducation bilingue sera aussi abordée. Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 501 La culture et l'individu
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude de la relation entre culture et personnalité dans les sociétés homogènes selon les théories de l'anthropologie psychologique. L'application de ces principes aux sociétés industrialisées permettra de mieux comprendre le développement de l'identité culturelle chez l'être humain et ses rapports avec l'identité de soi dans/parmi les groupes ethno-culturels en situation minoritaire. Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 510 Psychologie de l'apprentissage d'une deuxième langue
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Analyse des divers facteurs qui influencent l'apprentissage d'une deuxième langue. Etude des différentes dimensions du bilinguisme (aspects psychologique, cognitif, socio-linguistique, et socio-culturel).

M EDU 511 Fondements théoriques de l'acquisition de la langue
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude des diverses théories de l'acquisition de la langue. Le rôle de la langue dans le développement de l'enfant. Le lien entre le développement langagier et le développement cognitif. Ce cours peut comprendre une section à distance; Veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 520 Tendances actuelles en éducation des francophones
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude des phénomènes propres à l'éducation des Francophones au Canada selon la pratique et la recherche effectuées dans les diverses provinces: abandon du bilinguisme institutionnel; programmes socio-culturels; innovations en didactique de la langue maternelle. Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 521 Tendances actuelles en pédagogie de l'immersion française
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude critique des orientations théoriques et des pratiques actuelles dans la pédagogie de l'immersion française. Analyse de questions importantes dans l'implantation des programmes d'immersion. Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 530 La problématique de l'enseignement des langues
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude de la langue et de son impact sur le développement de la personne. Nouvelles orientations centrées sur les réalités de l'enseignement des langues telles que l'intégration des matières, l'individualisation, l'enseignement par atelier, etc.

M EDU 531 La problématique de la technologie et de la science face au curriculum
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude des récents développements technologiques, scientifiques et sociaux qui ont un impact significatif sur le curriculum.

M EDU 532 L'écologie de la salle de classe
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Étude des influences et des relations interpersonnelles qui ont un effet sur l'apprentissage, l'enseignement et la communication en salle de classe. Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 533 L'évaluation en milieu scolaire
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude des différents types d'évaluation utilisés dans le milieu scolaire selon les objectifs poursuivis et les innovations récentes en évaluation.

M EDU 540 Dimensions politiques et administratives de l'éducation bilingue
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude des structures de l'éducation française et bilingue dans les diverses provinces canadiennes et du rapport existant entre ces structures et le contexte socio-politique.

M EDU 541 Enseignement des langues assisté par ordinateur
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Ce cours vise à faire connaître les différentes approches et les fondements de l'enseignement des langues assisté par ordinateur. Il vise aussi à fournir les outils pour concevoir, construire et évaluer des didacticiels. Ce cours peut comprendre une section à distance: veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 560 L'administration de l'éducation
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Étude approfondie de concepts d'administration. Les rôles du gestionnaire de l'éducation. Gestion des ressources humaines et financières en éducation. Examen des problèmes en milieu d'éducation et analyse de solutions administratives pertinentes.

M EDU 561 Formation des habiletés de supervision et de leadership
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Principes, organisation et techniques de supervision. Le développement des habiletés de leadership en gestion, particulièrement pour l'éducation en français.

M EDU 562 Stage pratique de direction
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Vise à développer des habiletés en observation, en entrevues, en animation de groupes et en réflexion lors de visites dans des écoles et en travaillant avec la direction des écoles.

M EDU 580 Méthodologie de la recherche en éducation I
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Etude du processus de la recherche et des concepts de base de la recherche en éducation. Présentation des divers types de recherches: méthodes de collecte de données et les instruments, analyse et interprétation. Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 581 Méthodologie de la recherche en éducation II
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Pendant ce cours, chaque étudiant doit approfondir son projet de recherche. Après un survol des devis expérimentaux (ou d'échantillonnage selon le cas), de la statistique descriptive et inférentielle, et de la probabilité, chacun fera une analyse multi-causale du problème (visant à intégrer ses recherches qualitatives et quantitatives), développera son hypothèse et des méthodes de collecte convenables, et choisira les tests statistiques appropriés: moyennes, méta-analyse avec écarts-types, régressions ou corrélations multiples, Chi carré, tests non-paramétiques, ANOVA, ANCOVA, MANOVA et d'autres analyses multivariées. Sera enseigné surtout: le choix des tests appropriés; l'utilisation des ordinateurs dans le traitement, la synthèse et la présentation graphique des données; comment éviter les erreurs d'interprétation et de prédiction. Préalable(s): M EDU 580. Cours à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 582 Séminaire de recherche
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Rédaction d'un exposé écrit dans lequel l'étudiant doit tenter de préciser le problème qui est à la source de sa recherche et les objectifs de celle-ci, de situer le sujet étudié dans un cadre de référence général, de formuler la problématique de la recherche. Présentation par l'étudiant d'un exposé écrit. Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 583 La recherche et le praticien
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Étude des retombées de la recherche sur la pratique éducative. Méthodologie de la recherche-action, et la formation professionnelle continue des enseignants. Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 589 Le processus créateur chez l'enseignant
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Ce cours approfondit les dimensions multiples du processus créateur dans les pratiques éducatives. Un apprentissage interdisciplinaire fait état des recherches théoriques et pratiques visant à développer ce processus dans divers contextes culturels.

M EDU 594 Lectures dirigées
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0).

M EDU 596 Thème ouvert
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 597 Séminaire portant sur l'enseignement au niveau élémentaire et secondaire
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 598 Choix de sujet en éducation
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Ce cours peut comprendre une section à distance; veuillez consulter le Fees Payment Guide dans la section University Regulations and Information for Students de l'annuaire.

M EDU 599 Etude personnelle dirigée
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0).

M EDU 900 Activité de synthèse
★3 *(fi 6)* (variable, unassigned).

231.175 Management Information Systems, MIS

Department of Accounting and Management Information Systems
Faculty of Business

Note: Enrolment in all MIS courses is restricted to students registered in the Faculty of Business, or to students registered in specified programs that require Business courses to meet degree requirements and who have obtained prior approval of their Faculty.

Undergraduate Courses

MIS 311 Management Information Systems
★3 *(fi 6)* (either term, 3-0-1). Introduction to all major areas of information systems. Technology and file systems, organizational and behavioral issues, datamodeling, databases, expert systems, systems analysis, systems development life cycle, etc. Development of analytical skills which can be brought to bear on MIS problems. Notes: Students are expected to have basic familiarity with microcomputer applications (word processing, spreadsheets, personal data base, presentation graphics, personal information manager, email, web browser). The lab component will be taught for up to 10 weeks.

MIS 412 Managerial Support Systems
★3 *(fi 6)* (either term, 3-0-0). Provides students with an understanding of the interaction between decision-making and technology within organizational contexts. Within the context of decision support systems (DSS), focus is on four key components: 1) the technology; 2) the broader context, including the decision-making styles which exist at the organizational, group and individual levels; 3) the design and development of DSS; 4) the effectiveness of DSS to support decision-making processes, including issues of implementation and evaluation. Prerequisite: MIS 311.

MIS 413 Systems Analysis and Design
★3 *(fi 6)* (either term, 3-0-0). Examination of the critical stages of the systems development process. These include the initiation, planning, analysis, design, implementation and maintenance of information systems needed to support business functions in organizations. The concepts of life cycle, requirements definition, analysis and design methods, and computer-assisted software engineering (CASE) tools are presented. Specific modeling techniques such as process models, data models and logic models are examined in detail. Hands-on experience with a high-end CASE tool are provided. Prerequisite: MIS 311.

MIS 415 Data Base Design and Administration
★3 *(fi 6)* (either term, 3-0-2). Application of database concepts in organizations. A comprehensive introduction to the design and development of relational databases from a logical data model. The relational database access language SQL is used along with a number of key-software development tools. Effective data administration techniques for enforcing integrity and security as well as enhancing performance are discussed. Topics of special current interest include data warehousing and the object-oriented data model. Prerequisite: MIS 311. Note: There will be a lab component for up to ten weeks during the term.

MIS 417 Telecommunications in Business
★3 *(fi 6)* (either term, 3-0-0). An introduction to fundamental concepts required to understand and apply telecommunication technologies within a business environment. Emphasizes the principles of those technologies to familiarize the students with the fundamental concepts and terminology of telecommunications. Telecommunications equipment, networks, protocols and architectures are introduced and discussed regarding their relevance and impact on business-oriented

organizations. Also introduces managerial aspects such as planning, design and performance of telecommunication systems. Prerequisite: MIS 311.

MIS 418 Electronic Commerce
★3 *(fi 6)* (either term, 3-0-0). An examination of the development of electronic commerce in business across a number of different sectors. Using a process modelling approach, traditional vs. electronic business transactions are discussed in business-to-business and business-to-consumer modes; strategies for e-commerce are developed with a focus on the appropriate technical architecture to support business in an electronic marketplace. In particular, requirements of payment systems, and issues of security and privacy are discussed as key considerations in implementation. The course uses software development tools in the implementation of these electronic commerce strategies. Prerequisite: MIS 311.

MIS 419 Systems Development Using Advanced Software Tools
★3 *(fi 6)* (either term, 3-0-2). Covers the physical design and implementation of computer systems with modern software development tools. Is a continuation of the systems analysis and design topics introduced in MIS 413 and uses the outcomes of the logical systems analysis and design process to create the actual system. Prerequisite: MIS 413. Co-requisites: MIS 415 and CMPUT 115, or consent of Department. Note: There will be a lab component for up to 12 weeks during the term. Credit may not be obtained for both MIS 419 and CMPUT 301 or 401.

MIS 424 Introduction to Information Systems Project Management
★3 *(fi 6)* (either term, 3-0-0). Examines information system development project management. The system development project is a multi-stage activity involving investigation and analysis, scope definition, resource analysis and estimation, timing estimation, cost estimation, scheduling, monitoring, and implementation. Prerequisite: MIS 311.

MIS 426 Technology-Enabled Business Process Management
★3 *(fi 6)* (either term, 3-0-0). Focuses on the major operational activities and tasks that have come to be called business processes. Will identify and categorize key business processes, demonstrate process mapping as a method of business process analysis, and demonstrate process redesign principles as a way to better manage these processes. Will feature the role of IT in process redesign. Prerequisite: MIS 311.

MIS 435 Information, Ethics and Society
★3 *(fi 6)* (either term, 3-0-0). For students in all majors who are interested in information and the roles it plays in business and society. Focus is on the nature and basic characteristics of information, and its importance in contemporary society, viewing information as a commodity that is produced, used, bought and sold. Two aspects of the ways in which information affects people are emphasized: (1) ethical issues relating to professions, businesses, government, and individuals; (2) the impact of information technology and technological change on society. Prerequisites: Open only to third or fourth year Business students, or by consent of Department Chair. Credit may be granted for only one of ACCTG 435, BUS 435 or MIS 435.

MIS 437 Accounting Information Systems
★3 *(fi 6)* (either term, 3-0-0). An introduction to the field of computerized accounting information systems in organizations from the perspective of the information system professional. Accounting information systems are typically the foundation for many other information systems in organizations. Concentrates on the design of accounting information systems in organizations and integration of accounting information systems with other functional area and management information systems as well as commonalities in the system development process for accounting and other functional area information systems. Prerequisites: ACCTG 311, 322, MIS 311. Credit may be granted for only one of ACCTG 437 or MIS 437.

MIS 441 Managing Information Systems: A Senior Management Perspective
★3 *(fi 6)* (either term, 3-0-0). Intended as a capstone course to the MIS Major. Issues, opportunities, and problems involved in the management of information system resources in organizations. These include human resource, financial, policies, standards, and strategic alignment concerns relating to the information systems department. The role of the CIO (Chief Information Officer) will be explored as the focal point for the course. Integrative cases of information systems issues in small, medium and large organizations will be discussed. Prerequisites: MIS 311 and a minimum of one 400-level MIS course, or consent of Department. Open only to fourth year students. Credit will be granted for only one of MIS 414 or 441.

MIS 488 Selected Topics in Management Information Systems
★3 *(fi 6)* (either term, 3-0-0). This course may contain a lab component. Normally restricted to third- and fourth-year Business students. Prerequisites: MIS 311 or consent of Department. Additional prerequisites may be required.

MIS 490 Management Information Systems Competition Part I
★1.5 *(fi 3)* (either term, 0-1.5s-0). Preparation for Student Competition in Management Information Systems. Prerequisite: consent of Instructor.

MIS 491 Management Information Systems Competition Part II
★1.5 *(fi 3)* (either term, 0-1.5s-0). Completion of Student Competition in Management Information Systems. Prerequisite: MIS 490 and consent of Instructor.

MIS 495 Individual Research Project I

★3 *(fi 6)* (either term, 3-0-0). Special Study for advanced undergraduates. Prerequisites: consent of Instructor and Assistant Dean, Undergraduate Program.

MIS 496 Individual Research Project II

★3 *(fi 6)* (either term, 3-0-0). Special Study for advanced undergraduates. Prerequisites: MIS 495, consent of the Instructor and Assistant Dean, Undergraduate Program.

MIS 497 Individual Research Project III

★3 *(fi 6)* (either term, 3-0-0). Special Study for advanced undergraduates. Prerequisites: MIS 496, consent of the Instructor and Assistant Dean, Undergraduate Program.

Graduate Courses

MIS 541 Information Systems Planning and Management

★1.5 *(fi 3)* (either term, 18 hours). Focuses on key IT/IS issues especially relevant to non-technical managers and professionals in organizations who are likely to be involved in the overall management and/or use of IT/IS resources in organizations in a role such as user, evaluator, and/or manager of IT/IS resources. These issues include (1) strategic alignment of IT/IS and organizational goals and strategies, (2) critical IT/IS applications that support organizational decision making, business process improvement and competitive strategies, and (3) management of IT/IS resources. Offered in a six-week period.

MIS 612 Managerial Support Systems

★3 *(fi 6)* (either term, 3-0-0). Provides students with an understanding of the interaction between decision-making and technology within organizational contexts. Within the context of decision support systems (DSS), focus is on four key components: 1) the technology; 2) the broader context, including the decision-making styles which exist at the organizational, group and individual levels; 3) the design and development of DSS; 4) the effectiveness of DSS to support decision-making processes, including issues of implementation and evaluation.

MIS 613 Systems Analysis and Design

★3 *(fi 6)* (either term, 3-0-0). This course examines the critical stages of the systems development process. These include the initiation, planning, analysis, design, implementation and maintenance of information systems needed to support business functions in organizations. The concepts of life cycle, requirements of definition, analysis and design methods, and computer assisted software engineering (CASE) tools are presented. Specific modeling techniques such as process models, data models and logic models are examined in detail. Hands-on experience with a high-end CASE tool is provided.

MIS 615 Data Base Design and Administration

★3 *(fi 6)* (either term, 3-0-2). Application of database concepts in organizations. A comprehensive introduction to the design and development of relational databases from a logical data model. The relational database access language SQL is used along with a number of key software development tools. Effective data administration techniques for enforcing integrity and security as well as enhancing performance are also discussed. Topics of special current interest include data warehousing and the object-oriented data model. Note: The lab component will be taught for ten weeks during the term.

MIS 618 Electronic Commerce

★3 *(fi 6)* (either term, 3-0-0). An examination of the development of electronic commerce in business across a number of different sectors. Using a process modelling approach, traditional vs. electronic business transactions are discussed in business-to-business and business-to-consumer modes; strategies for e-commerce are developed with a focus on the appropriate technical architecture to support business in an electronic marketplace. In particular, requirements of payment systems, and issues of security and privacy are discussed as key considerations in implementation. The course uses software development tools in the implementation of these electronic commerce strategies.

MIS 624 IT/IS Project Management

★3 *(fi 6)* (either term, 3-0-0). Examines information system development project management. The system development project is a multi-stage activity involving investigation and analysis, scope definition, resource analysis and estimation, timing estimation, cost estimation, scheduling, monitoring, and implementation.

MIS 626 IT/IS Enabled Process Management

★3 *(fi 6)* (either term, 3-0-0). Focuses on the major operational activities and tasks that have come to be called 'business processes'. Will identify and categorize key business processes, demonstrate process mapping as a method of business process analysis, and demonstrate process redesign principles as a way to better manage this processes. Will feature the role of IT in process redesign.

MIS 637 Accounting Information Systems

★3 *(fi 6)* (either term, 3-0-0). An introduction to the field of computerized accounting information systems in organizations from the perspective of the information system professional. Accounting information systems are typically the foundation for many other information systems in organizations. Concentrates on the design of accounting information systems in organizations and integration of accounting information systems with other functional area and management information systems as well as commonalities in the system development process for accounting and other functional area information systems.

MIS 641 Information Systems Management

★3 *(fi 6)* (either term, 3-0-0). Issues, opportunities, and problems involved in the management of information system resources in organizations. These include human resource, financial, policies, standards, and strategic alignment concerns relating to the information systems department. The role of the CIO (Chief Information Officer) will be explored as the focal point for the course. Integrative cases of information systems issues in small, medium and large organizations will be discussed.

MIS 686 Selected Topics in Management Information Systems

★3 *(fi 6)* (either term, 3-0-0). Topics dealt with in this seminar may vary from year to year and will be chosen at the discretion of the instructor.

231.176 Management Science, MGTSC

Department of Finance and Management Science
Faculty of Business

Note: Enrolment in all MGTSC courses is restricted to students registered in the Faculty of Business, or to students registered in specified programs that require Business courses to meet degree requirements and who have obtained prior approval of their Faculty.

Undergraduate Courses

MGTSC 312 Probability and Statistics for Business

★3 *(fi 6)* (either term, 3-0-0). This course deals with model building, multiple regression analysis, and related methods useful in a business environment. Microcomputer software will be utilized throughout the course, with necessary computing skills being taught as the course proceeds. However, students are expected to already possess some basic familiarity with microcomputer applications. Prerequisite: MGTSC 301 or STAT 151. Credit will be granted for only one of MGTSC 312 and STAT 252.

MGTSC 352 Operations Management

★3 *(fi 6)* (either term, 3-0-1). A problem-solving course which introduces the student to deterministic and stochastic models which are useful for production planning and operations management in business and government. Note: Students are expected to have basic familiarity with microcomputer applications. Prerequisite: MATH 113 and MGTSC 301 or STAT 151.

MGTSC 404 Decision Analysis

★3 *(fi 6)* (either term, 3-0-0). This course helps students deal systematically with decisions involving two or more parties with opposing interests. Decision trees and influence diagrams are used to model available strategies and weigh tradeoffs. Game-theoretic models for bidding, bargaining, and negotiation are examined and applied in case studies and simulations. Particular attention is paid to the effect of uncertainty and the strategic use of private information. Possible examples include labor negotiations, baseball salary arbitration, construction bidding, international boundary disputes, and environmental hazard location. Ethical and moral issues are discussed. Prerequisites: MGTSC 312, 352.

MGTSC 405 Forecasting for Planners and Managers

★3 *(fi 6)* (either term, 3-0-0). This course is concerned with methods used to predict the uncertain nature of business trends in an effort to help managers make better decisions and plans. Such efforts often involve the study of historical data and manipulation of these data to search for patterns that can be effectively extrapolated to produce forecasts. This is a business statistics course that covers all aspects of business forecasting where the emphasis is on intuitive concepts and applications. Topics covered include the family of exponential smoothing methods, decomposition methods, dynamic regression methods, Box-Jenkins methods and judgmental forecasting methods (e.g., the Delphi method). Because forecasting is best taught through practice, the course contains numerous real, relevant, business oriented case studies and examples that students can use to practice the application of concepts. Prerequisites: MGTSC 312, MGTSC 352.

MGTSC 422 Simulation and Computer Modelling Techniques in Management

★3 *(fi 6)* (either term, 3-0-0). Computer modelling of management systems in such functional areas as accounting, finance, marketing and operations. Basic concepts of deterministic and probabilistic (Monte Carlo) simulation and their applications. Microcomputer implementation of case studies using spreadsheets particularly emphasized. Required term project. Prerequisites: MGTSC 312 (or equivalent STAT course), 352; and FIN 301 or ACCTG 311.

MGTSC 426 Service Operations Management

★3 *(fi 6)* (either term, 3-0-0). This course introduces tools that managers can use to increase profits from operating decisions in service businesses and other service organizations. These decisions range from strategic (where to locate, what to sell) to tactical (how to schedule employees for the coming week). The

course will emphasize realistic business projects and the use of easily available software tools. Examples of topics are models to describe and reduce congestion, work force scheduling heuristics, and selected marketing models. Prerequisites: MGTSC 312, 352.

MGTSC 431 Managerial Performance Measures
★3 *(fi 6)* (either term, 3-0-0). The historical development and the current practice of performance measurement and evaluation in the public and private sectors. Topics include main purposes served by performance measures; uses of non-financial and financial measures within large organizations; input, throughput, output and outcome measures; measures that involve a built-in standard of comparison, which include growth rates, input-output coefficients and single factor efficiencies, output-input coefficients and single factor efficiencies, multi-factor productivity measures, and managerial accounting cost and sales variances; managerial functions and alternative ways of computing aggregative measures on a non-technical level; strategies for using performance measure and evaluation evidence in accountability agreements. Prerequisite: MGTSC 312.

MGTSC 455 Quality Management
★3 *(fi 6)* (either term, 3-0-0). The objective of the course is to study and understand process and product variation, interactions among product and process variables, and ultimately to take action to reduce variation. The topics covered include statistical process control, design of experiment, factorial design, Taguchi's methods and cases, and applications of quality control in management. Prerequisites: MGTSC 312, 352.

MGTSC 461 Distribution Management
★3 *(fi 6)* (either term, 3-0-0). This course will deal with the economically efficient distribution of goods and services from their points of creation to the customers. Topics will include strategic decisions, such as aggregate distribution plans and warehouse location, as well as operational decisions, such as selection of delivery routes and dispatching. This course has a significant microcomputer component. The potential of geographic-information-systems as a profit tool will be demonstrated. Prerequisite: MGTSC 312, 352.

MGTSC 467 Analytical Techniques for Management Consulting
★3 *(fi 6)* (first term, 3-0-0). This case-based course will cover the most popular analytical problem-solving techniques such as regression, simulation, and optimization. Topics will include inventory management, queueing, multiple regression, facility location, genetic algorithms, optimization on spreadsheets, capacity selection, process mapping, data analysis tools in spreadsheets, aggregate planning, and supply chain management. Guest speakers from the consulting sector will be invited to speak. Prerequisites: MGTSC 352 and another 400-level MGTSC or consent of Instructor.

MGTSC 468 Quantitative Management Consulting Project
★3 *(fi 6)* (second term, 3-0-0). This course applies the techniques developed in MGTSC 467 to a group project. The emphasis in the projects is on quantitative approaches to operational problems. Student groups will be assigned to consulting projects from businesses and other organizations in and near Edmonton. Groups will work on their projects under the supervision of the instructor(s). Prerequisites: MGTSC 467 or consent of Instructor.

MGTSC 471 Decision Support Systems
★3 *(fi 6)* (either term, 3-0-0). Decision support systems integrated with various management tools in a microcomputer environment. Programming language to be used is Visual Basic for Applications. Different multicriteria decision making tools such as the Analytic Hierarchy Process, Multiattribute Utility Theory, Goal Programming and Multiobjective Optimization are introduced. Students create decision support systems with graphical user interfaces that use a formal multicriteria decision-making front end as well as optimization, simulation or other appropriate engines for calculations in the background. Student projects in this implementation-oriented course will come from different areas such as employee scheduling, facility location, project/product selection and portfolio optimization. Prerequisites: MGTSC 312, 352.

MGTSC 480 Honours Essay in Management Science
★3 *(fi 6)* (second term, 3-0-0). Preparation of the honours essay required for students in the Management Science Honours program. Prerequisite: consent of the Department.

MGTSC 488 Selected Topics in Management Science
★3 *(fi 6)* (either term, 3-0-0). Normally restricted to third- and fourth- year Business students. Prerequisites: MGTSC 312, 352 or consent of Department. Additional prerequisites may be required.

MGTSC 490 Management Science Competition Part I
★1.5 *(fi 3)* (either term, 0-1.5s-0). Preparation for Student Competition in Management Science. Prerequisite: consent of Instructor.

MGTSC 491 Management Science Competition Part II
★1.5 *(fi 3)* (either term, 0-1.5s-0). Completion of Student Competition in Management Science. Prerequisite: MGTSC 490 and consent of instructor.

MGTSC 495 Individual Research Project I
★3 *(fi 6)* (either term, 3-0-0). Special study for advanced undergraduates. Prerequisites: consent of Instructor and Assistant Dean, Undergraduate Program.

MGTSC 496 Individual Research Project II
★3 *(fi 6)* (either term, 3-0-0). Special Study for advanced undergraduates. Prerequisites: MGTSC 495, consent of the Instructor and Assistant Dean, Undergraduate Program.

MGTSC 497 Individual Research Project III
★3 *(fi 6)* (either term, 3-0-0). Special Study for advanced undergraduates. Prerequisites: MGTSC 496, consent of the Instructor and Assistant Dean, Undergraduate Program.

Graduate Courses

MGTSC 501 Data Analysis and Decision Making
★3 *(fi 6)* (either term, 3-0-0). This course begins with a survey of graphical and numerical techniques available for studying and describing data. Following an introduction to probability distributions, an overview of statistical inference for means and proportions is provided. Regression, analysis of variance, and time series models are discussed. The data analyzed throughout the course will be representative of data commonly employed by managers. Not open to students who have completed MGTSC 511 and 521.

MGTSC 502 Operations Management
★3 *(fi 6)* (either term, 3-0-0). This course focuses on (1) the comparative advantage that a business unit can derive from innovative and efficient production of goods and services and on (2) analytical solution methods that are useful to analyze an organization's operations. Specific modules include process management; operations strategy; business forecasting; measuring and managing flow times, capacity, and inventory; and supply chain coordination. Analytical solution methods include risk and decision analysis, Monte Carlo simulation, and optimization. Cases will be used extensively. Not open to students who have completed MGTSC 541. Prerequisite: MGTSC 501.

MGTSC 531 Decision Analysis
★1.5 *(fi 3)* (either term, 18 hours). This course provides an overview of probability theory. A survey of decision theory, computer simulation and central management science concepts and techniques is included. The student is introduced to concepts using a variety of cases and assignments. Formulation of problems and interpretation of results are stressed. Computer spreadsheet software is used throughout. Offered in a six-week period. Not open to students who have completed MGTSC 501. Prerequisite: MGTSC 521.

MGTSC 604 Bargaining and Negotiation
★3 *(fi 6)* (either term, 3-0-0). This course is a blend of both experiential learning and theory with the objective of making the student more effective in all types of bargaining. A study of positive theories on how to improve negotiation skills will be combined with analytical models of the game theoretic structure of bargaining. Through this mix of theories and several case studies and bargaining exercises, students will see both the opportunities for joint gain (win-win) and the constraints which can lead to inferior outcomes. Prerequisite: MGTSC 531 and BUEC 501.

MGTSC 626 Service Operations Management
★3 *(fi 6)* (either term, 3-0-0). This course introduces tools that managers can use to increase profits from operating decisions in service businesses and other service organizations. These decisions range from strategic (where to locate, what to sell) to tactical (how to schedule employees for the coming week). The course will emphasize realistic business projects and the use of easily available software tools. Examples of topics are models to describe and reduce congestion, workforce scheduling heuristics, and selected marketing models. Prerequisite: MGTSC 541.

MGTSC 631 Managerial Performance Measures
★3 *(fi 6)* (either term, 3-0-0). The historical development and the current practice of performance measurement and evaluation in the public and private sectors. Topics include main purposes served by performance measures; uses of non-financial and financial measures within large organizations; input, throughput, output and outcome measures; measures that involve a built-in standard of comparison, which include growth rates, input-output coefficients and single factor efficiencies, output-input coefficients and single factor efficiencies, multi-factor productivity measures, and managerial accounting cost and sales variances; managerial functions and alternative ways of computing aggregative measures on a non-technical level; strategies for using performance measure and evaluation evidence in accountability agreements. Prerequisite: MGTSC 511/521.

MGTSC 632 Simulation and Computer Modelling Techniques in Management
★3 *(fi 6)* (either term, 3-0-0). This course will discuss computer modelling of management systems in such functional areas as accounting, finance, marketing, and production. Basic concepts of deterministic and probabilistic (Monte Carlo) simulation and their applications will also be covered. Micro computer implementations of case studies using spreadsheets will be particularly emphasized. A term project will be required. Prerequisite: MGTSC 541.

MGTSC 655 Quality Management
★3 *(fi 6)* (either term, 3-0-0). The objective of the course is to study and understand process and product variation, interactions among product and

process variables and ultimately to take action to reduce variation. The topics covered include statistical process control, design of experiment, factorial design, Taguchi's methods and cases and applications of quality control in management. Prerequisite: MGTSC 521.

MGTSC 671 Decision Support Systems
★3 *(fi 6)* (either term, 3-0-0). Decision support systems integrated with various management tools in a microcomputer environment. Programming language to be used is Visual Basic for Applications. Different multicriteria decision making tools such as the Analytic Hierarchy Process, Multiattribute Utility Theory, Goal Programming and Multiobjective Optimization are introduced. Students create decision support systems with graphical user interfaces that use a formal multicriteria decision-making front end as well as optimization, simulation or other appropriate engines for calculations in the background. Student projects in this implementation-oriented course will come from different areas such as employee scheduling, facility location, project/product selection and portfolio optimization. Prerequisite: MGTSC 511/521.

MGTSC 686 Selected Topics in Management Science
★3 *(fi 6)* (either term, 3-0-0). Topics in this seminar may vary from year to year and are chosen at the discretion of the Instructor.

MGTSC 698 Individual Study Project in Management Science
★3 *(fi 6)* (either term, 3-0-0).

MGTSC 701 Seminar in Mathematical Programming
★3 *(fi 6)* (either term, 3-0-0). Topics from the areas of linear programming, nonlinear programming, quadratic programming, integer programming, stochastic programming, network analysis, and large-scale programming (decomposition and column generation) in a business context. Students are expected to have as background at least a one-semester introduction to linear programming and optimization. This course may be appropriate for some graduate students in engineering or computing science. Prerequisite: Written permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MGTSC 702 Seminar in Decision Analysis and Game Theory
★3 *(fi 6)* (either term, 3-0-0). Decision-making under uncertainty, analysis of competitive strategies, competitive bidding, theory of auctions, bargaining, and negotiation models. Students are expected to have as background at least a one semester introduction to probability and random variables. This course may be appropriate for some graduate students in engineering and computing science. Prerequisite: Written permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MGTSC 703 Seminar on Advanced Applications of Operations Research
★3 *(fi 6)* (either term, 3-0-0). Applications selected from areas such as transportation and distribution, energy modeling, urban services, health care, natural resource management, workforce management, and environmental management. Students are expected to have taken at least one of MGTSC 701, 702, or 704 or have equivalent background. This course may be appropriate for some graduate students in engineering and computing science. Prerequisite: Written permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MGTSC 704 Seminar in Stochastic Models
★3 *(fi 6)* (either term, 3-0-0). Review of probability distributions and random variables, followed by selected topics from stochastic processes and their application in business contexts. Possible topics include Bernoulli, Poisson, Markov, and renewal processes, queueing theory, computational probability, simulation, and stochastic dynamic programming. Students are expected to have as background at least two semesters of calculus and one semester introduction to probability and random variables. This course may be appropriate for some graduate students in engineering and computing science. Prerequisite: Written permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MGTSC 705 Multivariate Data Analysis I
★3 *(fi 6)* (either term, 3-0-0). An overview of multivariate data analysis normally taken by students in the first year of the Business PhD program. Designed to bring students to the point where they are comfortable with commonly used data analysis techniques available in most statistical software packages. Students are expected to complete exercises in data analysis and in solving proofs of the major results. Topics will include univariate analysis, bivariate analysis, multiple linear regression, and analysis of variance. It is expected that students have as background at least one semester of calculus, one semester of linear algebra, and two semesters introduction to probability, probability distributions and statistical inference. Prerequisite: Registration in Business PhD Program or written permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MGTSC 706 Multivariate Data Analysis II
★3 *(fi 6)* (either term, 3-0-0). A continuation of the overview of multivariate data analysis begun in MGTSC 705. Topics include categorical data analysis, multivariate linear regression, discriminant analysis, canonical correlation, multivariate analysis of variance, principal component analysis, factor analysis, cluster analysis and

logistic regression. Prerequisite: MGTSC 705 or consent of Instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MGTSC 710 Individual Research
★3 *(fi 6)* (either term, 3-0-0).

MGTSC 820 Data Analysis and Modeling
★3 *(fi 32)* (first term, 3-0-0). Developing the ability to collect information and to use information technology to analyze statistically and draw conclusions; developing computer skills and understanding research methods. Restricted to Executive MBA students only.

MGTSC 830 Operations Management
★3 *(fi 32)* (second term, 3-0-0). Understanding the strategic role of operations in an enterprise and the relationship between operations and other business functions; designing, implementing and controlling an effective and efficient operating process. Restricted to Executive MBA students only.

231.177 Marine Science (Biological Sciences), MA SC

Department of Biological Sciences, Bamfield Marine Sciences Centre
Faculty of Science

Notes
(1) Courses are offered at Bamfield Marine Science Centre. Details are available from the Department of Biological Sciences.
(2) Prerequisite for all of the following courses is consent of the Department of Biological Sciences.
(3) Students will be expected to take a full course load of ★15 during the Fall term.
(4) See also §173.11.

Undergraduate Courses

○ MA SC 400 Directed Studies
★3-6 *(variable)* (two term, 0-0-6). A course of directed studies under the supervision of a visiting professor. The study will involve a research project approved by the supervisor in the field of interest of the student, and will be designed to take maximum advantage of the laboratory and/or field opportunities offered by the Bamfield Marine Station.

○ MA SC 401 Special Topics in Marine Biology
★6 *(fi 12)* (two term, 0-0-6). Offered, as opportunities arise, by distinguished scientists who are working at the Bamfield Marine Station. It is expected that the course will generally be of a specialized nature and be at a level appropriate to graduate or senior undergraduate students.

○ MA SC 402 Special Topics in Marine Biology
★3 *(fi 6)* (either term, 0-0-6). Offered, as opportunities arise, by distinguished scientists who are working at the Bamfield Marine Station and are prepared to offer a course extending over a three-week period. Course will be of a specialized nature.

○ MA SC 403 Directed Studies in Marine Science
★3-6 *(variable)* (first term, 13 weeks). Study will involve a research project approved by a supervisor in the student's field of interest, and will be designed to take maximum advantage of the laboratory and/or field opportunities. Students may arrange for a supervisor before the start of the fall semester. Advanced students may, with the permission of their university, take a ★6 directed study in lieu of MA SC 415, 425, or 437.

○ MA SC 410 Marine Invertebrate Zoology
★6 *(fi 12)* (two term, 0-0-6). A survey of the marine phyla, with emphasis on the benthic fauna in the vicinity of the Bamfield Marine Station. The course includes lectures, laboratory periods, field collection, identification, and observation. Emphasis is placed on the study of living specimens in the laboratory and in the field.

○ MA SC 412 Biology of Fishes
★6 *(fi 12)* (two term, 0-0-6). Classification, physiology, ecology, behavior and zoogeography of fishes with particular emphasis on those in the marine environment of the British Columbia coast. Course will involve some field projects.

○ MA SC 415 Structure and Function in Animals
★3 *(fi 6)* (first term, 4 weeks). This course is intended to examine the form and function of invertebrates and vertebrates using a comparative approach. The following subject areas are included: morphology and evolution, systems physiology, biomechanics, and development. The local marine and coastal fauna are used to illustrate the principles. The course includes fieldwork and a series of laboratory exercises and experiments.

○ MA SC 420 Marine Phycology
★6 *(fi 12)* (two term, 0-0-6). A survey of the marine algae, with emphasis on the

Course Listings Ⓜ

benthic forms in the vicinity of the Bamfield Marine Station. The course includes lectures, laboratory periods, field collection, identification, and observation. Emphasis is placed on the study of living specimens in the laboratory and in the field.

Ⓞ MA SC 425 Ecological Adaptations of Seaweeds
★3 *(fi 6)* (first term, 4 weeks). The course explores morphological, physiological, genetic and reproductive adaptations of seaweeds to their natural and man-altered environments.

Ⓞ MA SC 430 Marine Ecology
★6 *(fi 12)* (two term, 0-0-6). An analytical approach to biotic associations in the marine environment. Opportunities will be provided for study of the intertidal realm in exposed and protected areas and of beaches and estuaries in the vicinity of the Bamfield Marine Station; plankton studies and investigations of the subtidal and benthic environments by diving and dredging are envisaged.

Ⓞ MA SC 437 Marine Population Ecology and Dynamics
★3 *(fi 6)* (first term, 4 weeks). An analytical approach to the study of marine ecology and marine populations. Intertidal and subtidal communities will be examined, with emphasis on the biota of the Barkley Sound region.

Ⓞ MA SC 440 Biology of Marine Birds
★6 *(fi 12)* (two term, 0-0-6). A study of the interrelationship of birds and the marine environment. Lectures will emphasize the systematics and ecological relationships, behavior, life histories, movements and conservations of marine birds. Census techniques and methods of studying marine birds in the field will be treated as we observe seabirds and marine associated birds in the Barkley Sound region. Seabird identification, classification, morphology, plumages and moult will be examined in the laboratory.

Ⓞ MA SC 445 Biology of Marine Mammals
★6 *(fi 12)* (two term, 0-0-6). A survey course covering systematics and distribution of marine mammals, their sensory capabilities and physiology, with special emphasis on the Cetacea. The course includes lectures, laboratory periods and the course will involve an independent field study.

Ⓞ MA SC 454 Special Topics in Aquaculture
★3 *(fi 6)* (either term, 0-0-6). An examination of the culture techniques for selected groups of aquatic plants, animals, or micro organisms. Participants will be expected to complete a project which examines some aspects of applied science relevant to commercial culture.

Ⓞ MA SC 480 Seminars and Papers in Marine Science
★3 *(fi 6)* (first term, 13 weeks). A series of weekly seminars covering current topics of interest in the marine sciences. Seminars will be presented by BMS researchers, graduate students, visiting scientists as well as by the students themselves.

Graduate Courses

MA SC 500 Graduate Level Directed Studies
★6 *(fi 12)* (two term, 0-0-6). A graduate level course of directed studies under the supervision of a member of the faculty. The study will involve a research project provided by the supervisor in the field of interest of the student, and will be designed to take maximum advantage of the laboratory and/or field opportunities offered at Bamfield Marine Station. May be offered over a 3-week period.

MA SC 502 Graduate Level Special Topics
★3 *(fi 6)* (two term, 0-0-6). Courses offered as opportunities arise, by distinguished scientists who are visiting at Bamfield Marine Station and are prepared to offer a course extending over a three-week period. The course will carry graduate credit.

231.178 Marketing, MARK

Departments of Marketing, Business Economics, and Law
Faculty of Business

Note: Enrolment in all MARK courses is restricted to students registered in the Faculty of Business, or to students registered in specified programs that require Business courses to meet degree requirements and who have obtained prior approval of their Faculty.

Undergraduate Courses

MARK 301 Introduction to Marketing
★3 *(fi 6)* (either term, 3-0-0). Students are introduced to the marketing concept and the role of marketing within the overall business framework. The basic tools of marketing are introduced: market segmentation, positioning, product, price, distribution, and promotion, together with marketing research, consumer behavior, planning, and global marketing. A critical theme of the course is the need for the marketing mix to fit with the requirements of consumers, the competitive environment, company strengths, and community expectations. These issues are considered from strategic and tactical perspectives. Prerequisites: ECON 101 and 102, MATH 113 or equivalent.

MARK 312 Marketing Research
★3 *(fi 6)* (either term, 3-0-0). Nature and significance of marketing research. Marketing research methods, investigation and analysis of specific research problems. Prerequisite: MARK 301. Not open to students with credit in MARK 412.

MARK 320 Consumer Behavior
★3 *(fi 6)* (either term, 3-0-0). The study of the factors affecting the consumer decision process. Analysis of consumer behavior models and their application to marketing decision making, with an emphasis on empirical research. Prerequisite: MARK 301. BCom degree credit will not be granted for both MARK 320 and HECOL 320. Not open to students with credit in MARK 422 or CONS 220.

MARK 420 Advanced Topics in Consumer Behavior
★3 *(fi 6)* (either term, 3-0-0). Advanced study of consumer behavior theories and their application to consumer research that informs marketing, consumer policy, and consumer education. Prerequisite: MARK 320 or HECOL 320. BCom degree credit will not be granted for both MARK 420 and HECOL 420. Not open to students with credit in MARK 423 or CONS 420.

MARK 432 Marketing Communications
★3 *(fi 6)* (either term, 3-0-0). Students study basic concepts of interpersonal and mass communications. An emphasis on integrated marketing communications (IMC) which consist of advertising, personal selling, sales promotion, direct marketing, and public relations. A focus on integrating the elements which make up an IMC plan, resulting in a coherent communications strategy. Consumer motivation and the measurement of communication effectiveness are also examined. Prerequisite: MARK 301.

MARK 442 Seminar in International Marketing
★3 *(fi 6)* (either term, 3-0-0). Analysis of problems of international marketing; development of marketing strategies in light of world cultural, economic, geographic, legal and political factors. Prerequisite: MARK 301.

MARK 450 Electronic Marketing
★3 *(fi 6)* (either term, 3-0-0). Provides an in-depth understanding of the marketing aspects of electronic commerce. Expands upon the principles of marketing by focusing on those aspects that are unique in electronic marketplaces. Combines the study of pertinent theoretical concepts with a discussion of current developments in the practice of electronic marketing. In a major group project, students have the opportunity to apply the skills and knowledge acquired in the course to a real-world electronic marketing challenge. Prerequisites: MARK 301 and MIS 311.

MARK 452 Strategic Marketing
★3 *(fi 6)* (either term, 3-0-0). The objective of this course is to provide students with the analytic, planning, and communication skills to be successful marketing managers. The focus is on practical marketing planning, along with the development and implementation of marketing strategies. Course activities may include the use of marketing simulation games, case analyses, field research projects, secondary research and in-depth discussion of current literatures. The course focuses on the integration of all the conceptual areas in marketing. Prerequisite: MARK 301.

MARK 465 Retailing and Services Internship
★3 *(fi 6)* (either term, 3-0-0). Practical application of marketing and related business skills and theory to a problem or issues addressed during a period of 13 weeks of summer placement in a sponsoring retailing or services organization. The internship includes preliminary instruction and requires, under the supervision of the Faculty, the presentation of a project report to the sponsoring organization. Prerequisites: MARK 301 and consent of Department.

MARK 466 Service Marketing
★3 *(fi 6)* (either term, 3-0-0). Students are introduced to the important differences between marketing tangible products and marketing services. The unique nature of services is examined and the importance of service quality to both consumer and business to business customers, is emphasized. The marketing mix variables are discussed from the service perspective. Designing a marketing mix for service, not-for-profit and government institutions poses interesting and formidable challenges which are dealt with in terms of marketing planning, implementation and control. Trade barriers to the global marketing of services, together with other global service issues are also given attention. Prerequisite: MARK 301.

MARK 468 Retailing and Channel Management
★3 *(fi 6)* (either term, 3-0-0). Students are introduced to the activities involved in retailing goods and services to consumers and to the elements that make up effective distribution channels. Retailing topics include the evolution of retailing, store location, store image, shopping behavior, retail marketing strategies and current trends in retailing management. Channel management topics include: channel structure, designing the marketing channel, channel relationships and responsibilities, selecting channel members, and physical distribution and transportation. Effective channel management, the application of marketing planning, and analysis of retailing and channel management are also examined Prerequisite: MARK 301.

MARK 470 Selling and Sales Management
★3 *(fi 6)* (either term, 3-0-0). The role of selling and management of the sales force in diverse modern business environments. Topics include sales strategies,

sales force planning, organization and evaluation, recruiting, selection and training, leadership and motivation, sales forecasting quotas and types of compensation. Prerequisite: MARK 301.

MARK 472 Product Management and Pricing

★3 *(fi 6)* (either term, 3-0-0). Development, management and pricing of interrelated goods and services. New product development, managing a product portfolio, bundling of goods and services, and tailoring price and product to different segments. Prerequisites: MARK 301 and BUEC 311.

MARK 488 Selected Topics in Marketing

★3 *(fi 6)* (either term, 3-0-0). Normally restricted to third- and fourth- year Business students. Prerequisites: MARK 301 or consent of Department. Additional prerequisites may be required.

MARK 490 Marketing Competition Part I

★1.5 *(fi 3)* (either term, 0-1.5s-0). Preparation for Student Competition in Marketing. Prerequisite: consent of Instructor.

MARK 491 Marketing Competition Part II

★1.5 *(fi 3)* (either term, 0-1.5s-0). Completion of Student Competition in Marketing. Prerequisite: MARK 490 and consent of Instructor.

MARK 495 Individual Research Project I

★3 *(fi 6)* (either term, 3-0-0). Special study for advanced undergraduates. Prerequisites: MARK 312 or equivalent, consent of Instructor and Associate Dean Undergraduate Program.

MARK 496 Individual Research Project II

★3 *(fi 6)* (either term, 3-0-0). Special Study for advanced undergraduates. Prerequisites: MARK 495, consent of the Instructor and Assistant Dean, Undergraduate Program.

MARK 497 Individual Research Project III

★3 *(fi 6)* (either term, 3-0-0). Special Study for advanced undergraduates. Prerequisites: MARK 496, consent of the Instructor and Assistant Dean, Undergraduate Program.

Graduate Courses

MARK 502 Principles of Marketing Management

★3 *(fi 6)* (either term, 3-0-0). This course commences with an examination of core marketing concepts, including strategic marketing planning, segmentation and the marketing mix (product, price, place and promotion) and the integration of these concepts into a marketing plan. Specific focus is then provided to developing pragmatic skills regarding marketing effectiveness.

MARK 586 Selected Topics in Marketing

★1.5 *(fi 3)* (either term, 3-0-0). Topics in this seminar may vary from year to year and are chosen at the discretion of the Instructor.

MARK 612 Marketing Research

★3 *(fi 6)* (either term, 3-0-0). Provides an examination of marketing research methodologies emphasizing the translation of marketing problems into researchable form, research design, data gathering, data analysis, and implementation of research results. Prerequisite: MARK 502, or 501 and 511. Credit will not be given for both MARK 612 and 620.

MARK 624 Consumer Behaviour

★3 *(fi 6)* (either term, 3-0-0). Individual and group influences on consumer decision-making and their implications for marketing strategy. Individual influences examined include personality, information processing strategies, and attitude change. Group influences include reference groups such as family, social class, culture, and sub-culture. Prerequisite: MARK 502, or 501 and 511. Credit will not be given for both MARK 624 and 620.

MARK 630 Advertising, Promotion and Retail Management

★3 *(fi 6)* (either term, 3-0-0). This course introduces the student to the management of advertising and other marketing communications tools in a managerial setting. It also examines the application of marketing analysis to retail management with emphasis on locations/spatial theory, market research techniques, consumer behavior, channel policies, competition analysis, and pricing, merchandising, and promotion strategies. Prerequisite: MARK 502 or 511.

MARK 644 International Marketing

★3 *(fi 6)* (either term, 3-0-0). Topics in international marketing, including the importance of international marketing to Canadian business, comparative marketing systems, evaluation of socioeconomic influences on international marketing, and marketing strategies as they relate to firm size. Prerequisites: MARK 501, 511.

MARK 650 Marketing in Electronic Environments

★3 *(fi 6)* (either term, 3-0-0). This course equips students with a conceptual understanding of the marketing-related issues that are of importance to e-commerce managers and a set of skills that will enable them to develop successful marketing strategies for digital marketplaces. In a major group project, students have the opportunity to apply the knowledge and skills acquired in the course to a real-world electronic-marketing challenge. Prerequisites: MARK 501 and 511.

MARK 664 Product Management and Pricing

★3 *(fi 6)* (either term, 3-0-0). Development, management and pricing of interrelated goods and services. New product development, pricing strategies for new products, managing a product portfolio, bundling of goods and services and pricing the bundles, and tailoring price and product to different segments. Prerequisites: MARK 501, 511, MANEC 511.

MARK 686 Selected Topics in Marketing

★3 *(fi 6)* (either term, 3-0-0).

MARK 710 Research Methodology in Marketing

★3 *(fi 6)* (either term, 3-0-0). The nature of scientific inquiry and its relevance and application to research in marketing. The development and testing of marketing theory. Marketing measurement methodology. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students. Students may not receive credit for both MARK 701 and 710.

MARK 715 Experimental Design for Behavioural Research

★3 *(fi 6)* (either term, 3-0-0). This course teaches the principles of experimental design for the study of human behaviour. Experiments may be administered through surveys and on the Internet as well as in laboratory settings. Behavioural texts on experimental design rely heavily on weak between-subjects designs, whereas statistics texts favour engineering applications that are inherently simpler than the study of human behaviour. After explaining the principles of randomization and of efficient design, the course concludes by illustrating how more powerful designs can characterize human learning without confounding it with subjects' naive responses. MARK 715 is integrated and coordinated with MARK 716 - Computer-Based Experiments for Behavioural Research. However, it may be taken separately by arrangement with the instructor. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 716 Computer-Based Experiments for Behavioural Research

★3 *(fi 6)* (either term, 3-0-0). The learning goal for this course is the acquisition of the skills required to design and implement computer-based experiments for research in the behavioral social sciences. Students develop an understanding of the conceptual issues relevant to computer-based experimental research. They get an overview of the available software platforms, and obtain advanced skills in connection with one particular general-purpose platform. The course has a significant hands-on component that allows students to apply their acquired knowledge in the implementation of actual experiments that they plan to conduct. Prerequisites: Working knowledge of experimental design for behavioural research. (The recommended preparation for this course is MARK 715: Experimental Design for Behavioural Research.) Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 717 Bayesian Modelling of Human Behaviour

★3 *(fi 6)* (either term, 3-0-0). This course teaches how to model human behaviour using Bayesian computer software. The motivation for Bayesian data analysis is pragmatic -- Bayesian modelling allows researchers to analyze data on human behaviour in a manner consistent with behavioural theory, whereas traditional statistical analyses place greater restrictions on the types of data and models that can be analyzed. Programming is not involved, but it is necessary to describe, in terms of statistical distributions, a model of the data generation process. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 720 Buyer Behaviour

★3 *(fi 6)* (either term, 3-0-0). This course is concerned with the impact of environmental factors on consumers, as well as the impact of marketing on society. In particular, this course will provide an intensive examination of external factors including situational variables and sociocultural influences on consumer behaviour. Macro issues relevant to the impact of marketing on society will also be considered, with a focus on issues relevant to mass communication and public policy. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 725 Human Judgment And Decision Making

★3 *(fi 6)* (either term, 3-0-0). This course will familiarize students with theories of cognitive information processing and affective processes as they relate to consumer judgments and decisions. More specifically, the cognitive component of this course will provide an intensive examination of memory, perception, attitude formation, and behavioural decision theory. The affect component of the course will deal with factors influencing affect formation as well as the impact of affect on attitudes and decision making. Research methods underlying each of these streams of information will be examined. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 740 Marketing Models

★3 *(fi 6)* (either term, 3-0-0). This course describes theoretical and empirical models used to analyze marketing management issues in the areas of product introduction and positioning, pricing, advertising, and distribution channels. The

theoretical structure in the course comes from microeconomics of firm and consumer decision making, with special consideration of competitive issues analyzed with game theory and some applications of control theory. The empirical work draws from conjoint analysis, choice modeling, and multivariate techniques. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 750 Marketing Theory

★3 *(fi 6)* (either term, 3-0-0). Recent and classic contributions to marketing theory development. The course addresses conceptual development and current practice in marketing decision-making. Topics critically examined include marketing orientation, competitive interaction, product development and introduction, channel relationship management, customer relationship management, advertising and promotion, pricing and revenues, and sales, service and quality. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 797 Current Research in Marketing

★3 *(fi 6)* (either term, 3-0-0). An overview of recently published research in marketing with an emphasis on the research interests of enrolled students not adequately covered in other marketing doctoral courses. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 799 Individual Research

★3 *(fi 6)* (either term, 3-0-0). Special studies for advanced students. Prerequisites: Registration in the Business PhD Program or permission of instructor. Approval of the Business PhD Program Director is also required for non-PhD students.

MARK 830 Marketing

★3 *(fi 32)* (second term, 3-0-0). Understanding the role of marketing in determining the direction of an organization; the customer-focused organization; opportunity identification; forecasting demand; marketing segmentation; market planning, and implementation. Restricted to executive MBA students only.

231.179 Master of Internetworking, MINT

Departments of Computing Science; and Electrical and Computer Engineering
Faculties of Engineering Science

Graduate Courses

MINT 700 The Physical Layer

★3 *(fi 6)* (variable, 36 hours). Communication media, including copper, optical fiber and wireless. Modulation and coding standards. Framing. Error control techniques. MAN and WAN physical layers, including PDH, SONET/SDH, aATM, cable modems, xDSL, AMPS, GSM, GPRS, etc. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 702 Data Communication Protocols

★3 *(fi 6)* (variable, 36 hours). Structure of communication protocols, with an emphasis on the data link layer. SDLC and HDLC. Medium access control techniques. AAA. Local area, metropolitan area and wireless standards: Ethernet, 802.11 and Bluetooth. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 704 The Internet Protocol Suite

★3 *(fi 6)* (variable, 36 hours). Rationale and organization of the Internet protocols. IP, UDP, TCP, ICMP, ARP, RARP, Mobile-IP. Addressing and routing; intradomain routing protocols. Transport layer congestion control and flow control. IP over everything. Rationale and organization of the Internet protocols. IP, UDP, TCP, ICMP, ARP, RARP, Mobile-IP. Addressing and routing; intradomain routing protocols. Transport layer congestion control and flow control. IP over everything. Rationale and organization of the Internet protocols. IP, UDP, TCP, ICMP, ARP, RARP, Mobile-IP. Addressing and routing; intradomain routing protocols. Transport layer congestion control and flow control. IP over everything. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 706 Internet Application and Programming

★3 *(fi 6)* (variable, 36 hours). Concepts of Internet Applications. Sockets, client-server programming, proxies and gateways, application programming. XDR, example application protocols: SMTP, FTP, DNS and how to implement them. Possible source code inspection exercises covering BIND, zmailer. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 708 Internet Laboratory

★3 *(fi 6)* (variable, 36 hours). Demonstration of network principles. Practical aspects of network design and implementations. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 709 Internet Project

★6 *(fi 12)* (variable, 60 hours). Capstone project involving the design or analysis

of a significant internetwork or internetworking component. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 711 Network Modeling, Simulation, and Analysis

★3 *(fi 6)* (variable, 36 hours). Elements of queueing theory. Erlang and Engset models. Closed and open queueing systems. Introduction to discrete event simulation, experimental design and interpretation. Traffic workloads, including self-similar traffic and models for multimedia traffic. Equivalent bandwidth. Performance criteria and measures. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 712 Internet Security

★3 *(fi 6)* (variable, 36 hours). Security: vulnerabilities of Internet protocols, penetration techniques and defenses, intrusion detection systems. Cryptography: Public and private key cryptography, key negotiation, certificates. E-commerce security standards for both protocols and hosts.

MINT 713 Internetworking Platforms

★3 *(fi 6)* (variable, 36 hours). Real-time operating systems. Resource sharing. Interrups, clocked interrups and polling. Shared memory, shared bus and shared interconnect architectures. Bridging, switching and routing. Time vs. space switching. Spanning tree algorithm. Tag switching. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 714 High Performance Server Programming

★3 *(fi 6)* (variable, 36 hours). Server architecture. Multi-threaded and high-performance servers. Distributed databases. Transaction consistency. Load sharing and balancing. High availability, RAID. Case studies. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 715 Advanced Routing and Network Management

★3 *(fi 6)* (variable, 36 hours). Distance vector, link state and hybrid protocols. Intra-domain vs. inter-domain protocols. Multi-protocol routing and route redistribution. Network management protocols and procedures: autodiscovery, performance monitoring, fault isolation. Offered by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 716 Traffic Engineering and Network Design

★3 *(fi 6)* (variable, 36 hours). Configuring and dimensioning networks as an optimization problem. Designing fault-tolerant, cost-effective, secure networks. Iterative, multi-objective optimization. Linear and nonlinear programming. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 717 Internet Project Management

★3 *(fi 6)* (variable, 36 hours). Phases of implementing a new network. Phases of a network hardware or software upgrade. Risk management. Management tools including PERT, CPM, etc. Process mapping. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

MINT 719 Special Topics in Internet Technology

★3 *(fi 6)* (variable, 36 hours). Intended to enable individual students to study special internet topics under the supervision of a faculty member. Approval must be obtained from the program coordinator. Offered jointly by the Department of Electrical and Computing Engineering and the Department of Computing Science.

231.180 Materials Engineering, MAT E

Department of Chemical and Materials Engineering
Faculty of Engineering

The follow courses were renumbered effective 2007 - 2008:

Old	New
MAT E 251	MAT E 201
MAT E 252	MAT E 202
MAT E 440	MAT E 470
MAT E 441	MAT E 468
MAT E 442	MAT E 469
MAT E 480	MAT E 471

Undergraduate Courses

MAT E 201 Materials Science I

★3 *(fi 6)* (either term or Spring/Summer, 3-0-0). An introduction to the science of materials from the standpoint of the relationships between structure and physical and mechanical properties. Atomic bonding, crystal structure and crystal imperfections, binary phase equilibria and phase transformations. Structures of metallic, non-metallic and composite materials. Elastic and plastic deformation, fracture, fatigue and creep in crystalline and amorphous solids. Corrosion and thermal stability of materials in service. Credit may not be obtained in this course if previous credit has been obtained in MATE 251. Prerequisite: CHEM 105 or consent of Department.

MAT E 202 Materials Science II

★3.8 *(fi 6)* (either term or Spring/Summer, 3-0-3/2). An introduction to the science of materials relating their mechanical, thermal, electronic and chemical properties to atomic, molecular and crystal structure. Ceramic and metallic crystals, glasses, polymers and composite materials. Multi-phase materials, strengthening processes. Laboratories include mechanical properties of metals and polymers, microstructure, heat treatment of steel, corrosion. Credit may not be obtained in this course if previous credit has been obtained in MATE E 252. Prerequisite: CHEM 105 or consent of Department.

MAT E 211 Characterization of Materials

★3.9 *(fi 6)* (second term, 3-1s-3/4). Techniques for characterization of materials. Elements of crystallography. Optical microscopy and image analysis, diffraction techniques, electron microscopy, surface science techniques, wet chemical techniques, non-destructive characterization, emerging techniques. Prerequisite: MAT E 202 or consent of Department.

MAT E 221 Powder Fabrication and Processing

★3.5 *(fi 6)* (second term, 3-1s-0). Characteristics of particles including size, shape, textures, surface area and surface charges, etc. Top-down and bottom-up techniques of particle synthesis. Powder fabrication techniques for minerals, metals and ceramics. Particle separation techniques based on size and type. Stability of particulate dispersions, Consolidation. Prerequisite: MAT E 202 or consent of Department.

MAT E 331 Mineral Processing I

★3.8 *(fi 6)* (second term, 3-0-3/2). Unit operations employed to concentrate minerals including comminution, classification, gravity concentration, froth flotation, thickening, filtering; tailings disposal; marketing of minerals; economics. Prerequisite: STAT 235 or consent of Instructor.

MAT E 332 Pyrometallurgy

★3.8 *(fi 6)* (second term, 3-0-3/2). Nature of ores, furnaces fuels, slags, and mattes. Metallurgical calculations. Application of thermodynamics to metallurgical unit processes involving the use of elevated temperature to extract metals and metal compounds including calcining, roasting, reduction, smelting, refining and recycling. Air pollution problems in metallurgical industries. Prerequisites: CME 265 and MAT E 340.

MAT E 335 Phase Transformations I

★3.5 *(fi 6)* (first term, 3-1s-0). Solid state diffusion, diffusion mechanisms and mathematics of diffusion. Binary and ternary phase diagrams. Solid state transformations are addressed with applications in ceramics, metals and alloys. Prerequisite: MAT E 211, Co-requisite: MAT E 340.

MAT E 336 Phase Tranformations II

★3.5 *(fi 6)* (second term, 3-1s-0). Thermodynamics and kinetics of solid-vapour and solid-liquid transformations in materials science and engineering. Applications to chemical vapor deposition (CVD), physical vapor deposition (PVD), sputtering and solidification processing. Prerequisite: MAT E 335.

MAT E 340 Materials Thermodynamics

★3 *(fi 6)* (first term, 3-0-0). Fundamentals of thermodynamics in metallurgy and materials. Review of thermodynamic variables. First and second laws. Reaction equilibria, stability diagrams. Solution thermodynamics applied to metallurgical processes. Phase relations, free energy-composition diagrams. Electrochemistry. Experimental methods and estimation of thermochemical data. Prerequisite: CH E 243.

MAT E 341 Applied Electrochemistry

★3.5 *(fi 6)* (second term, 3-1s-0). Electrochemical reactions, equilibrium electrode potentials, cell potentials and Pourbaix diagrams. Electrochemical reaction kinetics, Butler-Volmer Model, polarization and Tafel equations. Metal recovery from solutions, electroplating, electroless plating. Corrosion. Batteries, fuel cells. Prerequisite: MAT E 340 or CH E 343.

MAT E 345 Corrosion and Oxidation

★3 *(fi 6)* (either term, 3-0-0). Electrochemical theory of galvanic attack, concentration cells and differential temperature cells. Uniform attack. The interaction of mechanical stresses and corrosion. Corrosion testing. Selection of corrosion-resistant materials. Protective coatings, inhibitors, cathodic and anodic protection, designing for corrosion control. High-temperature oxidation and other gas-metal reactions. Prerequisite: MAT E 201 or 202. Credit may not be obtained in this course if previous credit has been obtained in MAT E 341 and 474.

MAT E 351 Mechanical Properties

★3.5 *(fi 6)* (second term, 3-1s-0). Stress/strain relationships and tensile testing. Dislocation theory, twinning and plastic deformation. Strengthening mechanisms. Fundamentals of fracture, failure mechanisms, fracture mechanics and fracture testing. Prerequisites: CIV E 270, MAT E 211, and MAT E 335.

MAT E 353 Electronic Materials I

★3 *(fi 6)* (first term, 3-0-0). The science of electronic materials relating atomic, molecular and crystal structure to material properties; polymers, glasses, crystalline ceramics, metals, and composites; diffusion, electrochemical and corrosion properties; phase equilibria, strengthening mechanisms, mechanical properties and

failure; electrical conductors, semiconductors, and dielectrics; thermal, magnetic, and optical properties. Prerequisite: CHEM 105.

MAT E 357 Fundamentals of Physical Metallurgy

★3.8 *(fi 6)* (first term, 3-0-3/2). Diffusion in metals. Phase diagrams. Solidification and casting. Annealing. Diffusional and diffusionless solid state phase transformations. Carbon and low alloy steels and their heat treatment. Prerequisite: MAT E 256.

MAT E 358 Mechanical Metallurgy

★3.8 *(fi 6)* (second term, 3-0-3/2). Tensile testing, elastic deformation and plastic deformation. Dislocation theory and plastic deformation. Strengthening mechanisms in metals. Fundamentals of fracture and fracture testing. Fatigue and creep. Introduction to powder metallurgy. Prerequisite: MAT E 357.

MAT E 361 Materials Engineering Laboratory I

★2.3 *(fi 4)* (first term, 1-1s-3/2). Experimental data processing and report writing. Materials characterization. Materials testing. Particle size reduction and separation. Prerequisites: MAT E 211, 221, and STAT 235.

MAT E 362 Materials Engineering Laboratory II

★2.3 *(fi 4)* (second term, 1-1s-3/2). Technical report writing. Advanced materials characterization and testing. Stability of particulate dispersions. Prerequisites: MAT E 361.

MAT E 365 Materials Process Engineering Design

★4.5 *(fi 6)* (second term, 3-0-3). Engineering design concepts in materials processing; cost estimation; project planning and scheduling; plant safety and hazards analysis; selected project design examples. Prerequisites: CME 265, ENGG 310 or 401 and MAT E 340. Corequisites: CH E 314 and one of MAT E 331, 332 or 430.

MAT E 430 Hydrometallurgy and Electrometallurgy

★3.8 *(fi 6)* (first term, 3-0-3/2). Principles of hydrometallurgical and electrometallurgical unit processes to recover metals and metal compounds. Application of thermodynamics and kinetics to atmospheric and pressure leaching, ion exchange, solvent extraction, hydrogen reduction, electrowinning and electrorefining. Water pollution problems in metallurgical industries. Prerequisites: CME 265 and MAT E 340.

MAT E 433 Applied Surface Chemistry in Minerals and Materials Processing

★3.5 *(fi 6)* (either term, 3-1s-0). Fundamentals of surface and interfacial phenomena; physical chemistry of surfaces and interfaces; surface and interface energy and their origin; wetting adhesion and surface forces in material processing; role and mechanisms of surfactant adsorption and self assembly in materials engineering; techniques for surface characterization. Prerequisite CH E 243 or equivalent. Credit cannot be obtained in this course if credit has already been obtained in CH E 436.

MAT E 434 Metallurgical Process Analysis

★3.8 *(fi 6)* (second term, 3-0-3/2). The analysis, optimization and control of mineral and metallurgical processing systems through mathematical modelling and digital simulation. Instrumentation and control of metallurgical processing plants. Prerequisites: CH E 374, MAT E 331, MAT E 332.

MAT E 443 Materials Design Project

★4 *(fi 6)* (second term, 2-1s-3). Team or individual materials design projects. Selection and optimization of physical/mechanical properties and fabrication processes for chosen components or structures. Prerequisites: CIV E 265, 270, MAT E 345, 358, 452.

MAT E 448 Materials Engineering Field Trip

★0.5 *(fi 1)* (either term, 0-1s-0). An extended trip to visit materials and metallurgical plants may be made at the end of the summer by fourth-year Materials Engineering students accompanied by staff. Students in Materials may also be required to make several part-day trips during the session to materials, metallurgical and other industrial plants near Edmonton. This course requires the payment of additional miscellaneous fees. See §22.2.3 for details. Prerequisite: MAT E 357.

MAT E 452 Applications of Physical Metallurgy

★4.5 *(fi 6)* (first term, 3-0-3). Composition, structure, heat treatment and mechanical properties of alloy steels, cast irons and non-ferrous alloys. Mechanical processing of metals, including stress-strain relationships, forging, rolling, extrusion and sheet metal forming. Metallurgy of machining. Prerequisite: MAT E 357.

MAT E 454 Special Topics in Materials Engineering

★3 *(fi 6)* (either term, 3-0-0). Physical and chemical principles underlying metallurgical topics of current interest such as composite materials, materials problems in energy conversion, electrofinishing, recycling, extraction of metals from fossil fuels, iron and steelmaking, and refractory-slag interactions. Prerequisite: Consent of Department.

MAT E 455 Introduction to Stress Corrosion Cracking

★3 *(fi 6)* (either term, 3-0-0). The role of corrodents, stresses and microstructure in the phenomena of stress corrosion cracking; dissolution models and mechanical models proposed as mechanisms. Stress corrosion cracking of major systems. Evaluation and failure analysis of stress corrosion cracking. Prerequisite: MAT E 345 or consent of Instructor.

MAT E 456 Special Topics in Materials Processing
★3 *(fi 6)* (either term, 3-0-0). Studies of specific materials processing techniques which are of current interest. Prerequisite: Consent of Department.

MAT E 458 Nanomaterials for Biological Applications
★3.5 *(fi 6)* (either term, 3-1s-0). Survey of nanomaterials for nanofabrication. Nanofabrication techniques. Characterization tools. Biological applications for diagnostic and therapeutic options. Prerequisite: CH E 243 or equivalent, or consent of Instructor.

MAT E 460 Introduction to Diffraction Methods in Materials Science
★3 *(fi 6)* (either term, 3-0-0). Introduction to the basic theory of X-ray diffraction and the experimental practice of X-ray diffraction methods of materials analysis. Introduction to techniques that are useful for the analysis of metals, ceramics, polymers and semiconductors. Prerequisite: MAT E 256 or consent of Instructor.

MAT E 461 Materials Engineering Laboratory III
★3.5 *(fi 4)* (second term, 1-1s-4). Advanced technical report writing. Integration of materials characterization and testing techniques for problem solving. Integration of materials processing techniques for process development. Prerequisite: MAT E 362.

MAT E 462 Introduction to Fracture of Materials
★3 *(fi 6)* (first term, 3-0-0). Fracture mechanisms in metals and non-metals. Sources of flaws. Linear elastic and elastic plastic fracture test methods and applications. Prerequisite: MAT E 358 or consent of Instructor.

MAT E 463 Introduction to Wear and Friction of Engineering Materials
★3 *(fi 6)* (either term, 3-0-0). The materials aspects of wear and tribology. Wear mechanisms, tribological behavior of materials, characterization techniques, wear protection. Prerequisite: MAT E 358 or consent of Instructor.

MAT E 464 Materials Process Engineering Design
★4.5 *(fi 6)* (first term, 3-0-3). Engineering design concepts in materials processing. Cost estimation. Project planning and scheduling. Plant safety and hazards analysis. Selected project design examples. Credit may not be obtained in this course if previous credit has been obtained in MAT E 365. Prerequisites: CME 265 and MAT E 340. Corequisites: CH E 314 and ENGG 310 or ENGG 401.

MAT E 465 Materials Design Project
★4 *(fi 6)* (either term, 2-1s-3). Team or individual materials design projects. Selection and optimization of physical/mechanical properties and fabrication processes for chosen components or structures. Credit may not be obtained in this course if previous credit has been obtained in MAT E 443. Prerequisites: MAT E 336, 341, and 351.

MAT E 467 Polymer Science and Engineering
★3.5 *(fi 6)* (either term or Spring/Summer, 3-1s-0). Introduction to polymer physical, mechanical and chemical properties, structure and behavior of polymers, polymer processing, fracture of polymers, fiber-polymer composites, polymer synthesis, polymer characterization, polymer solution and blend thermodynamics, crystallinity, fluid flow in melt processing. Prerequisites: MAT E 252, CH E 312, STAT 235, CHEM 261, or consent of Instructor.

MAT E 468 Materials Research Project I
★2 *(fi 2)* (either term, 0-0-4). Research on current topics in materials engineering including structure, properties, processing or mineral processing. Literature survey on a specific topic and submission of a detailed research proposal. Credit may not be obtained in this course if previous credit has been obtained in MAT E 441. Requires a minimum GPA of 2.7 and consent of instructor.

MAT E 469 Materials Research Project II
★4.5 *(fi 6)* (either term, 0-0-9). Execute research according to research proposal prepared in MAT E 458. Write research report. Credit may not be obtained in this course if previous credit has been obtained in MAT E 442. Prerequisite: MAT E 468.

MAT E 470 Process Dynamics
★3 *(fi 6)* (second term, 3-1s-0). The study of diffusion, mass transfer and reaction kinetics in materials process engineering. The fundamental equations governing mass transfer are applied to study the rate of metallurgical processes. The use of dimensional analysis in scale-up of reactors and mixing in batch and continuous processes is also presented. Credit may not be obtained in this course if previous credit has been obtained in MAT E 440. Prerequisites: MAT E 340 and CH E 312. Co-requisite: CH E 314.

MAT E 471 Ceramics
★3 *(fi 6)* (first term, 3-0-0). Structure, processing, characterization, properties and application of ceramic materials and glass. Ceramic raw materials. Crystal chemistry and physics. Glassy state. Crystal defects, nonstoichiometry, diffusion, phase diagrams. Powder preparation, ceramic fabrication. Characterization of ceramic powders and components. Thermal, mechanical and electrical properties. Traditional and recent applications. Credit may not be obtained in this course if previous credit has been obtained in MAT E 480. Prerequisites: MAT E 221,341 or consent of Instructor.

MAT E 473 Shaping and Treating of Materials
★3.5 *(fi 6)* (second term, 3-1s-0). Heat treating of metals and alloys, annealing, age hardening, steel processing and sintering. Forming processes. Machining, Joining (welding, brazing and soldering). Polymer and ceramic processing. Prerequisites: MAT E 336 and 351.

MAT E 474 Performance of Materials
★3.5 *(fi 6)* (second term, 3-1s-0). Behaviour of materials in service, such as corrosion and oxidation, wear and tribology, failure analysis and surface engineering. Case studies will be used to illustrate principles. Prerequisites: MAT E 336 and 341.

MAT E 481 Processing and Applications of Ceramics
★3 *(fi 6)* (either term, 3-0-0). Production of raw materials, ceramic powders, additives, forming operations, thick and thin films, sintering, finishing steps. Defects, mass and electrical transport, microstructure. Applications include space shuttle tiles, superconductors, cutting tools, integrated circuit component and substrates, turbine engines, high energy density batteries, sensors, fuel cells, lasers and composites. Prerequisite: MAT E 480 or consent of Instructor.

MAT E 489 Advanced High Strength Steels
★3 *(fi 6)* (either term, 3-0-0). Processing and metallurgy of microalloyed steels for pipelines. Steelmaking, casting, thermomechanical processing, pipe fabrication, mechanical and chemical properties and in service performance. Prerequisite: MAT E 452.

MAT E 491 Functional Properties
★3.5 *(fi 6)* (first term, 3-1s-0). Band theory of solids. Dielectric materials, insulators, capacitance, piezoelectrics and pyroelectrics, electro-optical ceramics, ionic conductors. Semiconductors, doping, p/n junctions. Superconductivity, low and high TC materials, processing. Shape memory alloys. Magnetic and optical properties. Property measurement. Prerequisite: MAT E 335.

MAT E 494 Nanostructured Materials
★3.5 *(fi 6)* (second term, 3-1s-0). Types of materials and scaling. Ultrafine powders and communition. Nanocomposites. Thin films and coatings. MEMS. Fullerenes and nanotubes. Processing, sol-gel, vacuum deposition, selfassembly, consolidation. Properties and characterization. Prerequisites: MAT E 221, 336 and 351.

MAT E 533 Mineral Processing II
★2.8 *(fi 4)* (either term, 2-0-3/2). Chemical and mineralogical analyses of ores, metallurgical testing, process evaluation, flowsheet development and economic evaluation. Prerequisite: MAT E 331.

Graduate Courses

MAT E 601 Research Techniques in Materials Engineering
★3.5 *(fi 6)* (either term, 2-0-3). Statistical analysis, electron diffraction, crystal growth, diffuse scattering of x-rays, electron emission, high speed strain measurements, internal friction and radioactive tracers. Zone refining, high pressure and vacuum processes.

MAT E 615 Quality Control of Weldments
★3.8 *(fi 6)* (either term, 3-0-3/2). Quality assurance schemes and audits; destructive and non-destructive testing methods; fabrication code requirements and fitness-for-purpose criteria; welding procedures; statistical methods; case studies. Prerequisites: MAT E 610 and 611 or consent of Instructor.

MAT E 630 Special Topics in Process Metallurgy
★3 *(fi 6)* (either term, 3-0-0). Topics of current interest related to process metallurgy, such as process analysis, mathematical modelling and simulation, metal extraction from secondary sources, iron and steel making, physical chemistry of molten systems and production of industrial minerals.

MAT E 633 Surface Chemistry in Minerals and Materials Processing
★5 *(fi 6)* (either term, 3-1s-3). Fundamentals of surface and interfacial phenomena; physical chemistry of surfaces and interfaces; surface and interface energy and their origin; wetting, adhesion and surface forces in material processing; role and mechanisms of surfactant adsorption and self-assembly in materials engineering; techniques for surfactant adsorption and self-assembly in materials engineering; techniques for surface characterization. The course includes an experimental research project of 3 hours per week. Credit cannot be obtained in this course if credit has already been obtained in MAT E 433.

MAT E 640 Advanced Materials Thermodynamics
★3 *(fi 6)* (either term, 3-0-0). Advanced topics in core fundamentals of materials thermodynamics. Thermodynamic laws, statistical thermodynamics, reaction equilibria, phase diagrams, solutions, changing standard states, electrochemistry, and thermodynamics of surfaces. Prerequisite: MAT E 340 or consent of Instructor.

MAT E 645 Electrochemical Processes
★3 *(fi 6)* (either term, 3-0-0). Aqueous, molten and solid electrolytes: thermodynamics, structure, transport properties. Applications of conductivity measurements. Electrodes: types, reactions, potential. Electrochemical cells. Applications of EMF measurements. Electrical double layer, electrode kinetics, overpotential. Chlor-alkali industry, electrometallurgy, electrolysis of water, electroplating. Electrochemical energy conversion: primary and secondary batteries, fuel cells. High temperature applications. Prerequisite: MAT E 430 or consent of Instructor.

MAT E 653 Stress Corrosion Cracking
★3 *(fi 6)* (either term, 3-0-0). The role of corrodents, stresses and microstructure in the phenomena of stress corrosion cracking; dissolution models and mechanical models proposed as mechanisms. Stress corrosion of high-strength steels, stainless steels and the principal nonferrous metals. Stress corrosion testing and methods of preventing stress corrosion cracking. Prerequisite: MAT E 345 or consent of Instructor. Credit cannot be obtained in this course if credit has already been obtained in MAT E 455.

MAT E 654 Electrochemical Theory of Corrosion
★3 *(fi 6)* (either term, 3-0-0). Principles and applications of electrochemical corrosion theory in basic and applied research. Equilibrium thermodynamics and electrode kinetics. Passivation and breakdown of passivity. The study of galvanic corrosion; alloy evaluation. Corrosion testing methods and electrochemical measurement of corrosion rates. Prerequisite: MAT E 345 or consent of Instructor.

MAT E 660 Crystallography and Diffraction in Materials Science
★3 *(fi 6)* (either term, 3-0-0). Advanced concepts of geometric crystallography and the crystal structure of materials, the advanced theory of X-ray diffraction and the advanced experimental practice of X-ray diffraction methods of materials analysis. This course will concentrate on methods and techniques that are useful for the analysis of metals, ceramics, polymers, and semiconductors. Prerequisite: MAT E 256 or consent of Instructor.

MAT E 662 Fracture of Materials
★3 *(fi 6)* (either term, 3-0-0). Theoretical strength of solids, Griffith crack theory, mechanisms of brittle and ductile fracture, the ductile to brittle transition, fatigue and creep fracture, environmental effects on fracture. Prerequisites: MAT E 358 or consent of Instructor. Credit cannot be obtained in this course if credit has already been obtained in MAT E 462.

MAT E 663 Wear and Protection of Engineering Materials
★4.5 *(fi 6)* (either term, 3-0-3). The materials aspects of wear and tribology. Wear mechanisms, tribology behavior of materials, characterization techniques, wear protection. Prerequisite: MAT E 358 or consent of Instructor. Not open to students with credit in MAT E 463.

MAT E 664 Diffusion and Diffusion-Controlled Processes in Metallurgy and Materials
★3 *(fi 6)* (either term, 3-0-0). Fundamentals of diffusion, diffusion in dilute alloys, diffusion in a concentration gradient, diffusion in non-metals, high diffusivity paths, thermal diffusion. Applications to materials: sintering, superplasticity, creep, metal oxides and non-stoichiometry.

MAT E 665 Materials Applications of Transmission Electron Microscopy
★4.5 *(fi 6)* (either term, 3-0-3). Principles and design of the transmission electron microscope, specimen preparation, electron diffraction, image contrast theory, introduction to analytical electron microscopy. Applications to defects in metallic and non-metallic crystalline materials. Prerequisite: MAT E 358 or consent of Instructor.

MAT E 666 Materials Applications of Scanning Electron Microscopy
★3 *(fi 6)* (either term, 3-0-0). Principles and design of the scanning electron microscope, electron beam-specimen interactions, image formation, x-ray microanalysis in the scanning electron microscope, specimen preparation, application to materials analysis. Prerequisite: MAT E 358 or consent of Instructor.

MAT E 676 Special Topics in Physical Metallurgy
★3 *(fi 6)* (either term, 3-0-0). Subjects of current interest such as kinetics of heterogeneous nucleation and phase transformations in solids, grain boundary phenomena, internal friction, physics and chemistry of friction and wear.

MAT E 680 Advanced Ceramics
★3 *(fi 6)* (either term, 3-0-0). Important ceramic materials and products, processing, typical properties. Structure: binary and ternary compounds, crystalline silicates, glass. Point defects, nonstoichiometry, defect reactions, dislocations. Diffusion, electrochemical transport, examples. Thermal and mechanical properties, thermal shock resistance, electrical conduction. Applications: solid electrolytes, energy conversion systems, refractories, electronics. Prerequisites: MAT E 332 and 357 or consent of Instructor. Credit cannot be obtained in this course if credit has already been obtained in MAT E 481.

MAT E 689 Advanced Processing of Microalloyed Steels
★3.5 *(fi 6)* (either term, 3-1s-0). Advanced processing and metallurgy of microalloyed steels for pipelines. Steelmaking, casting, microstructural development during thermomechanical processing, pipe fabrication, mechanical and chemical properties and in service performance. Prerequisites: MAT E 452 or the consent of Instructor. Not open to students with credit in MAT E 489.

MAT E 738 Process Metallurgy
★3 *(fi 6)* (either term, 3-0-0).

MAT E 778 Physical Metallurgy
★3 *(fi 6)* (either term, 3-0-0).

MAT E 900 Directed Research
★6 *(fi 12)* (variable, unassigned). An engineering project for students registered in a Master of Engineering program.

231.181   Mathematical Physics, MA PH

Departments of Mathematical and Statistical Sciences; and Physics
Faculty of Science

Undergraduate Courses

Note: Permission to enrol in any mathematical physics course will not normally be granted unless the stated prerequisites have been met. However, students may enrol in a mathematical physics course if their department and the course instructor agree that their background and academic standing warrant the waiver of the stated prerequisites.

◘ MA PH 343 Classical Mechanics I
★3 *(fi 6)* (first term, 3-0-0). Principles of mechanics; non-inertial frames; Lagrange's equations and Hamilton's principle; dynamics of oscillating systems; rigid body kinematics and dynamics; Hamiltonian methods and canonical transformations. Prerequisite: PHYS 244. Corequisite: MATH 215 or 317.

◘ MA PH 451 Mathematical Methods of Physics I
★3 *(fi 6)* (first term, 3-0-0). Application to problems in physics of method of steepest descent, Fourier and Laplace transforms; boundary-value problems, integral equations, and Green's functions. Prerequisites: MATH 311 and 337, or equivalents.

◘ MA PH 453 Mathematical Methods of Physics II
★3 *(fi 6)* (second term, 3-0-0). Group representation theory and applications to problems in physics; spectral theory for matrices; application to the theory of resolvents and their relation to Green's functions; calculus of variations; integral representations of special functions. Prerequisite: MA PH 451.

◘ MA PH 468 Introduction to Relativity
★3 *(fi 6)* (second term, 3-0-0). Special relativity; principle of equivalence; Einstein field equations; stationary and static fields; Schwarzschild metric, experimental tests; black holes; linearized equations; gravitational collapse; cosmology. Prerequisite: PHYS 351 or MATH 446 or equivalent.

Graduate Courses

Note: The following undergraduate courses may be taken for graduate credit: MA PH 343, 451, 453, 467, 468.

231.182   Mathematics, MATH

Department of Mathematical and Statistical Sciences
Faculty of Science

Notes
(1) MATH 100, 101, 102, 201, 209, 300, 309 are open to Engineering students only.
(2) See Mathematical Physics (MA PH) listing for courses offered jointly by the Department of Physics and the Department of Mathematical and Statistical Sciences.
(3) Students who might take a calculus course as part of their program at the University of Alberta are encouraged to take Math 31, or equivalent, as part of their high school program.

Undergraduate Courses

MATH 100 Calculus I
★4 *(fi 6)* (either term, 3-0-2). Review of numbers, inequalities, functions, analytic geometry; limits, continuity; derivatives and applications, Taylor polynomials; log, exp, and inverse trig functions. Integration, fundamental theorem of calculus substitution, trapezoidal and Simpson's rules. Prerequisites: Pure Mathematics 30 or equivalent, and Mathematics 31. Notes: (1) This course may not be taken for credit if credit has already been obtained in MATH 113, 114, or 117. (2) Students in all sections of this course will write a common final examination. (3) Restricted to Engineering students. Non-Engineering students who take this course will receive ★3.0.

MATH 101 Calculus II
★3.5 *(fi 6)* (either term, 3-0-1). Area between curves, techniques of integration. Applications of integration to planar areas and lengths, volumes and masses. First order ordinary differential equations: separable, linear, direction fields, Euler's method, applications. Infinite series, power series, Taylor expansions with remainder terms. Polar coordinates. Rectangular, spherical and cylindrical coordinates in 3-dimensional space. Parametric curves in the plane and space: graphing, arc length, curvature; normal binormal, tangent plane in 3-dimensional space. Volumes and surface areas of rotation. Prerequisite: MATH 100. Notes: (1) This course may not be taken for credit if credit has already been obtained in either MATH

Course Listings M

115 or 118. (2) Students in all sections of this course will write a common final examination. (3) Restricted to Engineering students. Non-Engineering students who take this course will receive ★3.0.

MATH 102 Applied Linear Algebra
★3.5 *(fi 6)* (either term, 3-0-1). Vectors and matrices, solution of linear equations, equations of lines and planes, determinants, matrix algebra, orthogonality and applications (Gram-Schmidt), eigenvalues and eigenvectors and applications, complex numbers. Prerequisite or corequisite MATH 100. Notes: (1) This course may not be taken for credit if credit has already been obtained in MATH 120 or 125 or 127. (2) Students in all sections of this course will write a common final examination. (3) Restricted to Engineering students. Non-Engineering students who take this course will receive ★3.0.

◻ MATH 113 Elementary Calculus I
★3 *(fi 6)* (either term, 3-0-1). Review of analytic geometry. Differentiation and integration of simple functions. Applications. Prerequisite: Pure Mathematics 30 or equivalent. Students who have taken Mathematics 31 are advised to take MATH 114. See Note (3) at the beginning of the Mathematic course listings. This course may not be taken for credit if credit has already been obtained in MATH 100, 114 or 117.

◻ MATH 114 Elementary Calculus I
★3 *(fi 6)* (either term, 3-0-0). The course description is the same as for MATH 113. Prerequisites: Pure Mathematics 30, Mathematics 31 or equivalent. This course may not be taken for credit if credit has been obtained in MATH 100, 113 or 117.

◻ MATH 115 Elementary Calculus II
★3 *(fi 6)* (either term, 3-0-0). Differentiation and integration of trigonometric, exponential and logarithmic functions. Indeterminate forms and improper integrals. Techniques of integration. Application. Prerequisite: MATH 113 or 114, or equivalent. Note: This course may not be taken for credit if credit has already been obtained in either of MATH 101 or 118.

◻ MATH 117 Honors Calculus I
★3 *(fi 6)* (first term, 4-0-0). Functions, continuity, and the derivative. Applications of the derivative. Extended limits and L'Hospital's rule. Prerequisite: Pure Mathematics 30 and 31 or their equivalents. Notes: This course is designed for students with at least a 80 percent grade in Pure Mathematics 30 and Mathematics 31. Other students may be admitted with the consent of the Department. This course may not be taken for credit if credit has already been obtained in any of MATH 100, 113, or 114. Engineering students will receive a weight of 4.0 units for this course.

◻ MATH 118 Honors Calculus II
★3 *(fi 6)* (second term, 4-0-0). Integration and the Fundamental Theorum. Techniques and applications of integration. Derivatives and integrals of the exponential, and trigonometric functions. Introduction to infinite series. Introduction to partial derivatives. Prerequisite: MATH 117 or its equivalent. Students with MATH 113 or 114 will be admitted with the consent of Department. Note: This course may not be taken for credit if credit has already been obtained in MATH 101 or 115. Engineering students will receive a weight of 4.0 units for this course.

◻ MATH 120 Basic Linear Algebra I
★3 *(fi 6)* (either term, 3-0-0). Systems of linear equations. Vectors in n-space, vector equations of lines and planes. Matrix algebra, inverses and invertibility. Introduction to linear transformations. Subspaces of n-space. Determinants. Introduction to eigenvalues and eigenvectors. The dot product and orthogonality. Applications in a variety of fields, numerical methods. Prerequisite: Pure Mathematics 30. Notes: (1) See also course description for MATH 125. (2) This course cannot be taken for credit if credit has already been obtained in any of MATH 102, 125 or 127. (3) Students planning to transfer into Engineering should take MATH 125 rather than MATH 120. (4) May contain Alternate Delivery sections; see Section 200.

◻ MATH 125 Linear Algebra I
★3 *(fi 6)* (either term, 3-0-0). Systems of linear equations. Vectors in n-space, vector equations of lines and planes. Matrix algebra, inverses and invertibility. Introduction to linear transformations. Subspaces of n-space. Determinants. Introduction to eigenvalues and eigenvectors. The dot product and orthogonality. Applications in a variety of fields, numerical methods. Prerequisites: Pure Mathematics 30. Notes: (1) This course is an enriched version of the basic linear algebra course MATH 120. It covers the same basic topics as MATH 120. However, some of these basic topics will be covered in more depth than in MATH 120. Also the instructor will discuss some additional applications and/or discuss some of the applications in more depth. MATH 125 is recommended for all students with at least 80% in Pure Mathematics 30. It is also recommended for students who plan to take further courses in algebra. (2) This course cannot be taken for credit if credit has already been obtained in MATH 102, 120 or 127.

◻ MATH 153 Elementary Theory of Interest
★3 *(fi 6)* (either term, 3-0-0). Simple and compound interest, simple and general annuities certain; variable annuities and perpetuities, amortization schedules, sinking funds, applications. Prerequisite: Pure Mathematics 30. Note: This course may not be taken for credit if credit has already been obtained in MATH 253.

MATH 160 Higher Arithmetic
★3 *(fi 6)* (either term, 3-0-0). Elementary Number Theory, Numeration Systems,

Number Systems and Elementary Probability Theory. Math Fair. Prerequisite: Pure Mathematics 30 or consent of Department. Note: This course is restricted to Elementary Education students.

MATH 164 Higher Algebra
★3 *(fi 6)* (either term, 3-0-0). Polynomial functions, factorization, theory of equations, inequalities, convexity and concavity, extremal problems, additional topics. Restricted to students in Open Studies as part of the EPSB Teacher Upgrade Program.

MATH 201 Differential Equations
★3.5 *(fi 6)* (either term or Spring/Summer, 3-0-1). First-order equations; second-order linear equations: reduction of order, variation of parameters; Laplace transform; linear systems; power series; solution by series; separation of variables for PDEs. Prerequisite or corequisite: MATH 209 or 214. Notes: (1) Open only to Engineering students and Science students in the following programs: Specialization Physics, Specialization Geophysics or Specialization Computing Science. (2) This course may not be taken for credit if credit has already been obtained in any of MATH 205, 334, or 336. (3) Students in all sections of this course will write a common final examination. Non-Engineering students who take this course will receive ★3.0.

MATH 209 Calculus III
★3.5 *(fi 6)* (either term, 3-0-1). Partial differentiation, derivatives of integrals. Multiple integration using rectangular, cylindrical, and spherical coordinates. Vector Field Theory. Prerequisite: MATH 101. Prerequisite or corequisite: MATH 102. Notes: (1) Students in all sections of this course will write a common final examination. (2) Restricted to Engineering students. Non-Engineering students who take this course will receive ★3.0.

◻ MATH 214 Intermediate Calculus I
★3 *(fi 6)* (either term, 3-0-0). Infinite Series. Plane curves and polar coordinates. Three dimensional analytic geometry. Partial derivatives. This course may not be taken for credit if credit has already been obtained in MATH 209 or MATH 217. Prerequisite: MATH 115 or equivalent.

◻ MATH 215 Intermediate Calculus II
★3 *(fi 6)* (second term, 3-0-0). First order and second order linear differential equations with constant coefficients. Curves, tangent vectors, arc length, integration in two and three dimensions, polar cylindrical and spherical coordinates, line and surface integrals. Green's divergence and Stokes' theorems. Note: This course may not be taken for credit if credit has already been obtained in MATH 209 or 317. Prerequisite: MATH 214 or equivalent.

◻ MATH 217 Honors Advanced Calculus I
★3 *(fi 6)* (first term, 4-0-0). Axiomatic development of the real number system. Topology of Rn. Sequences, limits and continuity. Multi-variable calculus: differentiation and integration, including integration in spherical and polar coordinates. The differential and the chain rule. Taylor's Formula, maxima and minima. Introduction to vector field theory. Prerequisites: MATH 118 (or MATH 115 or 101 with consent of Department) and MATH 120 or 125 or any linear algebra course. Engineering students will receive a weight of 4.0 units for this course.

◻ MATH 222 Introduction to Discrete Mathematics
★3 *(fi 6)* (either term, 3-0-0). A problem-solving approach to discrete mathematics, covering secret codes, public-key codes, error-correcting codes, enumeration, recurrence relations, induction, graph theory, graph algorithms and parallel algorithms. Prerequisite: Any 100-level mathematics course, MATH 120 or 125 recommended.

◻ MATH 225 Linear Algebra II
★3 *(fi 6)* (either term, 3-0-0). Vector spaces. Inner product spaces. Examples of n-space and the space of continuous functions. Gram-Schmidt process, QR-factorization of a matrix and least squares. Linear transformations, change of basis, similarity and diagonalization. Orthogonal diagonalization, quadratic forms. Applications in a variety of fields, numerical methods. Prerequisite: MATH 120 or 125 or any linear algebra course, Mathematics 31 or any calculus course. Note: This course cannot be taken for credit if credit has already been obtained in MATH 121 or 227.

◻ MATH 228 Algebra: Introduction to Ring Theory
★3 *(fi 6)* (either term, 3-0-0). Integers. Mathematical induction. Equivalence relations. Commutative rings, including the integers mod n, complex numbers and polynomials. The Chinese remainder theorem. Fields and integral domains. Euclidean domains, principal ideal domains and unique factorization. Quotient rings and homomorphisms. Construction of finite fields. Applications such as public domain encryption, Latin squares and designs, polynomial error detecting codes, and/or addition and multiplication of large integers. Prerequisite: MATH 120 or 125 or any linear algebra course. Note: This course cannot be taken for credit if credit has already been obtained in MATH 128 or 223.

◻ MATH 241 Geometry
★3 *(fi 6)* (either term, 3-0-0). Basic Euclidean geometry, congruence, parallelism, area, and similarity. Sound axiomatic development with emphasis on problem solving. Constructions and loci, inequalities, maxima and minima, circles, isometries, and additional topics. Prerequisites: Any 100-level Mathematics course.

O MATH 243 Transformation Geometry

★3 *(fi 6)* (second term, 3-0-0). Transformation geometry, isometry and homothety, applications in Euclidean geometry; the algebra of transformations, the Classification Theorem, frieze patterns and wall-paper groups. Prerequisite: MATH 241

O MATH 253 Theory of Interest

★3 *(fi 6)* (either term, 3-0-0). Accumulation and amount functions, effective, nominal, simple, and compound rates, force of interest and discount, simple and general annuities certain, variable annuities and perpetuities, amortization schedules and sinking funds, bonds and other securities, applications, installment loans, depreciation, depletion, capitalized cost. Prerequisite: MATH 115 or equivalent. Corequisite: MATH 214.

MATH 260 Topics in Mathematics

★3 *(fi 6)* (second term, 3-0-0). Problem solving in different areas of mathematics. Note: This course is intended for Education students and is not open to Science students. Prerequisite: MATH 160 or teaching experience at the elementary or junior high school level.

MATH 300 Advanced Boundary Value Problems I

★3 *(fi 6)* (either term, 3-0-0). Derivation of the classical partial differential equations of applied mathematics, solutions using separation of variables. Fourier expansions and their applications to boundary value problems. Introduction to Fourier Transform. Emphasis on building an appropriate mathematical model from a physical problem, solving the mathematical problem, and carefully interpreting the mathematical results in the context of the original physical problem. Prerequisites: MATH 201 and 209 or equivalents. Notes: (1) Open only to students in Engineering, Specialization Computing Science, Specialization Physics, and Specialization Geophysics. (2) This course may not be taken for credit if credit has already been obtained in MATH 337.

O MATH 309 Mathematical Methods for Electrical Engineers

★3 *(fi 6)* (first term, 3-0-0). Complex numbers, analytic functions, Cauchy-Riemann equation, Cauchy Theorem, power series and Laurent expansions, residues, inverse Laplace transform. Complex inner product spaces, orthogonal expansions, Gram-Schmidt orthogonalization completeness, Fourier expansions applied signals, Parseval's relation and Bessel's inequality. Prerequisite MATH 209. This course may not be taken for credit if credit has already been obtained in MATH 311 or 411.

O MATH 311 Theory of Functions of a Complex Variable

★3 *(fi 6)* (either term, 3-0-0). Complex numbers. Complex series. Functions of a complex variable. Cauchy's theorem and contour integration. Residue Theorem and its applications. Introduction to Fourier integrals and the Heisenberg inequality. Prerequisite or corequisite: MATH 209 or 215.

O MATH 314 Analysis I

★3 *(fi 6)* (first term, 3-0-0). Construction of real numbers, Heine-Borel and related theorems, differentiation and Riemann integral of functions, topological concepts in metric spaces, sequences, continuous maps, contraction maps, and applications. Prerequisite: MATH 209 or 215 or equivalent.

O MATH 317 Honors Advanced Calculus II

★3 *(fi 6)* (second term, 4-0-0). Implicit function theorem. Transformations of multiple integrals. Line integrals, theorems of Green, Gauss and Stokes. Sequences and series of functions. Uniform convergence. Prerequisite: MATH 217.

O MATH 322 Graph Theory

★3 *(fi 6)* (first term, 3-0-0). Graphs, paths and cycles, trees, planarity and duality, coloring problems, digraphs, matching problems, matroid theory. Prerequisite: MATH 120 or 125 or equivalent and any 200-level MATH course. MATH 222 recommended.

O MATH 324 Elementary Number Theory

★3 *(fi 6)* (first term, 3-0-0). Divisibility, prime numbers, congruences, quadratic residues, quadratic reciprocity, arithmetic functions and diophantine equations; sums of squares. Prerequisites: MATH 228 (or 128 or 223).

O MATH 325 Algebra: Vector Spaces and Modules

★3 *(fi 6)* (second term, 3-0-0). Abstract vector spaces. Modules over a principal ideal domain. Finitely generated abelian groups. Linear transformations, the Jordan canonical form and the rational canonical form. Application to matrix powers, discrete system evolution, matrix exponentials and differential equations. Prerequisites: MATH 225 (or 121 or 227) and 228 (or 128 or 223). Note: This course cannot be taken for credit if credit has already been obtained in MATH 427.

O MATH 328 Algebra: Introduction to Group Theory

★3 *(fi 6)* (either term, 3-0-0). Groups as a measure of symmetry. Groups of rigid motions. Frieze groups, and finite groups in 2 and 3 dimensions. Groups of matrices. Group actions with application to counting problems. Permutation groups. Subgroups, cosets, and Lagrange's Theorem. Quotient groups and homomorphisms. Prerequisite: MATH 228. This course may not be taken for credit if credit has already been obtained in MATH 229.

O MATH 334 Introduction to Differential Equations

★3 *(fi 6)* (either term, 3-0-0). First order equations, linear equations of higher order. Power series solution. Laplace transform methods. Introduction to special functions. Introduction to linear systems. Prerequisite: MATH 120 or 125 or equivalent. Corequisite: MATH 215 or 317. Note: This course may not be taken for credit if credit has already been obtained in MATH 201 or 336.

O MATH 337 Introduction to Partial Differential Equations

★3 *(fi 6)* (second term, 3-0-0). Boundary value problems of classical Math Physics, orthogonal expansions, classical special functions. Advanced transform techniques. Note: This course may not be taken for credit if credit has already been obtained in either MATH 334 or 336. Prerequisite: MATH 334.

O MATH 341 Geometry of Convex Sets

★3 *(fi 6)* (second term, 3-0-0). Combinatorial geometry and topology, convex sets, sets with constant width, Helly-type problems, extremal problems. Prerequisite: MATH 120 or 125 or equivalent, MATH 222 or MATH 241.

O MATH 343 Projective and Inversive Geometries

★3 *(fi 6)* (second term, 3-0-0). Projective geometry, Poncelet-Steiner constructions, inverse geometry, Mohr-Mascheroni constructions, Principle of Duality, conic sections. Prerequisite: MATH 241.

O MATH 347 Set Theory

★3 *(fi 6)* (first term, 3-0-0). Axioms for set theory, transfinite induction, cardinal and ordinal numbers, applications. Primarily intended for students enrolled in an honors or specialization program in mathematics. Prerequisite: One of MATH 215, 217, 228, 328.

O MATH 356 Introduction to Mathematical Finance I

★3 *(fi 6)* (first term, 3-0-0). Simple Market Model: one-step binomial model, basic notions and assumptions. Risk-Free Assets: simple interest, zero-coupon bonds, money market account. Risky Assets: dynamic of stock prices, binomial tree model, trinomial tree model. Discrete time market model: stock and money market model, extended models. Portfolio management: risk, two securities, capital asset pricing model. Prerequisite: MATH 253 and STAT 265 or consent of the Department.

O MATH 357 Introduction to Mathematical Finance II

★3 *(fi 6)* (second term, 3-0-0). Forward and futures contracts: forward and futures prices, hedging with futures. Options: put-call parity, bounds on option prices, time value of options. Option pricing: European and American options in the binomial tree model, Black-Scholes formula. Financial engineering: hedging option positions, hedging business risk. Variable interest rates: maturity-independent yields, general term structure. Stochastic interest rates: arbitrage pricing of bonds, interest rate derivative securities. Prerequisite: MATH 356 or consent of the Department.

O MATH 363 History of Mathematics

★3 *(fi 6)* (second term, 3-0-0). Topics or trends, as selected by the instructor, in ancient (including all cultures), classical or modern mathematics will be covered from an historical point of view. May be offered in alternate years. Prerequisites: MATH 101 or 115 or 118, MATH 102 or 120 or 125 and any 200-level MATH course.

O MATH 372 Mathematical Modelling I

★3 *(fi 6)* (either term, 3-0-0). This course is designed to develop the students' problem-solving abilities along heuristic lines and to illustrate the processes of Applied Mathematics. Students will be encouraged to recognize and formulate problems in mathematical terms, solve the resulting mathematical problems and interpret the solution in real world terms. Typical problems considered include nonlinear programming, optimization problems, diffusion models. Prerequisite: MATH 120 or 125 or equivalent; MATH 215.

O MATH 373 Mathematical Programming and Optimization I

★3 *(fi 6)* (first term, 3-0-0). Introduction to optimization. Problem formulation. Linear programming. The simplex method and its variants (revised Simplex method, dual simplex method). Extreme points of polyhedral sets. Theory of linear inequalities (Farkas Lemma). Complementary slackness and duality. Post-optimality analysis. Interior point methods. Applications (elementary games, transportation problems, networks, etc.). Pre- or corequisites: MATH 120 or 125 or equivalent; any 200-level MATH course.

O MATH 374 Mathematical Programming and Optimization II

★3 *(fi 6)* (second term, 3-0-0). Maximizing and minimizing functions of several variables (with or without constraints). Optimality conditions (necessary, sufficient, Karush-Kuhn-Tucker conditions). Iterative methods for unconstrained optimization. Penalty methods for constrained optimization. Trust region methods. Convex sets, convex functions, convex programming and dual convex programs. Dynamic programming. Applications. Prerequisites: MATH 215 or 217 and MATH 373.

O MATH 381 Numerical Methods I

★3 *(fi 6)* (either term, 3-0-1). Approximation of functions by Taylor series, Newton's formulae, Lagrange and Hermite interpolation. Splines. Orthogonal polynomials and least-squares approximation of functions. Direct and iterative methods for solving linear systems. Methods for solving non-linear equations and systems of non-linear equations. Introduction to computer programming. Prerequisite: MATH 214 or equivalent, MATH 120, 125 or equivalent. Note: Credit can be obtained for at most one of MATH 280, 381, CMPUT 340. Note: Extra classes may be held for students lacking a background in one of the major programming languages such as Fortran, C, C++ or Matlab.

MATH 400 Industrial Internship Practicum
★3 *(fi 6)* (first term, 0-3s-0). Required by all students who have just completed a Mathematical Sciences Industrial Internship Program. Must be completed during the first academic term following return to full-time studies. Note: A grade of F to A+ will be determined by the student's job performance as evaluated by the employer, by the student's performance in the completion of an internship practicum report, and by the student's ability to learn from the experience of the Internship as demonstrated in an oral presentation. Prerequisite: WKEXP 953.

Ⓞ MATH 411 Honors Complex Variable I
★3 *(fi 6)* (first term, 3-0-0). Complex number system. Analytic functions. Single- and multi-valued functions, Cauchy's theorem and formula. Applications including the maximum modulus principle, Taylor's theorem and Laurent expansion. Harmonic functions. Dirichlet problem for the disk. Series of analytic functions. Calculus of residues. Idea of Analytic Continuation. Note: This course is primarily for Honors students in Mathematics or Physics. Offered in alternate years. It may be offered in intervening years if demand is sufficient. Prerequisite: MATH 314 or 317.

Ⓞ MATH 414 Analysis II
★3 *(fi 6)* (second term, 3-0-0). Differentiation of maps in Rn, implicit function and mapping theorems, sequences of functions, Riemann-Stieltjes integration, additional topics at the discretion of the instructor. Prerequisite: MATH 314.

Ⓞ MATH 417 Honors Real Variables I
★3 *(fi 6)* (first term, 3-0-0). Elements of set theory, cardinality, brief construction of real numbers. Lebesgue measure and Lebesgue integral on the line. Differentiability, Riemann-Stieltjes integral and functions of bounded variation. Prerequisite: MATH 317 or equivalent.

Ⓞ MATH 418 Honors Real Variables II
★3 *(fi 6)* (second term, 3-0-0). Differentiation and integration. Elementary metric space theory. Banach space. Hilbert space. Baire Category. Lp spaces. Trigonometric series. Prerequisite: MATH 417.

Ⓞ MATH 421 Combinatorics
★3 *(fi 6)* (second term, 3-0-0). Permutations and combinations, Binomial Theorem, Principle of Inclusion-Exclusion, recurrence relations, generating functions, orthogonal Latin squares, balanced incomplete block designs, Steiner triple systems, perfect difference sets, Boolean algebra and Finite State Machines. Prerequisites: MATH 228 (or 223 or 128); any 300-level MATH course, MATH 322 recommended.

Ⓞ MATH 422 Coding Theory
★3 *(fi 6)* (second term, 3-0-0). Elements of group theory, cosets, Lagrange's theorem, binary group codes, polynomials, finite field theory, error correcting codes. Prerequisites: MATH 228 (or 223, or 128), any 300-level MATH course.

Ⓞ MATH 424 Algebra: Groups and Fields
★3 *(fi 6)* (first term, 3-0-0). Field extensions. Groups of automorphisms of fields. Galois theory. Finite fields and applications. Solvable groups, the insolvability of the quintic equation. Ruler and compass construction. Prerequisite: MATH 328 MATH 225 recommended. Note: (1) This course cannot be taken for credit if credit has already been obtained in MATH 427 or 329.

Ⓞ MATH 428 Algebra: Advanced Ring Theory
★3 *(fi 6)* (second term, 3-0-0). Topics in ring theory selected by the Instructor. The topics will be chosen to illustrate the use of ring theory in another area of mathematics such as the theory of numbers, algebraic geometry, representations of groups or computational algebra. Note: This course will normally be offered in alternate years beginning in 2000-2001. Prerequisite: MATH 325 (or 427) or consent of Department.

Ⓞ MATH 429 Algebra: Advanced Group Theory
★3 *(fi 6)* (second term, 3-0-0). The Sylow theorems, p-groups. Groups of small order. Simple groups and composition series. Additional topics in group theory. Note This course will normally be offered in alternate years beginning in 2001-2002. Prerequisite: MATH 328.

Ⓞ MATH 432 Intermediate Differential Equations
★3 *(fi 6)* (second term, 3-0-0). Elementary existence and uniqueness theorems. Systems of equations, stability, perturbation theory. Introduction to numerical methods. Introduction to phase plane analysis. Prerequisite: MATH 334 or 336.

Ⓞ MATH 436 Intermediate Partial Differential Equations I
★3 *(fi 6)* (first term, 3-0-0). Introduction to partial differential equations as physical models. Linear and quasilinear first-order equations. Classification of second order linear equations and reduction to canonical form. Characteristic surfaces and curves and shock formation. Formulation of initial and boundary-value problems. Stability theory and well-posedness. Introduction to spectral theory for positive self-adjoint operators on bounded domains. Finite Fourier Transforms. Duhamel's Principle. Eigenfunction expansions for nonlinear stability theory. Prerequisite: MATH 337.

Ⓞ MATH 438 Intermediate Partial Differential Equations II
★3 *(fi 6)* (second term, 3-0-0). Introduction to transforms; Fourier, Hankel, Laplace; asymptotic approximation of Fourier Integrals; applications to discontinuous solutions of the wave equation, point sources, fundamental solutions, Green's Functions, with an introduction to generalized functions. Eigenfunction expansions and applications. Difference equations. Prerequisite: MATH 436.

Ⓞ MATH 446 Tensor Analysis
★3 *(fi 6)* (first term, 3-0-0). Algebra of tensors, covariant differentiation in flat space, affine geometry, Riemannian geometry, Lie differentiation, subspaces, differential forms. Prerequisites: MATH 225 (or 227); MATH 217.

Ⓞ MATH 447 Elementary Topology
★3 *(fi 6)* (second term, 3-0-0). Set Theory, metric spaces and general topology. Compactness, connectedness. Urysohn's Lemma and Tietze's Theorem. Baire Category Theorem. The Tychonoff Theorem. Homotopy and covering spaces. Primarily intended for third and fourth year students with a good background in Mathematics. Prerequisite: MATH 347 (or 217 and any 300-level MATH course). Offered in alternate years. It may be offered in intervening years if demand is sufficient.

Ⓞ MATH 448 Elementary Differential Geometry I
★3 *(fi 6)* (first term, 3-0-0). Local and global geometry of curves in 3-space; surfaces in 3-space: quadrics, surfaces of revolution, ruled surfaces, minimal surfaces, Gaussian curvature, theorema egregium, geodesics, complete surfaces, Gauss-Bonnet Theorem. Prerequisites: MATH 225 (or 121 or 227); MATH 217; any 300-level MATH course. Offered in alternate years. It may be offered in intervening years if demand is sufficient.

Ⓞ MATH 472 Mathematical Modelling II
★3 *(fi 6)* (second term, 3-0-0). This course is a continuation of MATH 372, but with more emphasis on individual student projects (a term paper may be required) decided in consultation with the instructor and consideration of a student's present interest and mathematical/scientific background. Prerequisite: MATH 372.

Ⓞ MATH 481 Numerical Methods II
★3 *(fi 6)* (second term, 3-0-1). Numerical differentiation and integration. Numerical solution of initial value problems for systems of ordinary differential equations. Numerical solution of boundary value problems for ordinary and partial differential equations. Weighted residual methods and introduction to the finite element method. Prerequisite: MATH 381. Pre- or corequisite: MATH 334. Credit can be obtained for at most one of MATH 380, 481, 486.

Ⓞ MATH 496 Honors Seminar
★3 *(fi 6)* (either term, 3-0-0). This course is intended to give students experience with independent reading, and to improve their ability to present and explain mathematical ideas. The course is compulsory for all fourth year Honors students in BSc and BA Mathematics and BSc Applied Mathematics. Normally offered in alternate years. Prerequisite: MATH 317.

Ⓞ MATH 497 Reading in Mathematics
★3 *(fi 6)* (either term, 3-0-0). This course is designed to give credit to mature and able students for reading in areas not covered by courses, under the supervision of a staff member. A student, or group of students, wishing to use this course should find a staff member willing to supervise the proposed reading program. A detailed description of the material to be covered should be submitted to the Chair of the Department Honors Committee. (This should include a description of testing methods to be used.) The program will require the approval of both the Honors Committee, and the Chair of the Department. The students' mastery of the material of the course will be tested by a written or oral examination. This course may be taken in Fall or Winter and may be taken any number of times, subject always to the approval mentioned above. Prerequisite: Any 300-level MATH course.

Graduate Courses

MATH 501 Directed Study I
★3 *(fi 6)* (either term, 3-0-2). Basic principles of experimental design, completely randomized design-one way ANOVA and ANCOVA. Randomized block design. Latin square design, Multiple comparisons. Nested design. Factorial experiments. Each student will give a written report and seminar presentation highlighting statistical methods used in a research project. Prerequisite: STAT 252 or 337 or equivalent and a course in linear algebra. Note: Not open to graduate students in the Department of Mathematical Sciences.

MATH 506 Complex Variables
★3 *(fi 6)* (either term, 3-0-0). Conformal mapping, normal families, Riemann mapping theorem and symmetry principle. Harmonic functions: basic properties. Maximum modulus principle with Phragmen-Lindelof and Hadamard 3 circle theorem. Entire functions, infinite products and Hadamard factorization. Riemann surfaces. Prerequisite: MATH 411.

MATH 512 Algebraic Number Theory
★3 *(fi 6)* (either term, 3-0-0). Valuations and their extensions, ramifications; integral dependence, algebraic number fields, ideals and divisors, class number. Prerequisite: MATH 427.

MATH 515 Mathematical Finance I
★3 *(fi 6)* (either term, 3-0-0). Probability tools for discrete financial analysis; Conditional probabilities/expectations. Filtrations, adapted and predictable processes.

Martingales, submartingales and supermartingales in discrete-time. Doob-Meyer decomposition for supermartingales. Predictable representation. Discrete-time financial modes: Arbitrage, complete and incomplete markets. Self-financing property, value and gain processes. Valuation of contingent claims. Binomial model: Model specifications, Perfect hedging. Utility functions and consumption/investment problems. European and American options in discrete time. Futures and forward contracts in discrete time. Transition to the continuous-time framework. Prerequisite: Math 417 or Stat 571.

MATH 516 Linear Analysis
★3 *(fi 6)* (either term, 3-0-0). Banach spaces, Hahn-Banach theorem, Banach-Steinhaus theorem, Banach open mapping and closed graph theorems in Banach spaces. Hilbert spaces and orthonormal bases. Spectral theory of compact normal operators. Examples. Basic fixed point theorems and applications. Prerequisite: MATH 418 or consent of Department.

MATH 518 Functional Analysis
★3 *(fi 6)* (either term, 3-0-0). Locally convex spaces, weak topologies and duality in Banach spaces, weak compactness in Banach spaces, structure of classical Banach spaces, local structures, infinite-dimensional geometry of Banach spaces and applications. Prerequisite: MATH 516. Corequisite: MATH 447 or consent of Department.

MATH 519 Introduction to Operator Algebras
★3 *(fi 6)* (either term, 3-0-0). Banach algebras and spectral theory, compact and Fredholm operators, the spectral theorem for bounded normal operators, operator algebras, representations of C*-algebra, elementary von Neumann algebra theory, and other topics. Prerequisite: MATH 516. Corequisite: MATH 447 or consent of Department.

MATH 520 Mathematical Finance II
★3 *(fi 6)* (either term, 3-0-0). Probability tools: Brownian motion, diffusion processes and continuous martingales, Ito formula and stochastic differential equation, change of probability measures. Financial markets in continuous-time: Arbitrage, completeness, self-financing strategies. Black Scholes model. Option pricing and hedging in complete markets: European and American options. Consumption-investment problem in complete markets. Introduction to models of term structure of interest rates. Prerequisite: Math 515.

MATH 521 Differential Manifolds
★3 *(fi 6)* (either term, 3-0-0). Finite dimensional manifolds/submanifolds; tangent bundle, differential, inverse, and implicit function theorems, partitions of unity; imbeddings, immersions, submersions; vector fields and associated flows; Lie derivative, Lie bracket; tensor analysis, differential forms, orientation, integration, Stokes' theorem; basics of smooth bundle theory, Riemannian metrics; notion of a Lie group with basic examples, smooth Lie group actions, principal bundles. Prerequisite: MATH 446 or 448.

MATH 523 Application of Differential Geometry to Mechanics
★3 *(fi 6)* (either term, 3-0-0). Configuration and phase spaces as smooth manifolds, second order equations, connections, holonomic and nonholonomic systems. Review of the calculus of variations on manifolds, Lagrangians, Hamiltonians, Legendre transformations. General contact, symplectic and Poisson structures on manifolds. Actions of symmetry groups on symplectic manifolds, Noether's theorems and generalizations. Introduction to systems with infinite degree of freedom. Prerequisite: MATH 521.

MATH 524 Ordinary Differential Equations IIA
★3 *(fi 6)* (either term, 3-0-0). Existence theorems, uniqueness theorems; linear systems (basic theory); stability (basic theory); nonlinear systems (local theory); nonlinear systems (global theory); bifurcations. Prerequisite: MATH 334 or equivalent.

MATH 525 Ordinary Differential Equations IIB
★3 *(fi 6)* (either term, 3-0-0). Asymptotics; boundary value problems; Poincare-Bendixson theory. Additional material will be chosen from among the following topics at the option of the instructor: separation; dichotomies; comparison and oscillation theory; bifurcation theory; nonautonomous systems; dynamical systems; functional differential equations; contingent equations; differential equations in Banach spaces. Prerequisite: MATH 524 or equivalent.

MATH 527 Intermediate Partial Differential Equations
★3 *(fi 6)* (either term, 3-0-0). Notions; Elliptic PDE's; Parabolic PDE's; Hyperbolic PDE's; Nonlinear Integrable PDE's. Prerequisite: MATH 436 or equivalent; pre- or corequisite: MATH 518.

MATH 530 Algebraic Topology
★3 *(fi 6)* (either term, 3-0-0). Particular background from point set topology (pasting and quotienting constructions); homotopy relation between maps and spaces; fundamental group; Seifert VanKampen theorem; covering spaces. Additional topics at the discretion of the instructor. Prerequisites: MATH 227, 317 and 447 or consent of Department. Corequisite: MATH 426.

MATH 535 Numerical Methods I
★3 *(fi 6)* (first term, 3-0-0). Direct and iterative methods for solving linear systems, iterative methods for nonlinear systems, polynomial and spline interpolations, least square approximation, numerical differentiation and integration, initial value problems for ODE's (one-step, multistep methods, stiff ODE's). Prerequisite:

400-level MATH course. Students are required to have knowledge of advanced Calculus and introductory knowledge in Analysis and Linear Algebra and some computer programming. Note 1: Restricted to graduate students only. Note 2: May not be taken for credit if credit has already been obtained in MATH 381, 481 or 486 or equivalent.

MATH 536 Numerical Solutions of Partial Differential Equations I
★3 *(fi 6)* (either term, 3-0-0). Finite difference and finite element methods for boundary-value problems of elliptic equations. Numerical algorithms for large systems of linear algebraic equations: direct, classical relaxation, multigrid and preconditioned conjugate gradient methods. Algorithms for vector/parallel computers and the domain decomposition method. Prerequisites: MATH 337, 436 or equivalent and some computer programming.

MATH 538 Techniques of Applied Mathematics
★3 *(fi 6)* (either term, 3-0-0). Continuation of asymptotic expansion of integrals. Perturbation theory, asymptotic matching, perturbative eigenvalue problems. Boundary layer theory. WKB theory. Prerequisite: MATH 438.

MATH 542 Fourier Analysis
★3 *(fi 6)* (either term, 3-0-0). Review, theory and extension of Fourier series for square integrable functions; orthonormal systems, Bessel's inequality, completeness, Parseval's identity, Riesz-Fischer Theorem. Extension to Fourier series for functions in other Lebesgue classes; Fejer means, conjugate series, Dirichlet, Fejer and Poisson kernels. Norm convergence; remarks on pointwise convergence. Fourier transforms and series in several dimensions; inverse transform, Plancherel formula, Poisson Formula, maximal functions, Riesz-Thorin Theorem and applications. Elementary distribution theory; D, D', S, S' and some elementary results, Fourier transforms of tempered distributions. Examination of some earlier results with tempered distributions instead of functions and getting familiar with basic concepts. Prerequisite: MATH 418.

MATH 543 Measure Theory
★3 *(fi 6)* (either term, 3-0-0). Abstract measures. Integration. Lp spaces. Radon-Nikodym theorem. Hahn and Lebesgue decomposition theorems. Product measures. Fubini's theorem. Prerequisite: MATH 418.

MATH 556 Introduction to Fluid Mechanics
★3 *(fi 6)* (first term, 3-0-0). Fundamentals including continuum hypothesis surface tension, classical thermodynamics, and transport phenomena. Introduction to Cartesian tensors. Kinematics of flow including Lagrangian and Eulerian descriptions, streamline, path line, streak line, vorticity and circulation. Derivation of the conservation laws for mass, momentum, and energy and a detailed description of the Boussinesq approximation. Conservation laws in a rotating frame. Vortex lines and tubes, role of viscosity in vortices, Kelvin's circulation theorem, the vorticity equation in nonrotating and rotating frames. Irrotational flow including its relevance, velocity potential, sources and sinks, and flow past various shapes. Gravity waves in deep and shallow water with and without surface tension in both the linear and nonlinear contexts. Dynamic similarity and Buckingham's Pi Theorem. Prerequisites: One of MATH 311, 411 and MATH 436 or consent of Instructor.

MATH 557 Intermediate Fluid Dynamics
★3 *(fi 6)* (second term, 3-0-0). Linear and nonlinear waves, mixing, and turbulence in fluids with varying density. Application of dimensional analysis and scaling theory to lee waves, interfacial waves, trapped and propagating internal waves, gravity currents, internal hydraulic jumps, upstream wakes, blocking, plumes, thermals, and double diffusion. The dynamics of fluids on planetary scales and Coriolis effects. Conservation laws of potential vorticity and potential temperature/density. Derivation of geostrophic and thermal wind balance. Derivation of approximate governing equations including the quasi-geostrophic equations. Planetary wave dispersion relationships and dynamics of Kelvin, Rossby, Poincare and baroclinic waves. Derive the approximate equations and dynamics of the planetary boundary layer, the Ekman layer, the Eliassen-Palm flux, sudden stratospheric warming, and the Quasi-Biennial Oscillation. Prerequisites: MATH 556 or consent of Instructor.

MATH 570 Mathematical Biology
★3 *(fi 6)* (either term, 3-0-0). Mathematical modeling in the biological and medical sciences. Students will learn how to apply mathematical methods and theory to a variety of different biological problems. Topics will be taken from: (i) continuous and discrete dynamical systems describing interacting and structured populations, resource management, biological control, reaction kinetics, biological oscillators and switches, the dynamics of infectious diseases and genetics and (ii) models of spatial processes in biology including random walks, pattern formation in morphogenesis and ecology, applications of traveling waves to population dynamics, epidemiology, chemical reactions, and models for neural patterns. Prerequisites: MATH 524 and 527 or consent of Instructor.

MATH 581 Group Theory
★3 *(fi 6)* (either term, 3-0-0). Sylow theory, free groups, soluble/nilpotent groups; Bilinear forms, classical groups; Character theory of finite groups. Prerequisite: MATH 429 or consent of the Department.

MATH 582 Rings and Modules
★3 *(fi 6)* (either term, 3-0-0). Introduction to valuations; Free and projective modules, direct sums and products; Tensor products, central simple algebras;

Aerin-Wedderburn theory; Commutative Noetherian rings including Nullstellensatz. Topics from homological algebra and category theory which may vary from year to year. Prerequisite: MATH 428 or consent of the Department.

MATH 600 Reading in Mathematics
★3 *(fi 6)* (either term, 3-0-0). Students registered in this course are supervised by individual staff members in areas of interest of the staff members. Students will be allowed to take this course only in exceptional circumstances and with the permission of the Chairman of the Department. This course shall not be counted against the minimum course requirement for graduate students.

MATH 610 Stochastic Control
★3 *(fi 6)* (either term, 3-0-0). Optimal stopping, classical stochastic control, stochastic singular control, stochastic impulse control, and applications. Prerequisites: Stat 580 and either Math 417 or Stat 471, or consent of the Department.

MATH 615 Mathematical Models for the Term Structure of Interest Rates
★3 *(fi 6)* (either term, 3-0-0). The models of Vasicek and Cox-Ingersoll-Ross. The Heath-Jarrow-Morton model of forward rates. The short-rate process; single-factor and affine models. Estimation methods: Exponential splines. Nelson-Siegel Term Premia and the expectation hypothesis. Prerequisites: MATH 515, STAT 672.

MATH 617 Topics in Functional Analysis I
★3 *(fi 6)* (either term, 3-0-0).

MATH 618 Topics in Functional Analysis II
★3 *(fi 6)* (either term, 3-0-0).

MATH 620 Topics in Stochastic Analysis and Applications
★3 *(fi 6)* (two term, 1.5-0-0).

MATH 623 Topics in Differential Geometry and Mechanics
★3 *(fi 6)* (either term, 3-0-0).

MATH 625 Advanced Mathematical Finance
★3 *(fi 6)* (either term, 3-0-0). Multi-asset complete market models with random coefficients: hedging, pricing, portfolio optimization and equilibrium. Incomplete market models: hedging, pricing and portfolio optimization. Market models with transaction costs and constraints. Prerequisites: MATH 517 or consent of the Department.

MATH 630 Topics in Algebraic Topology
★3 *(fi 6)* (either term, 3-0-0).

MATH 641 Banach Space Theory
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MATH 519.

MATH 642 Abstract Harmonic Analysis
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MATH 519.

MATH 643 Topics in Analysis
★3 *(fi 6)* (either term, 3-0-0).

MATH 650 Seminar in Algebra
★1 *(fi 2)* (either term, 0-2s-0). Credit for this course may be obtained more than once.

MATH 651 Seminar in Analysis
★1 *(fi 2)* (either term, 0-2s-0). Credit for this course may be obtained more than once.

MATH 652 Seminar in Differential Equations
★1 *(fi 2)* (either term, 0-2s-0). Credit for this course may be obtained more than once.

MATH 653 Seminar in Functional Analysis
★1 *(fi 2)* (either term, 0-2s-0). Credit for this course may be obtained more than once.

MATH 654 Seminar in Nonlinear Waves/Fluid Mechanics
★1 *(fi 2)* (either term, 0-2s-0). Credit for this course may be obtained more than once.

MATH 655 Topics in Fluid Dynamics
★3 *(fi 6)* (either term, 3-0-0).

MATH 656 Seminar in Mathematical Biology
★1 *(fi 2)* (either term, 0-2s-0). Credit for this seminar course can be obtained more than once.

MATH 659 Research Seminar in Mathematics
★1 *(fi 2)* (either term, 0-2s-0). Credit for this course may be obtained more than once.

MATH 663 Topics in Applied Mathematics I
★3 *(fi 6)* (either term, 3-0-0).

MATH 664 Topics in Applied Mathematics II
★3 *(fi 6)* (either term, 3-0-0).

MATH 667 Topics in Differential Equations I
★3 *(fi 6)* (either term, 3-0-0).

MATH 676 Topics in Geometry I
★3 *(fi 6)* (either term, 3-0-0).

MATH 681 Topics in Algebra
★3 *(fi 6)* (either term, 3-0-0).

MATH 682 Topics in Algebra
★3 *(fi 6)* (either term, 3-0-0).

MATH 900 Directed Research Project
★6 *(fi 12)* (variable, unassigned). Open only to students taking the MSc non-thesis option in mathematics.

231.183   Mathématiques, MATHQ
Faculté Saint-Jean

Cours de 1er cycle

MATHQ 100 Calcul élémentaire I
★3 *(fi 6)* (premier semestre, 3-0-2). Les nombres, inéquations, fonctions, géométrie analytique, limite, continuité, dérivées et applications, polynôme de Taylor, fonctions exponentielles et logarithmiques, fonctions trigonométriques inverses et hyperboliques, différentielle et calculs approximatifs. Intégration et théorème fondamental du calcul intégral. Méthode des trapèzes et méthode de Simpson. Préalable(s): Mathématiques pures 30 et Mathématiques 31. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATH 117, MATHQ 113 ou 114.

MATHQ 101 Calcul élémentaire II
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-1). Techniques d'intégration et applications du calcul d'intégrales: calcul de longueurs, aires, volumes et masses, intégrales impropres, équations différentielles ordinaires d'ordre un; séparables, linéaires, méthode d'Euler, applications. Séries infinies, séries de Taylor, séries de puissances et critère de convergence d'une série. Coordonnées polaires, rectangulaires, sphériques et cylindriques dans l'espace de trois dimensions, courbes paramétriques dans le plan et l'espace. Volume et aire d'une surface de révolution. Préalable(s): MATHQ 100. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATHQ 115 ou MATH 118.

MATHQ 102 Algèbre linéaire appliquée
★3 *(fi 6)* (deuxième semestre, 3-0-1). Vecteurs et matrices; solution d'équations linéaires; équations de lignes et de plans; déterminants; algèbre matricielle; orthogonalité de Gram-Schmidt et applications; valeurs propres, vecteurs propres et applications; nombres complexes. Préalable(s) ou concomitant(s): MATHQ 100. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATHQ 120, MATH 125 ou 127.

Ⓛ MATHQ 113 Calcul élémentaire
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-1). Revue de la géométrie analytique, différentiation et intégration des fonctions simples, applications. Préalable(s): Mathématiques pures 30 ou l'équivalent. Les étudiants ayant complété Mathématiques 31 devront normalement suivre MATHQ 100 ou MATH 114. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATHQ 100, MATH 114 ou 117.

Ⓛ MATHQ 115 Calcul élémentaire II
★3 *(fi 6)* (deuxième semestre, 3-0-0). Différentiation et intégration des fonctions trigonométriques, exponentielles et logarithmiques. Formes indéterminées et intégrales impropres. Techniques d'intégration. Applications. Préalable(s): MATHQ 113, 114 ou l'équivalent.

Ⓛ MATHQ 120 Algèbre linéaire I
★3 *(fi 6)* (premier semestre, 3-0-0). Vecteurs et algèbre matricielle. Déterminantes. Système d'équations linéaires. Espaces vectoriels. Valeurs propres et vecteurs propres. Applications. Préalable(s): Mathématiques pures 30 ou l'équivalent. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATH 102, 125 ou 127.

Ⓞ MATHQ 160 Mathématiques pour enseignants
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Les concepts étudiés ont pour but d'aider l'enseignant à formuler une idée intuitive des concepts qu'il doit enseigner aux élèves. Nous aborderons les statistiques et les probabilités, les suites et les séries, les fonctions trigonométriques, les fonctions du deuxième degré, les polynômes. Note: Ce cours est réservé aux étudiants du BEd Elémentaire. Préalable(s): Mathématiques pures 30 ou l'approbation du Vice-doyen aux affaires académiques.

MATHQ 201 Equations différentielles
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-1). Equations du premier ordre; équations lineaires du deuxième ordre; réduction d'ordre, variation des paramètres; transformation de Laplace; systèmes linéaires; séries de puissance; solutions par séries; séparation des variables pour les équations ou dérivées partielles. Préalable(s) ou concomitant(s): MATH 209 ou MATHQ 214. Note: Ce cours est accessible seulement aux étudiants en génie et aux étudiants en sciences dans

les programmes suivants: spécialisation physique, spécialisation géophysique, spécialisation sciences informatiques, ou spécialisation géographie (météorologie). Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATH 205, 334 ou 336.

MATHQ 209 Calcul III
★3.5 (fi 6) (l'un ou l'autre semestre, 3-0-1). Dérivées partielles, dérivées d'intégrales. Intégration multiple avec des coordonnées rectangulaires, cylindriques et sphériques. Champs de vecteurs. Préalable: MATHQ 101. Préalable ou concomitant: MATHQ 102. Note: (1) Normalement pour les étudiants de la Faculty of Engineering. (2) Les étudiants de la Faculty of Engineering auront ★3.5.

MATHQ 214 Calcul intermédiaire I
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Séries infinies. Courbes planes et coordonnées polaires. Géométrie analytique à trois dimensions. Dérivées partielles. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATHQ 209 ou MATH 217. Préalable : MATHQ 115 ou l'équivalent.

MATHQ 215 Calcul intermédiaire II
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Équations différentielles d'ordre un et deux avec des coefficients constants. Courbes, vecteurs tangents, longueur d'arc, intégration en deux et trois dimensions, coordonnées polaires cylindriques et sphériques, intégrales de lignes et de surfaces. Théorèmes de Green, de Stokes et théorème de la divergence. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATHQ 209 ou MATH 317. Préalable : MATHQ 214 ou l'équivalent.

0 MATHQ 222 Introduction aux mathématiques discrètes
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Approche appliquée des mathématiques discrètes, couvrant les codes secrets, la cryptographie à clef publique, codes correcteurs d'erreurs, relations de récurrences, induction, théorie des graphes, algorithmes pour les graphes et algorithmes parallèles. Préalable(s) : ★3 de niveau 100 en mathématiques.

MATHQ 225 Algèbre linéaire II
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Espaces vectoriels. Espaces avec produit scalaire. Exemples d'espace à n dimensions, espace des fonctions continues. Procédé de Gram-Schmidt, factorisation QR, méthode des moindres carrés. Transformations linéaires, changements de base, transformations de similarité et diagonalisation. Diagonalisation orthogonale, formes quadratiques. Applications à une variété de champs, méthodes numériques. Préalable: MATHQ 120 ou MATH 125 ou un autre cours d'algèbre linéaire, Mathématiques 31 ou un autre cours de calcul. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATH 121 ou 227.

MATHQ 228 Algèbre: introduction á la théorie des anneaux
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Nombres entiers. Induction mathématique. Relations d'équivalence. Anneaux commutatifs, incluant les entiers modulo n, les nombres complexes et les polynômes. Le théorème du reste chinois. Champ et domaine intégral. Domaine euclidien, domaine idéal principal, factorisation unique. Les anneaux quotients et homomorphismes. Construction de champs finis. Applications telles que le chiffrement dans le domaine public, carrés latin et designs, codes polynomiaux et détection d'erreur, ou addition et multiplication de grands nombres entiers. Préalable : MATHQ 120 ou MATH 125 ou autre cours d'algèbre linéaire. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATH 128 ou 223.

MATHQ 241 Géométrie
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Géométrie euclidienne de base, congruence, parallélisme, aire et similarité. Développement axiomatique avec emphase sur la résolution de problèmes. Constructions et lieux géométriques, inégalités, maxima et minima, cercles, isométries, et autres sujets. Préalable: un cours de MATHQ de niveau 100.

MATHQ 243 Géométrie des transformations
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Géométrie des transformations, isométrie et homothétie, applications en géométrie euclidienne; algèbres des transformations, théorème de classification, formes de frise et groupes de pavage. Préalable: MATHQ 241.

MATHQ 334 Introduction aux équations différentielles
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Équations du premier ordre, équations linéaires d'ordre élevé. Solution par séries de puissance. Méthodes de transformée de Laplace. Introduction aux fonctions spéciales. Introduction aux systèmes linéaires. Préalables: MATHQ 120 ou MATH 125 ou l'équivalent. Concomitant: MATHQ 215 ou MATH 317. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATHQ 201 ou MATH 336.

MATHQ 337 Introduction aux équations aux dérivées partielles
★3 (fi 6) (l'un ou l'autre semestre, 3-0-0). Problèmes à conditions aux limites de la physiquemathématique, expansions orthogonales, fonctions spéciales classiques. Techniques avancées de transformées. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MATH 300 ou l'équivalent. Préalable: MATHQ 334 ou MATHQ 336.

231.184 Mechanical Engineering, MEC E
Department of Mechanical Engineering
Faculty of Engineering

Undergraduate Courses

MEC E 200 Introduction to Mechanical Engineering
★1 (fi 2) (either term, 0-2s-0). Introduction to the profession of mechanical engineering with special emphasis of industries in Alberta. Selected guest speakers on design problems in mechanical engineering. Communication skills including written and oral presentations.

MEC E 250 Engineering Mechanics II
★3.5 (fi 6) (either term, 3-1s-0). Moments of inertia. Kinematics and kinetics of rigid body motion, energy and momentum methods, impact, mechanical vibrations. Prerequisites: ENGG 130, EN PH 131 and MATH 101. There is a consolidated exam.

MEC E 260 Mechanical Design I
★3.5 (fi 6) (either term, 2-0-3). Design morphology, analysis and design of components, computer-aided design introduction, design project. Corequisite: MEC E 265.

MEC E 265 Engineering Graphics and CAD
★3.5 (fi 6) (either term, 2-0-3). Engineering drawing and sketching, conventional drafting, computer-aided drawing in 2D and 3D, solid modelling, and computer-aided design. Prerequisite: ENCMP 100.

MEC E 300 Mechanical Measurements
★3.5 (fi 6) (either term, 3-1s-0). Characterization and behavior of measuring systems. Statistics and analysis of measurement data; measurement techniques applied to fundamental mechanical engineering phenomena. Prerequisites: CIV E 270, E E 239, STAT 235. Corequisite: MEC E 330.

MEC E 301 Mechanical Engineering Laboratory I
★2.5 (fi 6) (either term, 1-0-3). Laboratory experiments in mechanical engineering measurement techniques, treatment of measurement data, introduction to engineering report writing. Corequisite: MEC E 300.

MEC E 330 Fluid Mechanics I
★3.5 (fi 6) (either term, 3-0-1). Basic equations, hydrostatics, Bernoulli equations, momentum theories, similitude fluid metering, fluid friction, fluid friction in pipes, external flow, boundary layers. Prerequisites: MEC E 250, MATH 209. Corequisite: CH E 243.

MEC E 340 Applied Thermodynamics
★3 (fi 6) (either term, 3-0-0). Review of thermodynamic principles. Applications to gas compressors, vapour and gas power cycles, heat pump cycles. Availability analysis. Psychrometrics. Combustion analysis. Prerequisite: CH E 243.

MEC E 360 Mechanical Design II
★3.8 (fi 6) (either term, 3-0-3/2). Design procedures, theories of failure, material selection, design for fatigue, creep and relaxation, selection of gears and bearings, development and application of computer-aided design software. Prerequisite: MEC E 260 and CIV E 270.

MEC E 362 Mechanics of Machines
★3.8 (fi 6) (either term, 3-0-3/2). Velocities and acceleration in plane mechanisms, balancing of rotating and reciprocating machinery, gears and gear trains. Prerequisite: MEC E 250.

MEC E 364 Manufacturing Processes
★2.8 (fi 6) (either term, 2-0-3/2). Primary and secondary processes in metal forming, material removal and fabrication techniques, selected field trips and laboratory and shop exercises. Prerequisite: MEC E 260.

MEC E 370 Heat Transfer
★3.5 (fi 6) (either term, 3-1s-0). Mechanisms of heat transfer, steady and unsteady heat conduction, numerical analysis, thermal radiation, free and forced convection, heat exchanger analysis and heat transfer with change of phase. Note: Credit cannot be obtained for both MEC E 370 and 470. Prerequisites: CH E 243. Corequisites: MATH 300 and MEC E 330.

MEC E 380 Advanced Strength of Materials I
★3.5 (fi 6) (either term, 3-1s-0). Stress, strain, stress-strain relation, time-independent and time-dependent behavior, virtual work and energy theorems, deformations, indeterminate systems, matrix methods. Prerequisite: MEC E 260 and CIV E 270.

MEC E 390 Numerical Methods of Mechanical Engineers
★3.5 (fi 6) (either term, 3-0-1). Application of numerical methods to mechanical engineering problems; topics include sources and definitions of error, root finding, solutions of linear and non-linear systems of equations, regression, interpolaton, numerical integration and differentiation, solution of initial value and boundary value ordinary differential equations. Applications include dynamics, solid mechanics, heat transfer and fluid flow. Prerequisites: MATH 102, 201, ENCMP 100 (or equivalent).

MEC E 403 Mechanical Engineering Laboratory II
★2.5 *(fi 6)* (either term, 1-0-3). Selected laboratory experiments in applied mechanics and thermosciences. Note: Credit cannot be obtained in both MEC E 303 and 403. Prerequisites: MEC E 300 and 301.

MEC E 409 Experimental Design Project I
★4 *(fi 6)* (either term, 2-0-4). Selected group projects in experimental measurement and mechanical design. Two to four person groups develop planning, design, testing and report writing skills on projects in applied mechanics, thermosciences and engineering management. Prerequisites: MEC E 301 and ENGG 310 or 401.

MEC E 420 Feedback Control Design of Dynamic Systems
★3.8 *(fi 6)* (either term, 3-0-3/2). Design of linear feedback control systems for command-following error, stability, and dynamic response specifications. PID, Root-locus, frequency response and design techniques. An introduction to structural design limitations. Examples emphasizing Mechanical Engineering systems. Some use of computer aided design with MATLAB/Simulink. Controls Lab - control of mechanical systems. Prerequisites: MEC E 390 or equivalent and consent of Instructor. Credit can only be granted for one of MEC E 420, E E 469, CH E 448.

MEC E 430 Fluid Mechanics II
★3 *(fi 6)* (either term, 3-0-0). Navier-Stokes equations, introductory computational fluid dynamics, boundary layers, compressible fluid flow (variable area ducts, normal and oblique shock waves, Prantdl-Meyer expansions, adiabatic and isothermal pipe flow), two phase flow. Prerequisite: MEC E 330.

MEC E 439 Principles of Turbomachines
★3 *(fi 6)* (either term, 3-0-0). Use of turbomachines in ground based and flight applications, thermodynamic cycles for gas turbines and cogeneration, performance predictions of propellers, compressors and turbines, air-breathing combustion and emissions. Prerequisites: MEC E 370.

MEC E 443 Energy Conversion
★3 *(fi 6)* (either term, 3-0-0). Sources, flow and overall efficiency of use of various energy forms in society, thermodynamic analysis of energy conversion devices such as thermoelectric and magnetohydrodynamic generators, solar and fuel cells, energy from fission and fusion reactors. Prerequisite: MEC E 340.

MEC E 451 Vibrations and Sound
★3.5 *(fi 6)* (either term, 3-0-1). Free and forced vibration of single degree of freedom systems with and without damping, vibration isolation, free vibration of multi degrees of freedom systems, vibration absorption, beam vibrations, sound waves, sound sources, subjective aspects of noise. Prerequisites: MEC E 250 and MATH 300.

MEC E 460 Design Project
★4 *(fi 6)* (either term, 2-0-4). Feasibility study and detailed design of a project which requires students to exercise creative ability, to make assumptions and decisions based on synthesis of technical knowledge, and in general, devise new designs, rather than analyse existing ones. Prerequisites: ENGG 310 (or 401), MEC E 330, 340, 360, 362, 370, and 380.

MEC E 463 Thermo-Fluids Systems Design
★4 *(fi 6)* (either term, 3-0-2). Design and optimization of thermo-fluid systems, heating and ventilating equipment and load calculations, system design, piping networks, heat exchanger analysis and design, computer-aided design projects. Prerequisite: MEC E 370.

MEC E 469 Experimental Design Project II
★2.5 *(fi 5)* (either term, 1-0-3). Advanced project in experimental measurement and mechanical designs in applied mechanics, thermosciences and engineering management. Prerequisite: MEC E 409.

MEC E 480 Advanced Strength of Materials II
★3 *(fi 6)* (either term, 3-0-0). Special topics for beams, torsion, pressure vessels, plane stress and strain, stability, fracture mechanics. Prerequisites: MEC E 360, 380, MATH 300.

MEC E 494 Introduction to Research
★0.5 *(fi 1)* (first term, 0-1s-0). Introduction to methods of mechanical engineering research. Organizational seminars for the research project in the following term. Prerequisites: MEC E 330, 380, and consent of Department.

MEC E 495 Research Project
★3 *(fi 6)* (second term, 0-0-6). Mechanical Engineering undergraduate research project with a faculty member. Prerequisites: MEC E 494 and consent of Department.

Graduate Courses

Note: The courses ENG M 620, MEC E 630, 640, 670, 680 and 681 normally will be offered annually. Other courses will be offered on a lecture basis when there is sufficient enrolment; otherwise they will be offered on a guided reading basis.

MEC E 512 Quality Engineering and Management
★3 *(fi 6)* (either term, 3-0-0). Quality engineering and management evolution, definitions, concepts and principles. Essential quality management theories and models. ISO 9000 principles models and applications. Seven quality engineering and management tools. Quality function deployment. Failure analysis. Quality costing. Statistical quality. Prerequisites: STAT 235 or equivalent.

MEC E 513 Production and Operations Management
★3 *(fi 6)* (either term, 3-0-0). Production and operations management, analysis, and design of work, forecasting, inventory management including MRP, JIT, and Kanban, maintenance management, facility layout, operations scheduling, and project planning and management. Prerequisites: ENGG 310 or 401; and STAT 235 or equivalent.

MEC E 520 Digital Control Design of Dynamic Systems
★3 *(fi 6)* (either term, 3-0-0). Design of sampled-data control systems using discrete equivalents, transform techniques and state space methods with an introduction to multivariable and optimal control. Control and estimator design with emphasis on Mechanical Engineering systems. Projects will be used to implement control on real systems to validate the control design and to understand the effects of sample rate, parameter variation, and signal noise. Prerequisite: consent of instructor.

MEC E 537 Aerodynamics
★3 *(fi 6)* (either term, 3-0-0). Boundary layer flow, vorticity, circulation and aerodynamic lift, wing theory, aeronautical applications. Prerequisite: MEC E 330 or equivalent.

MEC E 539 Applied Computational Fluid Dynamics
★3 *(fi 6)* (either term, 3-0-0). Grid generation, time-marching methods, control volume formulations, shock capture, artificial dissipation, upwind flux-limiting, space-marching multigrid acceleration. Hands-on experience with commercial CFD codes to illustrate practical implementations and performance of theory. Prerequisites: MEC E 390, and 330 or equivalent.

MEC E 541 Combustion Engines
★3 *(fi 6)* (either term, 3-0-0). History of basic cycles, combustion theory including ignition flame propagation and engine knock, cycle analysis with deviations from ideal cycles and performance characteristics, fuels, design and operation of carburation and injection processes, exhaust emissions measurements. Identification of design parameters and their effect on emissions. Prerequisite: MEC E 340.

MEC E 543 Nanotechnology in Mechanical Engineering
★3.8 *(fi 6)* (either term, 3-0-3/2). Scanning probe microscopy, characterization and detection techniques, nanofabrication techniques, self-assembly and self-organization, DNA-based assembly, nanotube devices, molecular electronics, single-electron and nanoscale inorganic devices, DNA computation, nanotechnology in integrated systems and optoelectronics, and nanobiotechnology. Prerequisite: MEC E 340 or consent of Instructor.

MEC E 551 Mechanics and Control of Robot Manipulators
★3.5 *(fi 6)* (either term, 3-1s-0). History and classification of robot manipulators, kinematics and dynamics, Singularity and Jacobian analysis, path/trajectory planning, open-loop and feedback control of robot manipulators. Some computer simulation and design using MATLAB/Simulink. Prerequisites: MEC E 250, 390 or consent of Instructor.

MEC E 553 Acoustics and Noise Control
★3 *(fi 6)* (either term, 3-0-0). Acoustic waves, sound transmission through walls and structures, acoustics of large and small rooms, mechanisms of sound absorption. Design of silencers. Prerequisites: MEC E 330 and 451.

MEC E 563 Finite Element Method for Mechanical Engineering
★4.5 *(fi 6)* (either term, 3-0-3). Application of finite element methods to mechanical engineering problems; topics include direct stiffness methods, assembly, constraints, solution techniques, post-processing, element types and the Galerkin procedure. Applications include beam truss and frame analysis, plane strain and stress problems, heat transfer and dynamic analysis Prerequisites: MATH 300, MEC E 360, 390 (or equivalents).

MEC E 564 Design and Simulation of Micro-Electromechanical Systems (MEMS)
★3 *(fi 6)* (either term, 3-0-0). Overview of micro-systems, common micro-systems and their working principles, mechanical modeling and simulation of MEMS, scaling laws in miniaturization, material for MEMS and micro-systems, mechanical design of micro devices, mechanical packaging of micro devices, overview on micro-systems fabrication processes. Corequisite: MEC E 563 or equivalent.

MEC E 565 Environmental Factors in Mechanical Engineering
★3 *(fi 6)* (either term, 3-0-0). System dynamics and limits to technological growth. Source inventories and regulatory standards for biological effects of pollutants, atmospheric dispersion models, stack design, analysis of source control of particulate and combustion product emissions, probability theory for risk analysis, and toxic release hazard assessments. Prerequisite: CH E 243. Corequisite: MEC E 330.

MEC E 567 Life Cycle Assessment for Sustainable Design
★3 *(fi 6)* (either term, 3-0-0). Introduction to the concept of Life Cycle Assessment (LCA). History and development of LCA methodologies and standards. Stages of LCA analysis: goal definition, scoping, inventory assessment, impact analysis, improvement analysis, reporting. Sources of data, boundary selection

and uncertainty. Relationship between LCA, Design for Environment and other environmental management tools. Prerequisites: STAT 235 or equivalent, or consent of Department.

MEC E 568 Numerical Simulation in Mechanical Engineering Design
★4.5 *(fi 6)* (either term, 3-0-3). Computer modelling in mechanical engineering. Simulation of mechanisms. Stress analysis and heat transfer using commercial software. Emphasis is on numerical model design including testing and verification methods, and the critical interpretation of the computed results. Prerequisites: MEC E 265, 362, 370, 380, 390, or consent of Instructor.

MEC E 569 Mechanics and Design of Composite Materials
★3 *(fi 6)* (either term, 3-0-0). Introduction to composite materials. Mechanical characterization and strength theories of a lamina. Micro-mechanical analysis of a lamina. Macro-mechanical analysis of laminates. Failure analysis and design of laminates. Prerequisite: MEC E 380.

MEC E 585 Biomechanical Modelling of Human Tissues and Systems
★3 *(fi 6)* (either term, 3-0-0). Biomechanics; mechanical characterization of biological tissues using elastic and viscoelastic models. Rheology of blood and flow properties. Static and dynamic analyses of selected physiological systems. Application of biomaterials in external and internal prostheses. Prerequisites: BME 210, BME 211, MEC E 300, 330, 362 and MEC E 380 or consent of Instructor.

MEC E 612 Engineering Optimization
★3 *(fi 6)* (either term, 3-0-0). The applications of optimization techniques in solving engineering problems. Linear programming, non-linear programming, dynamic programming, integer programming, stochastic programming, genetic algorithms, heuristic methods, queuing theory, and new optimization methods. Credit may not be obtained in both ENG M 640 and MEC E 612. Prerequisite: MP E 497, MGTSC 352 or equivalent.

MEC E 620 Combustion
★3 *(fi 6)* (either term, 3-0-0). Chemical reactions, chemical equilibrium and flame temperatures. Flame propagation and explosion theories. Detonations. Air pollution from combustion sources.

MEC E 630 Fluid Dynamics
★3 *(fi 6)* (either term, 3-0-0). Kinematics of fluid motion, fundamental fluid equations and concepts, laminar boundary layers, potential flow, stability and transition, introduction to turbulence.

MEC E 632 Turbulent Fluid Dynamics
★3 *(fi 6)* (either term, 3-0-0). Governing equations of turbulent flow. Statistical and phenomenological theories of turbulent transport of momentum, heat and mass in wall-bounded and free flows. Computational techniques, empirical data and applications. Prerequisite: MEC E 630 or equivalent or consent of Instructor.

MEC E 635 Mechanics of Respiratory Drug Delivery
★3 *(fi 6)* (either term, 3-0-0). Introduction to pharmaceutical aerosol delivery to the lung. Particle size distributions. Motion of a single aerosol particle in a fluid. Particle size changes due to evaporation or condensation. Fluid dynamics and particle deposition in the respiratory tract. Jet nebulizers. Dry powder inhalers. Metered dose propellant inhalers. Prerequisite: MEC E 330 or equivalent or consent of Instructor.

MEC E 637 Colloidal Hydrodynamics
★3 *(fi 6)* (either term, 3-0-0). Colloidal Systems; Colloidal Interactions; Hydrodynamics; Analysis of Complex Fluid flows; Thin Films; Flow in Porous Media; Microfluidics; Selected applications: Coagulation, flocculation and particle deposition; Sedimentation; Separation technologies such as deep bed filtration, membrane filtration, and chromatography; Microfluidic applications involving complex fluids; Colloid applications involving complex fluids; Colloid facilitated transport. Prerequisite/Corequisite; MEC E 430, 630, or approval of instructor.

MEC E 638 Vortex Flows
★3 *(fi 6)* (either term, 3-0-0). Vortex dynamics approach to large-scale structures in turbulent flows. Vortex motion equations, conservation laws, and modelling using discrete vortices. Prerequisite: a senior undergraduate course in fluid mechanics or consent of Instructor.

MEC E 639 Computational Fluid Dynamics
★3 *(fi 6)* (either term, 3-0-0). Computational fluid dynamics methods for incompressible and compressible fluids. Application to aeronautical and internal flows, finite difference, finite volume, and spectral methods. Prerequisite: CH E 674 or equivalent or consent of Instructor.

MEC E 640 Analytical Thermodynamics
★3 *(fi 6)* (either term, 3-0-0). Postulatory approach to thermodynamics, equilibrium and maximum entropy principles, fundamental equations, Legendre transformation, Maxwell relations, calculation of property changes, thermodynamics of elastic systems, rubber elasticity, and surface thermodynamics. Prerequisite: MEC E 340 or consent of Instructor.

MEC E 642 Surface Thermodynamics and Nanotechnology in Mechanical Engineering
★3 *(fi 6)* (either term, 3-0-0). Introduction to surface thermodynamics, theory of capillarity, modern techniques for surface tensions and contact angles, surface

energetics, surface preparation, molecular self-assembly, nanofabrication, analytical tools for surface characterization, application of nanotechnology. Prerequisite: MEC E 640 or consent of Instructor.

MEC E 643 Renewable Energy Engineering and Sustainability
★3 *(fi 6)* (either term, 3-0-0). Principles of renewable energy systems such as solar, wind, tidal, biomass, geothermal, and fuel cells. Environmental aspects of implementation of renewable energy e.g. hydro and nuclear energy sources. Energy conservation and conventional fossil fuel sources. New technologies and trends in renewable energy. Concept of sustainability and sustainable design for energy systems. Elementary economics of implementation of renewable energy sources and related policy and social issues. Prerequisites: consent of instructor.

MEC E 650 Analytical Dynamics
★3 *(fi 6)* (either term, 3-0-0). Principle of virtual work; Lagrange's equations of motion for holonomic and non-holonomic systems; Hamilton's principle; application to gyroscopes, stabilizers, etc.

MEC E 653 Signal Processing of Time and Spectral Series
★3 *(fi 6)* (either term, 3-0-0). Practical application of processing techniques to the measurement, filtering and analysis of mechanical system signals; topics include: signal classification, A/D conversion, spectral analysis, digital filtering and real-time signal processing.

MEC E 655 Dynamics of Structures
★3 *(fi 6)* (either term, 3-0-0). Behavior of elastic structures subjected to dynamic loads. Vibrations of buildings and bridges excited by machinery, earthquakes, wind and traffic.

MEC E 656 Wave Propagation in Structures
★3 *(fi 6)* (either term, 3-0-0). Introduction to advanced structures, dynamic elasticity equations and concepts, wave propagation in flexural structures, active control of wave propagation and vibration.

MEC E 664 Adv Design & Simulation of Micro and Nano Electromechanical Sensors (MEMS/NEMS)
★3 *(fi 6)* (either term, 3-0-0). Advanced topics dealing with MEMS technologies, transduction mechanisms, and microfabricated sensors and actuators. Sensors for acceleration, rotation rate, pressure, and different micro actuators. MEMS in microfluidics and biomedical applications. Chemical, gas, and biosensors. Prerequisite: MEC E 563 and consent of Instructor. Not open to students with credit in MEC E 564.

MEC E 665 Pressure Vessel Design
★3 *(fi 6)* (either term, 3-0-0). This course offers an integrated treatment of stress analysis, design theory, material behavior and construction of pressure vessels used in the energy, chemical and petroleum industries. Special topics covered include the basis of the ASME code, stresses in shells and heads, discontinuity stresses arising from openings and attachments, and design of welded joints. Prerequisite: MEC E 480 or consent of Instructor.

MEC E 670 Advanced Heat Transfer
★3 *(fi 6)* (second term, 3-0-0). Advanced topics in conduction and convection heat transfer; solution by analytical and numerical methods.

MEC E 680 Continuum Mechanics
★3 *(fi 6)* (either term, 3-0-0). Introduction to cartesian tensor algebra and calculus; analysis of finite deformation and kinematics of motion; transport theorems and balance laws; analysis of stress; continuum thermodynamics, constitutive equations and material symmetry with application to solids and fluids.

MEC E 681 Elasticity
★3 *(fi 6)* (either term, 3-0-0). Extension, torsion and flexure of beams; two-dimensional problems; complex variable methods; integral transform methods; variational methods.

MEC E 684 Static and Dynamic Stability
★3 *(fi 6)* (either term, 3-0-0). Classical stability analysis of bars and plates subjected to various loading conditions. Energy methods. Dynamic stability of non-conservative force systems and the effects of internal friction. Inelastic buckling, torsional buckling.

MEC E 685 Macro Fracture Mechanics
★3 *(fi 6)* (either term, 3-0-0). Basic concepts of linear and nonlinear fracture mechanics: linear and nonlinear stationary crack-tip stress, strain and displacement fields; energy balance and energy release rates; fracture resistance concepts-static and dynamic fracture toughness; criteria for crack growth; fracture control methodology and applications.

MEC E 686 Fatigue of Engineering Materials
★3 *(fi 6)* (either term, 3-0-0). A study of mechanisms and mechanics of fatigue process: damage caused by constant and variable cyclic amplitudes and random loading; effects of load interaction; initiation and propagation of fatigue cracks; life prediction; effects of multiaxial stress states, temperature and environment.

MEC E 687 Introduction to Impact Dynamics of Materials
★3 *(fi 6)* (either term, 3-0-0). Elastic waves, plastic waves, shock waves and stress wave propagation in solids. Low velocity impact on fibre composite materials and failure criteria. High velocity impact mechanisms and fracture criteria. Impact

penetration mechanics. Dynamic deformation and fracture of materials. Prerequisite: MEC E 480 or consent of Instructor.

MEC E 690 Analytical Techniques in Engineering
★3 *(fi 6)* (either term, 3-0-0). Application of mathematical techniques to the solution of ordinary and partial differential equations arising in engineering problems. In particular, separation of variables, method of characteristics, transform methods, solution by complex variables, and variational methods will be considered. Prerequisite: MATH 300 or equivalent.

MEC E 728 Advanced Topics in Applied Thermodynamics I
★3 *(fi 6)* (either term, 3-0-0).

MEC E 729 Advanced Topics in Applied Thermodynamics II
★3 *(fi 6)* (either term, 3-0-0). Combustion, refrigeration.

MEC E 738 Advanced Topics in Fluid Dynamics I
★3 *(fi 6)* (either term, 3-0-0).

MEC E 739 Advanced Topics in Fluid Dynamics II
★3 *(fi 6)* (either term, 3-0-0). Aerodynamics, rarefied gas dynamics, turbulence, hydro and thermo stability.

MEC E 748 Advanced Topics in Thermodynamics I
★3 *(fi 6)* (either term, 3-0-0).

MEC E 749 Advanced Topics in Thermodynamics II
★3 *(fi 6)* (either term, 3-0-0). Energy conversion, general thermodynamics, irreversible thermodynamics.

MEC E 758 Advanced Topics in Dynamics I
★3 *(fi 6)* (either term, 3-0-0).

MEC E 759 Advanced Topics in Dynamics II
★3 *(fi 6)* (either term, 3-0-0). Wave propagation, orbital dynamics.

MEC E 778 Advanced Topics in Heat Transfer I
★3 *(fi 6)* (either term, 3-0-0).

MEC E 779 Advanced Topics in Heat Transfer II
★3 *(fi 6)* (either term, 3-0-0). Conduction, convection, radiation.

MEC E 788 Advanced Topics in Solid Mechanics I
★3 *(fi 6)* (either term, 3-0-0).

MEC E 789 Advanced Topics in Solid Mechanics II
★3 *(fi 6)* (either term, 3-0-0). Elasticity plasticity, viscoelasticity, shells.

MEC E 900 Directed Research Project
★6 *(fi 12)* (variable, unassigned). Detailed Engineering report in the student's major area of interest.

MEC E 910 Directed Research Project
★3 *(fi 6)* (variable, unassigned). Detailed Engineering Report in the student's major area of interest.

231.185   Medical Genetics, MDGEN

Department of Medical Genetics
Faculty of Medicine and Dentistry

Graduate Courses

MDGEN 601 Selected Topics in Medical Genetics
★3 *(fi 6)* (either term, 0-3s-0). A directed reading and seminar course based on papers taken from the recent literature of medical genetics. The course consists of lectures on a specific topic in medical genetics and oral presentations of the current literature by students. Selected topics vary so that students may take the same course but examining a different topic for additional credit. Prerequisite: consent of the Department of Medical Genetics.

MDGEN 602 Special Topics in Medical Genetics
★1 *(fi 2)* (either term, 0-1s-0). This course is designed as a journal club and discussion group in which topics in medical genetics are discussed. Students will critically discuss papers and give oral presentations to the class. Specific topics will include research in genomics, disease gene cloning, chromosome structure, and clinical aspects of medical genetics. Prerequisite: consent of the Department of Medical Genetics.

231.186   Medical Laboratory Science, MLSCI

Division of Medical Laboratory Science
Faculty of Medicine and Dentistry

Notes
(1) See also INT D 409 and 491 for courses offered by more than one Department or Faculty and which may be taken as options or as a course in this discipline.

(2) MLSCI 320, 330, 340, 350, 360, and 370 are to be taken as a unit over a 42-week period. They are open to students of Medical Laboratory Science only or by special permission of the Division.

Undergraduate Courses

MLSCI 230 Hematology
★3 *(fi 6)* (first term, 3-0-6). An introduction to the theory and practise of hematology, this course will include the morphology, structure, and function of red cells, white cells, and platelets, malignant and benign conditions that affect each cell type, and tests to distinguish among disease states including anemia and leukaemia. Restricted to Medical Laboratory Science students.

MLSCI 231 Hematology
★3 *(fi 6)* (first term, 3-0-0). This course is designed for students who are excused from the laboratory component of the normal MLSCI course. An introduction to the theory and practise of hematology, this course will include the morphology, structure, and function of red cells, white cells, and platelets, malignant and benign conditions that affect each cell type, and tests to distinguish among disease states including anemia and leukaemia. Prerequisite: RT (CSMLS) certification or consent of Department. Credit granted for only one of MLSCI 230 or 231.

MLSCI 235 Hemostasis
★1 *(fi 2)* (second term, 3-0-6 in 4 weeks). Four weeks. This course will present the theory and practice of hemostasis. Topics include the vascular, platelet, clotting factor, fibrinolytic, and inhibitor systems: coagulation disorders; tests that identify factor deficiencies, monitor anticoagulant therapy, and assess thrombolytic states; disorders of hemostasis. Prerequisite: MLSCI 230 or consent of Department. Restricted to Medical Laboratory Science students.

MLSCI 236 Hemostasis
★1 *(fi 2)* (second term, 3-0-0 in 4 weeks). Four weeks. This course is designed for students who are excused from the laboratory component of the normal MLSCI course. This course will present the theory and practice of hemostasis. Topics include the vascular, platelet, clotting factor, fibrinolytic and inhibitor systems: coagulation disorders; tests that identify factor deficiencies, monitor anticoagulant therapy, and assess thrombolytic states; disorders of hemostasis. Prerequisite: MLSCI 230 or consent of Department. Restricted to Medical Laboratory Science students.

MLSCI 240 Pathogenic Microbiology
★6 *(fi 12)* (two term, 3-0-4). Considers the role of bacteria, viruses, fungi, and parasites in human disease. Lectures emphasize mechanisms of microbial pathogenicity and immune response to infection. Laboratory emphasizes diagnostic procedures. Restricted to Medical Laboratory Science students. May not be taken for credit if credit already received in MMID 240 or MMI 240.

MLSCI 241 Pathogenic Microbiology
★6 *(fi 12)* (two term, 3-0-0). Considers the role of bacteria, viruses, fungi, and parasites in human disease. Lectures emphasize mechanisms of microbial pathogenicity and immune response to infection. Prerequisite: CSMLS general certification or consent of department. May not be taken for credit if credit already obtained in MMID 241 or MMI 241.

MLSCI 250 Human Histology and Histotechnology
★3 *(fi 6)* (either term, 3-0-4). This course is primarily designed to provide an understanding of human histology and of the techniques used in its study. It will also include, in part, basic pathology (including the nature of malignant disease) and the application of histological and histochemical techniques to demonstrate the diagnostic features of human disease processes. The goal of the course is for students to understand the structure and functions of the cell, and the components and functions of organ systems. The course will also teach students to recognize human tissues at the light and electron microscopical levels. Lectures will be used to illustrate basic principles, and the ability to recognize tissues and organ systems will be acquired in the laboratory. Students will be expected to acquire a detailed knowledge of the subject both from a theoretical and practical level. Restricted to Medical Laboratory Science students or consent of Department.

MLSCI 262 Clinical Biochemistry
★3 *(fi 6)* (first term, 3-0-3). This course considers how the analysis of samples from the body for various constituents can give insight into pathological processes. Included are the principles for tests routinely carried out in a clinical biochemistry laboratory, and the biological understanding of test results. Specific subjects considered are carbohydrates, renal function, blood proteins and electrolytes, and acid-base balance. Restricted to Medical Laboratory Science students.

MLSCI 263 Clinical Biochemistry
★3 *(fi 6)* (second term, 3-0-3). This course considers how the analysis of samples from the body for various constituents can give insight into pathological processes. Included are the principles for tests routinely carried out in a clinical biochemistry laboratory, and the biological understanding of test results. Specific subjects considered are clinical enzymology, heme catabolism, liver function toxicology and therapeutic drug monitoring principles of immunoassays, blood lipids porphyrins, endocrinology, gastric and GI function, fetal-placental function, and biochemical tumor markers. Restricted to Medical Laboratory Science students.

MLSCI 264 Clinical Biochemistry
★3 *(fi 6)* (first term, 3-0-0). This course considers how the analysis of samples from the body for various constituents can give insight into pathological processes. Included are the principles for tests routinely carried out in a clinical biochemistry laboratory, and the biological understanding of test results. Specific subjects considered are carbohydrates, renal function, blood proteins and electrolytes, and acid-base balance. Prerequisites for non-Medical Laboratory Science students only: CHEM 101, 161, 163 and BIOL 107. Credit granted for only one of MLSCI 262 or 264.

MLSCI 265 Clinical Biochemistry
★3 *(fi 6)* (second term, 3-0-0). This course considers how the analysis of samples from the body for various constituents can give insight into pathological processes. Included are the principles for tests routinely carried out in a clinical biochemistry laboratory, and the biological understanding of test results. Specific subjects considered are clinical enzymology, heme catabolism, liver function, toxicology and therapeutic drug monitoring, principles of immunoassays, blood lipids, porphyrins, endocrinology, gastric and GI function, fetal-placental function, and biochemical tumor markers. Prerequisites for non-Medical Laboratory Science students only: MLSCI 264. Credit granted for only one of MLSCI 263 or 265.

MLSCI 270 Transfusion Science
★2 *(fi 4)* (second term, 3-0-6 in 9 weeks). Nine weeks. This course will present the theory and practice of transfusion science. Topics covered include the genetics of blood groups pretransfusion testing, blood donation and component therapy, adverse effects of transfusion, hemolytic disease of the newborn, and autoimmune hemolytic anemia Prerequisite: MLSCI 230 or consent of Department. Restricted to Medical Laboratory Science students.

MLSCI 271 Transfusion Science
★2 *(fi 4)* (second term, 3-0-0 in 9 weeks). Nine weeks. This course is designed for students who are excused from the laboratory component of the normal MLSCI course. This course will present the theory and practice of transfusion science. Topics covered include the genetics of blood groups, or pretransfusion testing, blood donation and component therapy, adverse effects of transfusion, hemolytic disease of the newborn, and autoimmune hemolytic anemia. Prerequisite; MLSCI 230 or consent of Department. Restricted to Medical Laboratory Science students.

MLSCI 320 Analysis and Communication of Biomedical Information
★3 *(fi 6)* (two term, 1-0-2). Lectures, seminars, and assignments address the following components of writing a literature review: library searches, critical analysis, organizing, writing and editing. Speaking skills are developed through oral presentation of case studies. Prerequisite: consent of Division.

MLSCI 330 Clinical Hematology
★5 *(fi 10)* (two term, clinical rotation). As a part of a clinical laboratory education for Medical Laboratory Science students, this course will provide experience in a modern hospital hematology laboratory along with weekly tutorials followed by comprehensive theoretical and practical examinations.

MLSCI 340 Clinical Microbiology
★5 *(fi 10)* (two term, clinical rotation). As a part of a clinical laboratory education for Medical Laboratory Science students, this course will provide experience in a modern hospital microbiology laboratory along with weekly tutorials followed by comprehensive theoretical and practical examinations.

MLSCI 350 Histopathology
★3 *(fi 6)* (two term, clinical rotation). As a part of a clinical laboratory education for Medical Laboratory Science students, this course will provide experience in a modern hospital histopathology laboratory along with weekly tutorials followed by comprehensive theoretical and practical examinations.

MLSCI 360 Clinical Biochemistry
★5 *(fi 10)* (two term, clinical rotation). As a part of a clinical laboratory education for Medical Laboratory Science students, this course will provide experience in a modern hospital clinical biochemistry laboratory along with weekly tutorials followed by comprehensive theoretical and practical examinations.

MLSCI 370 Transfusion Science
★3 *(fi 6)* (two term, clinical rotation). As a part of a clinical laboratory education for Medical Laboratory Science students, this course will provide experience in a modern hospital transfusion service laboratory, along with weekly tutorials, followed by comprehensive theoretical and practical examinations.

MLSCI 410 Introduction to Clinical Laboratory Management
★1 *(fi 2)* (second term, 1-0-0). An introduction to the principles of management as they apply to clinical laboratories. Subject matter will include healthcare funding and allocation of funds, the management process in small and large clinical laboratories, performance appraisals, ethics and setting priorities for laboratory services. Prerequisite: consent of Division.

MLSCI 430 Advanced Hematology
★3 *(fi 6)* (second term, 3-0-0). This course is designed to enhance the student's ability to assimilate new and specialized knowledge in an evolving hematology discipline. As such, the course content will change from year to year. Consent of Division is required for non-Medical Laboratory Science students.

MLSCI 460 Clinical Biochemistry
★3 *(fi 6)* (second term, 3-0-0). Advanced lectures on specialized topics including diagnostic enzymology, blood lipids, transplantation biochemistry, hormone receptors and protein purification. Other topics will be considered through studies of case reports. A term paper is a requirement for this course. Prerequisite: BIOCH 200 and 330 or equivalents and consent of Division.

MLSCI 466 Applied Toxicology
★3 *(fi 6)* (first term, 3-0-0). A consideration of the protocols and their rationale used in a large toxicology laboratory. Topics include analytical, environmental, regulatory, and inhalation toxicology; clinical and forensic toxicology; and doping related to sports. Prerequisites: BIOCH 200 and 330 or equivalents and consent of Division.

MLSCI 475 Clinical Immunology
★3 *(fi 6)* (first term, 3-0-0). The application of basic immunology concepts to disease and transplantation, and their monitoring by the clinical laboratory. Topics include the cellular and humoral immune responses, human immune development, immunology and cancer, immune deficiency, autoimmune disease, immunopathology, and transplant immunology. Prerequisite: IMIN 370 or equivalent and consent of Division.

MLSCI 480 Molecular Genetic Approaches to the Study and Diagnosis of Disease
★3 *(fi 6)* (first term, 3-0-0). Emphasis on the application of techniques of molecular genetics to the practice of Medicine. General subject areas include: organization of the genome, techniques of molecular genetics and their application to medicine, molecular genetics and oncology, and ethical issues involving these techniques as applied to medicine. Prerequisites: Genetics and BIOCH 200 and 330 or equivalents and consent of Division.

MLSCI 481 Techniques in Molecular Biology
★3 *(fi 6)* (either term, 1-0-5). A laboratory course emphasizing introductory and advanced techniques in molecular biology. Isolation of RNA, Northern blotting, construction of cDNA, amplification of DNA by the polymerase chain reaction, analysis of DNA by restriction digestion, transfection of eukaryotic cells for protein expression and Western blot analysis. Corequisite: MLSCI 480 or consent of Department. This course is designed for senior undergraduate students. Credit may only be obtained in one of MLSCI 481 or LABMP 581.

231.187 Medical Microbiology and Immunology, MMI

Department of Medical Microbiology and Immunology
Faculty of Medicine and Dentistry

Note: See also the IMIN listings for the following courses offered by more than one department or faculty which may be taken as options or as a course in this discipline, specifically: IMIN 200, 324, 371, 372, and 452 (courses in immunology and infection); and INT D 409 and 491 (research project courses for medical laboratory science students).

Undergraduate Courses

○ MMI 133 Medical Microbiology for Health Care Professionals
★3 *(fi 6)* (first term, 3-0-0). Introductory course in medical microbiology designed for students enrolled in health care related programs. The course begins with basic information on microorganisms (bacteria, viruses, fungi, parasites and prions), the immune system, infection control, transmission of infection, epidemiology, antimicrobials, disinfection and sterilization. The later part of the course concentrates on infectious diseases caused by pathogenic microorganisms.

○ MMI 351 Bacterial Pathogenesis
★3 *(fi 6)* (second term, 3-0-0). Medically important bacteria, how they cause disease and the body's immune response to bacteria. Lectures will systematically discuss the organisms and describe their distinctive as well as their common features of structure and pathogenicity. Prerequisites: MICRB 265 and IMIN 200. May not be taken for credit if credit already obtained in MLSCI 240 or 241.

MMI 352 Practical Pathogenic Bacteriology
★3 *(fi 6)* (second term, 0-0-4). This laboratory course will emphasize development of skills and knowledge for the safe handling of infectious bacteria, how medically important organisms are identified and will examine some of the molecular mechanisms of bacterial virulence. Prerequisite or corequisite: MMI 351 or MLSCI 240 or 241 or consent of the Department.

○ MMI 405 Mechanisms of Pathogenicity I
★3 *(fi 6)* (first term, 3-3s-0). Selected topics regarding the production of disease by bacterial pathogens, with special emphasis on the biochemical, immunological and physiological properties of the host and microbe that account for the pathological process. Contemporary concepts will be introduced by means of lectures and student seminars. Prerequisites: BIOCH 200 and MMI 351 or MLSCI 240 or 241 or consent of Department.

Course Listings M

◯ MMI 415 Mechanisms of Pathogenicity II
★3 *(fi 6)* (second term, 3-0-0). Mechanisms of pathogenesis of globally significant infectious agents, such as protozoa, viruses and other microbes relevant in current endemics, oncogenesis, biological weapons, social and emerging diseases. Prerequisites: BIOCH 200 and IMIN 371 and either of MMI 351 or MLSCI 240 or 241 or IMIN 324, or consent of Department.

MMI 426 Medical Parasitology
★3 *(fi 6)* (first term, 3-0-3). A survey of the protozoan and metazoan parasites of man. Emphasis will be placed on biology, epidemiology, clinical presentation and methods for detection and identification, as well as global impact of parasitic diseases in today's world. Prerequisite: MLSCI 240 or 241 or IMIN 200, consent of Department.

◯ MMI 427 Fungi Affecting Human and Animal Health
★3 *(fi 6)* (second term, 3-0-3). Human health implications of allergenic, toxigenic and pathogenic fungi will be considered. Topics include pathogenicity, epidemiology, occupational and environmental risks of exposure to fungi or their metabolites, immune responses, diversity and ecology of fungi involved, aspects of clinical presentation, and principal tests and results expected for diagnosis of infection. The laboratory component consists of web-based exercises and assignments. Prerequisites: Introductory course in medical microbiology (MLSCI 240 or 241 or MMI 351) or mycology (BOT 306) or microbiology (MICRB 265) or consent of Department.

MMI 498 Research Project in Infection and Immunity
★3 *(fi 6)* (either term, 0-0-6). Directed research on a specific topic in medical microbiology or immunology in the laboratory of an academic staff member associated with MMI. Can be taken for credit more than once. An oral presentation on the research project is required for completion of the course. Pre- or corequisites: IMIN 324 or 371 or 452 or MMI 351 and/or consent of Department.

MMI 499 Independent Research in Infection and Immunity
★6 *(fi 12)* (two term, 0-0-6). Directed research project on a specific topic in medical microbiology
or immunology in the laboratory of an academic staff member associated with MMI. An oral presentation and a written report on the research project is required for completion of the course. Pre- or corequisites: IMIN 324 or 371 or 452 or MMI 351 and/or consent of the Department.

Graduate Courses

MMI 505 Mechanisms of Pathogenicity I
★3 *(fi 6)* (first term, 3-3s-0). Selected topics regarding the production of disease by bacterial pathogens, with special emphasis on the biochemical, immunological and physiological properties of the host and microbe that account for the pathological process. Contemporary concepts will be introduced by means of lectures and student seminars. Lectures and seminars are the same as MMI 405, but there will be an additional requirement of a written research proposal. This course may not be taken if credit has already been obtained in MMI 405. Consent of Department required.

MMI 512 Special Projects
★3 *(fi 6)* (either term, 0-0-3).

MMI 515 Mechanisms of Pathogenicity II
★3 *(fi 6)* (second term, 3-0-0). Mechanisms of pathogenesis of globally significant infectious agents, such as protozoa, viruses and other microbes relevant in current endemics, oncogenesis, biological weapons, social and emerging diseases. Lectures are the same as MMI 415, but there will be an additional requirement of a written/oral presentation on selected topics of emerging diseases. May not be taken for credit if credit has already been obtained in MMI 415. Consent of Department required.

MMI 520 Bacterial Plasmids
★3 *(fi 6)* (first term, 3-0-0). The biology of plasmids and plasmids as tools for molecular biology. The structure and properties of various bacterial plasmids (antibiotic resistance plasmids, colicin and enterotoxin-producing plasmids) will be considered in light of our current understanding of the evolution of plasmids. The involvement of insertion sequences and transposons in plasmids organization will be discussed. The course will focus on the modes of plasmid DNA replication and the means by which bacterial plasmids are maintained in host cells. Important plasmid-coded functions such as incompatibility and conjugative transfer will be discussed in detail. The effects of plasmids in human and veterinary medicine and on plant pathogenesis (the crown gall disease) will also be considered. The use of plasmids in genetic engineering including the choice of vectors, cloning methods and risks and benefits will complete the course. Note: Designed for advanced honors and graduate students and offered in alternate years. Prerequisites: BIOCH 200, GENET 270, or consent of Department.

MMI 526 Medical Parasitology
★3 *(fi 6)* (first term, 3-0-3). A survey of the protozoan and metazoan diseases of man. Emphasis will be placed on biology, epidemiology, clinical presentation and methods for detection and identification as well as global impact of parasitic diseases in today's world. Lectures and laboratories are the same as MMI 426, but

there will be an additional requirement for a written literature review/discussion paper on recent developments or controversies in the field of parasitology. This course may not be taken for credit if credit has already been obtained in MMI 426. Consent of Department required.

MMI 552 Advanced Immunology
★3 *(fi 6)* (second term, 3-1s-0). A lecture course on the detailed mechanisms of the immune system, describing recent discoveries in cellular and molecular immunology. Topics include the mechanism of T-cell receptor selection, antigen processing, activation of B and T lymphocytes, cellular collaboration, negative and positive regulatory mechanisms in immunity, transplantation, cytokine actions and interactions. Interaction between immune systems and pathogens, and immunogenetics. Lectures are the same as IMIN 452, but there will be an additional requirement of a written paper to evaluate a current controversy in immunology. May not be taken for credit if credit has already been obtained for INT D 452 or IMIN 452. Consent of Department required.

MMI 601 Seminar in Medical Microbiology and Immunology
★3 *(fi 6)* (either term, 0-3s-0). The student will prepare a seminar on an assigned topic in medical microbiology or immunology. Evaluation will focus on presentation, content, discussion of other student seminars, and proficiency in chairing other presentations. Required course. Open to graduate students in Medical Microbiology and Immunology only.

MMI 605 Current Topics in Infection and Immunity
★3 *(fi 6)* (either term, 0-4s-0). Selected topics in infections and immunity are explored in depth through evaluation of the primary research literature. Emphasis is on the molecular and cellular mechanisms underlying pathogenesis, host resistance, and immune regulation. Information is provided through selected readings and student seminar presentations. The primary objective is to introduce students to current research topics in infection and immunity, and develop their ability to critically evaluate, organize, and present scientific information.

231.188   Medicine, MED

Department of Medicine
Faculty of Medicine and Dentistry

Note: Joint Medicine/Dentistry Courses are listed in §201.52 (DMED).

Undergraduate Courses

231.188.1   Department of Medicine Courses

MED 555 Geriatrics Student Internship
★2 *(fi 4)* (either term, 2 weeks). Student internship in Geriatrics for students registered in the MD Program. Credit will not be granted for both MED 545 and 555.

231.188.2   Faculty of Medicine and Dentistry Courses

MED 400 Two-Week Medical Elective
★0 *(fi 1)* (either term, 2 weeks). This represents a contract period of registration with variable start and end dates for undergraduate medical students who are undertaking clinical electives. The type of clinical elective is open to any area of specialization. Prerequisite: enrolment in an MD program and approval by the Electives Coordinator of the Faculty of Medicine.

MED 401 Four-Week Medical Elective
★0 *(fi 1)* (either term, 4 weeks). This represents a contract period of registration with variable start and end dates for undergraduate medical students who are undertaking clinical electives. The type of clinical elective is open to any area of specialization. Prerequisites: enrolment in an MD program and approval by the Electives Coordinator of the Faculty of Medicine.

MED 402 Eight-Week Medical Elective
★0 *(fi 2)* (either term, 8 weeks). This represents a contract period of registration with variable start and end dates for undergraduate medical students who are undertaking clinical electives. The type of clinical elective is open to any area of specialization. Prerequisites: enrolment in an MD program and approval by the Electives Coordinator of the Faculty of Medicine.

MED 403 Twelve-Week Medical Elective
★0 *(fi 3)* (either term, 12 weeks). This represents a contract period of registration with variable start and end dates for undergraduate medical students who are undertaking clinical electives. The type of clinical elective is open to any area of specialization. Prerequisites: enrolment in an MD program and approval by the Electives Coordinator of the Faculty of Medicine.

MED 516 Patient-Centred Care, Part 1
★6 *(fi 12)* (two term, 2-6s-0). A discussion of medical skills which may be generalized across different disease states and different specialties. Topics include epidemiology, evidence-based Medicine, and public health, clinical skills, family

issues, ethics, the role of the health-care team, and related areas. Instruction in the role of the health-care team will be carried out in conjunction with INT D 410. Open only to students registered in the MD program.

MED 517 First-Year Elective
★1 *(fi 2)* (either term, 12 hours). Electives time to be developed by the students in consultation with a Faculty supervisor. Open only to students registered in the MD program.

MED 518 Optional Summer Elective
★1 *(fi 2)* (variable, variable). An optional elective of variable length, to be developed by the student in consultation with a Faculty supervisor. Open only to students registered in the MD program.

MED 520 Pre-Clinical Exam
★5 *(fi 10)* (second term, 9 hours). Final pre-clinical exam for students registered in the MD program.

MED 521 Gastroenterology and Nutrition
★5 *(fi 10)* (either term, 6 weeks). An integrated course covering nutrition, gastrointestinal physiology, pathophysiology and anatomy. Related surgical, paediatric and geriatric topics will also be addressed. Open only to students registered in the MD program.

MED 522 Reproductive Medicine and Urology
★6 *(fi 12)* (either term, 7 weeks). An overview of reproductive medicine in both genders, including discussion of conception, pregnancy and fetal development, birth, reproductive technology and relevant health-related issues in men and women. Also covered will be the physiology, pathophysiology and anatomy of the urinary tract, and management of problems in the genitourinary system. Open only to students registered in the MD program.

MED 523 Musculoskeletal System
★6 *(fi 12)* (two term, 7 weeks). Anatomy, physiology, pathophysiology and management in the musculoskeletal system. Open only to students registered in the MD program.

MED 524 Neurosciences
★9 *(fi 18)* (either term, 11 weeks). Fundamental Clinical Neurosciences taught in an integrated fashion. Involves instruction in subject areas related to the head and neck, including Neuroanatomy, Neurophysiology, Neuorpathology, Neuropharmacology, Neuroradiology, Neurology, Neurosurgery, Psychiatry, Rehabilitation Medicine, otorhinoloaryngology and Ophthalmology. Open only to students registered in the MD program.

MED 525 Oncology
★3 *(fi 6)* (either term, 4 weeks). Principles and concepts of clinical oncology. Open only to students registered in the MD program.

MED 526 Patient-Centred Care, Part II
★3 *(fi 6)* (two term, 2-4s-0). A continuation of MED 516, which involves further discussion of medical skills which may be generalized across different disease states and different specialities. Open only to students registered in the MD program.

MED 527 Second Year Elective
★1 *(fi 2)* (either term, 12 hours). Elective time to be developed by the student in consultation with a Faculty supervisor. Open only to students registered in the MD program.

MED 528 Optional Summer Elective
★1 *(fi 2)* (variable, variable). An optional elective of variable length, to be developed by the student in consultation with a Faculty supervisor. Open only to students registered in the MD program.

MED 531 Clinical Problems Series
★1 *(fi 2)* (two term, 36 hours). A series for students registered in the MD program.

MED 532 Link
★2 *(fi 4)* (first term, 2 weeks). This course serves as a transition between the pre-clinical and clinical years. It will include procedural skills, emergency medicine, otolaryngology, radiology, a review of history taking and physical exam skills and of the responsibilities of the health care team. Open only to students registered in the MD Program.

MED 540 Exams
★5 *(fi 10)* (second term, 18 hours). Final exams for students registered in the MD program.

MED 541 Clinical Problems Series
★1 *(fi 2)* (two term, 36 hours). A series for students registered in the MD Program.

MED 542 Review of Student Internship
★1 *(fi 2)* (second term, 3 weeks). Lecture and seminar series for students registered in the final year of the MD Program.

MED 546 Medicine Student Internship
★11 *(fi 22)* (either term, 11 weeks). Student internship in Medicine for students registered in the MD Program.

MED 547 Clinical Electives
★5 *(fi 10)* (either term, 5 weeks). Student internship in electives for students registered in the MD program.

MED 556 Medicine Student Internship
★6 *(fi 12)* (either term, 6 weeks). Student internship in medicine for students registered in the MD Program.

MED 557 Clinical Electives
★8 *(fi 16)* (either term, 8 weeks). Electives for students registered in the MD Program.

MED 558 Emergency Medicine Students Internship
★4 *(fi 8)* (either term, 4 weeks). Student internship in emergency medicine for students registered in the MD Program.

Graduate Courses

231.188.3 Department of Medicine Courses

MED 501 Clinical Pulmonary Physiology
★3 *(fi 6)* (second term, 2-0-0). Basic and clinical lectures on: Lung Structure; Pulmonary Blood Flow; Airflow; Gaseous Diffusion; Ventilation/Perfusion Matching; Control of Ventilation; Oxygen Transport; Lung Defense; Mucociliary Transport; ARDS; Asthma; Exercise; Lung Growth; Surfactant; Lung Metabolism; Pulmonary Function Testing. Prerequisites: General courses in Physiology, Physics and Biochemistry or consent of Department.

MED 529 Clinical Skills Program
★3 *(fi 6)* (two term, 2-4s-0). The Clinical Skills Program covers instruction on how to take and record a history and physical examination, as well as to demonstrate appropriate communication skills and professional attributes. These tasks are covered in the Gilbert Scholars Program as well as in material from the blocks and from ancillary pediatric sessions.

MED 543 Integrated Community Clerkship
★36 *(fi 72)* (two term, 36 weeks). A patient-centred, community clerkship based in select rural and regional Alberta communities. This course uses Family Medicine as the core of the clerkship experience to provide students with experience in continuity of care, in handling undifferentiated problems, in coordinating care for those with chronic disease, and in other key areas of family medicine and generalist specialties. 32 to 36 weeks will be spent in the rural community. The remainder of the second term will be a mix of electives and selectives.

MED 571 Directed Reading in the Basic Medical Sciences
★3 *(fi 6)* (either term, 3-0-0). Reading and study of basic medical science topics relevant to the student's chosen field of study under the direction of one or more faculty members. Prerequisite: consent of Department.

MED 573 Directed Reading in Clinical Medicine
★3 *(fi 6)* (either term, 3-0-0). Reading and study in a field relevant to the student's chosen field of study under the direction of one or more Faculty members. Prerequisite: consent of Department.

MED 575 Nutrition and Metabolism
★3 *(fi 6)* (two term, 1-1s-0). A seminar and discussion course in advanced nutrition and metabolism that examines current topics in nutrition and features regular seminars on alternate weeks throughout Fall and Winter Terms. A discussion group meets after each seminar. Preference will be given to graduate and postgraduate students in the area of nutrition and metabolism. Maximum enrolment of 15. Prerequisite: consent of Department.

MED 600 Advanced Clinical Trials
★3 *(fi 6)* (either term, 3-0-0). A formal lecture course to provide a background knowledge in clinical trials. Each session will consist of a formal lecture, followed by discussion on class assignments. Lectures will consist of Experimental Designs; Patient Recruitment, Randomization, Blinding, Compliance and Generalization; Sample Size Calculations, Statistical Methods; Outcomes Measures; Equivalence Trials; Economic Evaluation and Clinical Trials; Multicentre Clinical Trials; Data: Efficacy and Safety and Working with Industry and Funding Agencies. Prerequisite: consent of Department.

MED 650 Fundamentals for Clinical Investigators
★3 *(fi 6)* (two term, 3/2-0-0). A biweekly lecture course covering the important aspects of becoming a clinical investigator. Each session will include a lecture followed by a full class discussion and take home assignments related to the lecture. The topics include: clinical trial design, bioethics, biostatistics, literature appraisal, grant writing, manuscript writing, slide presentation for oral presentations, teaching enhancement, time management, ethics of industry liaisons, linking basic bench research to the bedside, technology transfer, career opportunities. Prerequisite: consent of Department.

MED 671 Current Topics in Biomedical Research
★2 *(fi 4)* (two term, 0-1s-0). A general seminar course covering recent advances across the field of biomedical research. Research topics will feature the areas of research being investigated by the graduate students and staff of the department.

All graduate students are required to participate and to give a research presentation. Other topics will provide for the acquisition of basic skills and knowledge in biomedical research and will include experimental design, critical review of the literature, communication skills, ethics of experimentation, and career development. Note: Restricted to graduate students in the Department of Medicine.

MED 700 Fundamentals for Translational Cardiovascular Clinical Investigators (#I)
★6 *(fi 12)* (two term, 3-0-0). [Strategic Training Fellow in Cardiovascular Research Tomorrow's Research Cardiovascular Health Professionals (TORCH)]. Is a lecture/seminar course designed to provide a comprehensive "hands on" exposure to a variety of research fields including Bio-medical, Clinical, Health Services, Social, Cultural, Environmental and Population Health. This multidisciplinary approach will use seminars, debates, case studies, journal clubs and workshops to develop the skills and knowledge base required to implement collaborative cardiovascular research projects. Seminar topics to include: biostatistics and health economics, congestive heart failure, obesity, new technologies, vascular biology, women's issues in vascular medicine, endothelial dysfunction, and electrophysiology. Prerequisite: Restricted to students who have received consent from TORCH Executive Advisory Committee and the course coordinator.

MED 701 Fundamentals for Translational Cardiovascular Clinical Investigations (#2)
★6 *(fi 12)* (two term, 3-0-0). [Strategic Training Fellow in Cardiovascular Research Tomorrow's Research Cardiovascular Health Professionals (TORCH)]. Is a lecture/seminar course designed to provide a comprehensive "hands on" exposure to a variety of research fields including Bio-medical, Clinical, Health Services, Social, Cultural, Environmental and Population Health. This multidisciplinary approach will use seminars, debates, case studies, journal clubs and workshops to develop the skills and knowledge base required to implement collaborative cardiovascular research projects. Seminar topics to include: stroke, hypertension, congenital heart disease, atherosclerosis, gene therapy, databases, aging, stents, MRI principles and the metabolic syndrome. Prerequisite: MED 700.

231.189   Microbiologie, MICRE
Faculté Saint-Jean

Cours de 1er cycle

MICRE 133 Microbiologie Médicale pour Infirmières
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Cours d'introduction pour les étudiants du BSciInf (bilingue). La première partie du cours se concentre sur les microorganismes, le système immunitaire, l'hygiène en milieu hospitalier, la transmission d'infection, les infections, les antibactériens, la désinfection et la stérilisation. La deuxième partie du cours se concentre sur les organismes pathogènes reliés aux systèmes d'organes et comment ils causent la maladie. Notes: La priorité sera accordée aux étudiants du BSciInf (bilingue). Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MMI 133.

231.190   Microbiology (Biological Sciences), MICRB
Department of Biological Sciences
Faculty of Science

Notes
(1) See the following sections for listings of other Biological Sciences courses: Bioinformatics (BIOIN); Biology (BIOL); Botany (BOT); Entomology (ENT); Genetics (GENET); Zoology (ZOOL)
(2) See the following sections for listings of other relevant courses: Interdisciplinary Studies (INT D); Immunology and Infection (IMIN); Marine Science (MA SC); Paleontology (PALEO).

Undergraduate Courses

O MICRB 265 General Microbiology
★3 *(fi 6)* (either term, 3-0-4). This course will focus on the structure and physiology of free-living and pathogenic bacteria. The diversity of their metabolic activities, the interaction of microbes with their environment, symbiotic relationships and cell-to-cell communication are major topics. Lectures and laboratory exercises are coordinated to explore topics in basic microbiology, environmental microbiology, molecular microbiology, and the production of economically or medically important products through microbial biotechnology. Prerequisites: BIOL 107 and CHEM 161 or 261.

O MICRB 311 Microbial Physiology
★3 *(fi 6)* (first term, 3-0-0). The structure, growth, and metabolic path-ways used by bacteria, yeasts, and molds. Emphasis is placed on the comparative biochemical aspects of microbial life. Prerequisites: MICRB 265 and BIOCH 200 or 205.

O MICRB 316 Molecular Microbiology
★3 *(fi 6)* (second term, 3-0-0). Factors that affect prokaryotic gene expression at the levels of replication, transcription, post-transcriptional and post-translational control. Topics will include mobile genetic elements and their effect on chromosome structure and gene expression; alternate sigma factors; protein modification and degradation; RNA structure, processing and decay; and DNA modification and rearrangement in gene control. Prerequisites: GENET 270, MICRB 265 and BIOCH 203/205 or BIOCH 200. Note: MICRB 316 and 516 cannot both be taken for credit.

MICRB 343 Analysis of Microbial Macromolecules
★3 *(fi 6)* (second term, 3-0-0). Description and critical discussion of current techniques used for the isolation and characterization of macromolecular constituents of prokaryotic cells with emphasis on proteins. Prerequisites: MICRB 311 or consent of instructor.

MICRB 345 Microbial Laboratory Techniques
★3 *(fi 6)* (second term, 0-0-8). A series of laboratory projects employing current techniques used in the isolation and characterization of macromolecular constituents of prokaryotic cells. Prerequisite: BIOL 391 (or consent of instructor); Co-or Prerequisite: MICRB 343. Credit may not be obtained for both MICRB 344 and 345.

O MICRB 406 Topics in Cell Biotechnology
★3 *(fi 6)* (two term, 0-2s-0). This course is designed to develop familiarity with current research literature in Cell Biotechnology. Note: Restricted to Honors Cell Biotechnology students. Prerequisites: A 300-level Microbiology course and consent of the Cell Biotechnology Committee.

O MICRB 410 Structure of Microorganisms
★3 *(fi 6)* (second term, 3-0-0). Cellular structure of prokaryotes with particular emphasis on cell wall active antibiotics and experimental methodologies. Prerequisite: MICRB 311. Note: MICRB 410 and 510 cannot both be taken for credit.

O MICRB 415 Industrial Microbiology
★3 *(fi 6)* (first term, 3-0-0). Microbial production of commercially important metabolites and products. Emphasis will be placed on control and regulation of metabolic pathways involved in the production of these microbial products and the use of genetic manipulation to improve production levels. Prerequisites: GENET 270 and MICRB 311.

MICRB 450 Fermentation Biotechnology
★3 *(fi 6)* (first term, 0-0-6). Involves a series of laboratory exercises designed to give students hands-on experience with the cultivation of various microbes at large scale. Students are responsible for all stages of the cultivation process, from medium preparation through inoculum development to harvesting and downstream processing, and so work at times outside of the scheduled laboratory period is required. Co-requisite: MICRB 415 or consent of Department.

O MICRB 491 Environmental Microbiology
★3 *(fi 6)* (first term, 3-0-0). Interactions between microorganisms and the environment. Topics include methods of sampling various environments, methods for monitoring microbial activities, petroleum microbiology, bioremediation, survival of airborne microorganisms, microbial metabolism of selected pollutants. Prerequisite: MICRB 265, corequisite: a 300-level Biological Sciences course or consent of Instructor. Note: Credit can be received in only one of MICRB 391, 491 and 591.

MICRB 492 Laboratory Methods for Environmental Microbiology
★3 *(fi 6)* (second term, 0-0-6). Laboratory experiments evaluate methods for enumerating bacteria from aquatic environments and introduce methods for monitoring their metabolic activities. Factors that influence petroleum biodegradation and comparisons of methods for sampling airborne microorganisms are also studied. Strong emphasis on statistical analysis of numerical data obtained. Pre- or corequisite: MICRB 491. MICRB 392 and 492 cannot both be taken for credit.

Note: For other Immunology courses not listed above, see MMI listing.

Graduate Courses

Notes
(1) All 300- and 400-level courses in the Department of Biological Sciences may be taken for credit (except for BIOL 490, 498 and 499) by graduate students with approval of the student's supervisor or supervisory committee.
(2) The following courses may be taken as an option in graduate programs in the Department of Biological Sciences with approval of the student's supervisor or supervisory committee: BIOCH 510, 520, 530, 541, 550, 555, 560; CHEM 361, 363, 461; CELL 300, 301; IMIN 371, 372, 452; INT D 421; MA SC 400, 401, 402, 410, 412, 420, 425, 430, 437, 440, 445, 470, 480; MMI 405, 415, 520; NEURO 472; NU FS 363; PALEO 318, 319; PHARM 601.

MICRB 510 Advanced Topics in Microbial Structure
★3 *(fi 6)* (second term, 3-0-0). Lecture course on cellular structure of prokaryotes with particular emphasis on experimental methodologies. Oral presentations are required. Prerequisite: consent of the Department. Note: MICRB 410 and 510 cannot both be taken for credit.

MICRB 514 Advanced Topics in Microbiology

★3 *(fi 6)* (second term, 3-0-0). Critical reading and discussion of scientific literature. Students will present scientific articles for group discussion and will also prepare a major literature review in their field of study. Topics covered will vary from year to year. Prerequisite: consent of Department.

MICRB 516 Advanced Molecular Microbiology

★3 *(fi 6)* (second term, 3-0-0). Lecture course on molecular mechanisms relating to gene expression of prokaryotes based on the current literature. In addition, students will prepare an analytical literature review on a chosen topic relating to this field. Prerequisite: consent of the Department. Note: MICRB 316 and 516 cannot both be taken for credit.

MICRB 591 Environmental Microbiology

★3 *(fi 6)* (first term, 3-0-0). Interactions between microorganisms and their environment. Topics include methods of sampling various environments, methods for monitoring microbial activities, petroleum microbiology, bioremediation, survival of airborne microorganisms, microbial metabolism of selected pollutants. Lectures and exams are the same as MICRB 491, but preparation of a major term paper and an oral presentation are required. Prerequisite: consent of Instructor. Note: Credit can be received in only one of MICRB 391, 491 and 591.

MICRB 606 Microbiology Seminar

★3 *(fi 6)* (either term, 0-3s-0). Intended for all Microbiology and Biotechnology graduate students, except those in their second year who should register for MICRB 607. Credit may be obtained more than once.

MICRB 607 Microbiology Seminar

★3 *(fi 6)* (either term, 0-3s-0). Graded seminar course intended for second-year graduate students.

231.191   Middle Eastern and African Studies, MEAS

Office of Interdisciplinary Studies
Faculty of Arts

Undergraduate Courses

O MEAS 200 Introduction to Middle Eastern and African Studies

★3 *(fi 6)* (either term, 0-3s-0). Explores conceptual framework and interdisciplinary tools for understanding Middle East and Africa as geographical and intellectual space.

O MEAS 300 Themes and Topics I

★3 *(fi 6)* (either term, 3-0-0).

O MEAS 301 Themes and Topics II

★3 *(fi 6)* (either term, 3-0-0).

MEAS 310 Religion and Politics in the Middle East and North Africa

★3 *(fi 6)* (either term, 3-0-0). This course examines the complex issues that derive from religion and politics in the formation of modern nation states across the contemporary Middle East and North Africa.

MEAS 320 Muslim Societies in the Middle East and Africa

★3 *(fi 6)* (either term, 3-0-0). This course takes a comparative approach to understanding development of societies that share Islam as a religion and culture, in the larger context of developing relations with the West. Specific topical, chronological and geographical focus will vary.

MEAS 330 Cultural Representations of Post-coloniality

★3 *(fi 6)* (either term, 3-0-0). Questioning identity in the post-colonial Middle East and Africa through expressive forms (literature, visual and performing arts, political cartoons, cinema, advertising, and other popular media).

MEAS 400 Topics in the Study of the Middle East and Africa

★3 *(fi 6)* (either term, 0-3s-0). Explores themes and issues central to what unifies and divides the Middle East and Africa. Exploits interdisciplinarity as a tool to deepen methodological and theoretical understanding.

MEAS 401 Themes and Topics

★3 *(fi 6)* (either term, 0-3s-0). Pre-requisite: any MEAS 300-level course or permission of Program Coordinator.

MEAS 475 Methodology in Middle Eastern and African Studies

★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of the Program Coordinator.

MEAS 480 Directed Reading in Middle Eastern and African Studies

★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Program.

MEAS 499 Honors Essay in Middle Eastern and African Studies

★6 *(fi 12)* (two term, 0-3s-0). Preparation of the Honors Essay. Prerequisite: MEAS 475

231.192   Mining Engineering, MIN E

School of Mining and Petroleum Engineering
Department of Civil and Environmental Engineering
Faculty of Engineering

Note: See also Materials Engineering (MATE); Mining and Petroleum Engineering (MPE); and Petroleum Engineering (PET E) listings.

Undergraduate Courses

MIN E 295 Introduction to Mining Engineering

★3.8 *(fi 6)* (either term, 3-0-3/2). Essential mining concepts and terminology; mining in Alberta; company operations; stages of mining; unit mining operations; surface mine development and methods; underground mine development and methods; mining methods selection and comparison; feasibility studies and mine costs. Laboratories will cover case studies, basic mine design problems, mine visits and mining films/videos. Students will also undertake small group projects on the operations of selected Canadian mining companies. Prerequisite: consent of Instructor.

MIN E 310 Ore Reserve Estimation

★4.5 *(fi 6)* (second term, 3-0-3). Conventional and geostatistical methods for construction of orebody models. Contouring techniques for mapping bounding surfaces of stratigraphic layers. Coordinate transforms and geometric techniques for modelling rock types. Estimation and simulation methods for characterizing ore grade variability. Students will learn the principles and procedures for constructing orebody models in a variety of geologic settings. Specialized topics such as ore reserve classification, uncertainty assessment, mine selectivity, and grade control will also be covered. A variety of public-domain and commercial software will be used for a series of laboratories. Pre- or corequisites: MATH 209 and STAT 235 and EAS 210.

MIN E 323 Rock Mechanics

★4.5 *(fi 6)* (first term, 3-0-3). Mechanical properties of rock masses, field and laboratory determination; classification and index testing; permeability and flow; stresses around underground openings, elastic prototypes and numerical methods; ground support principles and mechanics of common support systems, loads on supports; hydraulic backfill, earth pressures, consolidation theory and practical consequences in mining; mechanics of subsidence and caving; rockburst mechanics; slope stability, rock mechanics instrumentation. Prerequisite: CIV E 270 or consent of Instructor.

MIN E 324 Drilling, Blasting, and Explosives

★3 *(fi 6)* (either term, 3-0-0). Drilling methods, breakage mechanics, performance, and equipment. Explosive characteristics, initiation systems, selection, handling, and loading. Blasting, rock dynamics, design of surface and underground blasts, fragmentation prediction, vibrations and damage control, monitoring. Prerequisite: MIN E 295 or consent of Instructor.

MIN E 325 Mine Planning and Design

★4.5 *(fi 6)* (first term, 3-0-3). Introduction to mine planning and design using standard software tools. Planning of surface mines; pit designs, pit limits and optimization; mine scheduling. Specialized topics include mine production simulation, planning of underground mines, mine access and development methods, mine layout and mine plan requirements. Prerequisites: MIN E 295, CIV E 265, MIN E 310 or consent of Instructor.

MIN E 330 Mine Transport and Plant Engineering

★3.8 *(fi 6)* (either term, 3-3s/2-0). Covers underground and surface mine transport systems, rail haulage, hoisting, conveying and slurry pipelining. Auxiliary mining services such as electric power distribution, pumping and compressed air power. Seminars will include design problems dealing with the materials taught in the classroom. Oral presentation is required. Prerequisites: MIN E 295 and E E 239 or consent of Instructor.

MIN E 402 Mine Design Project I

★4 *(fi 6)* (first term, 1-0-6). First phase of a full Prefeasibility Study of a commercial mining property. Data collection, preparation of geological model using commercially available software. Calculate reserves and prepare plans and sections. Prepare geotechnical, hydrogeological, hydrological sections and review and identify conceptual mining methods for development in Mine Design Project II, (see MIN E 403). Prepare report. Present report at seminar. Weekly session (one hour) with project supervisor. Prerequisites or corequisites: MIN E 310, MIN E 325, MIN E 413 and MIN E 414 or consent of instructor.

MIN E 403 Mine Design Project II

★4 *(fi 6)* (second term, 1-0-6). Second phase of a full Prefeasibility Study of a commercial mining property. This phase follows on from Phase I (MIN E 402) requiring the development of marketing plans, detailed mine plans and equipment selection, environmental aspects, capital and operating cost estimates and financial and economic analyses. Prepare report. Submit report and present at seminar. Weekly session (one hour) with project supervisor. Prerequisite: MIN E 402.

MIN E 407 Principles of Mine Ventilation
★3.8 *(fi 6)* (second term, 3-0-3/2). Principles and practices for control of the underground environment including application of software and governing legislation. Prerequisite: CIV E 330, ENV E 302, and MIN E 414.

MIN E 408 Mining Enterprise Economics
★3 *(fi 6)* (either term, 2-0-2). Fundamentals of economic evaluation. Cost estimation, commodity price modelling and revenue forecasts and taxation related to mine development. Economic evaluation of mining ventures, profitability, risks and uncertainty analyses. Commodity markets and mine management strategies. Weekly laboratory/tutorial sessions will address case studies and specific problems. Prerequisites: ENGG 310 or 401, STAT 235 or consent of Instructor.

MIN E 413 Surface Mining and Waste Management
★3.8 *(fi 6)* (first term, 3-0-3/2). Cyclic and continuous surface mining methods. Production and productivity considering the generation of mine specific landform structures. Design for closure with consideration of mining and environmental legislation, waste streams, acid rock drainage, emissions and effluent treatment. Reclamation, restoration and rehabilitation. Prerequisites: MIN E 310, 330, 323, and 325 or consent of Instructor.

MIN E 414 Underground Mining Methods
★3.8 *(fi 6)* (first term, 3-0-3/2). Underground mining methods; Equipment types; specification and operation, mine organization, labor productivity, cost estimating and cost control. Methods studied include room-and-pillar, sublevel stoping and caving, vertical crater retreat, block caving, selective methods for vein mines, and underground coal mining systems. Prerequisites: MIN E 323, MIN E 324 and MIN E 325 or consent of Instructor.

MIN E 420 Mine Equipment Selection and Maintenance
★3 *(fi 6)* (second term, 3-0-0). Introduction to the principles of equipment selection and maintenance practice. Selected issues of machine and component longevity, wear, service and optimization for both surface and underground equipment. Prerequisites: CIV E 270, MIN E 413, 414 or consent of Instructor.

MIN E 428 Mining Field Trip
★2 *(fi 4)* (Spring/Summer, 0-4s-0). An extended trip to visit surface and underground mines is made every year by students entering third or fourth year Mining Engineering, accompanied by staff. A report on the trip is to be submitted. All Mining students may be required to make other field trips during the sessions. Prerequisite: MIN E 295.

MIN E 555 Special Topics in Mining Engineering
★3 *(fi 6)* (either term, 3-0-0). Research studies and/or projects dealing with selected metal, nonmetal and coal mining subjects. Suitable subjects are chosen in consultation with a mining engineering faculty member. Typical study categories are reserve evaluation, surface and underground mining methods and operations, mine planning, computer simulation of mining operations, mineral processing, ventilation, regulations, mine safety, feasibility studies, economics and management. Prerequisite: consent of Instructor

Graduate Courses

MIN E 612 Principles of Geostatistics
★3.5 *(fi 6)* (either term, 3-1s-0). Geostatistical methods are presented for characterizing the spatial distribution of regionalized variables. The theory of random variables and multivariate spatial distributions is developed. This class focuses on the quantification of spatial variability with variograms, estimation with kriging, and simulation with Gaussian techniques.

MIN E 613 Non-Parametric & Multivariate Geostatistics
★3.5 *(fi 6)* (either term, 3-1s-0). Cell based methods for geology modeling, including indicator formalism for categorical data and truncated Gaussian simulation. Object based and process-based approaches for fluvial reservoirs. Indicators for continuous variable estimation and simulation. Multivariate geostatistics including models of coregionalization, cokriging, Gaussian cosimulation, Markov-Bayes simulation and multivariate data transformation approaches. Introduction to advanced simulation approaches including direct simulation, simulated annealing and multiple point simulation. Prerequisite: Consent of instructor.

MIN E 614 Risk Management with Geostatistics
★3 *(fi 6)* (either term, 3-1s-0). Advanced methods for the modeling of heterogeneity, quantification of uncertainty and management of risk. The theory and place of historical and advanced methods in geostatistics. Matrix methods, alternative variogram measures, kriging with a trend, dual kriging, spectral simulation, direct simulation and multiple point statistics.

MIN E 615 Application of Geostatistics
★3 *(fi 6)* (either term, 3-1s-0). Public domain and commercial software are reviewed for geostatistical modeling. Special projects in petroleum, mining, environmental and other areas will be undertaken.

MIN E 620 Rock Mechanics
★4 *(fi 6)* (either term, 3-1s-1). Properties of intact rocks and testing methods. Properties of rock masses and rock mass classifications. Rock and rock mass strength criteria. Stresses in rock masses. Analysis of rock mass performance, rock support and stabilization. Empirical, analytical and numerical analysis techniques. Surface and underground rock engineering case studies Prerequisite: Consent of Instructor.

MIN E 622 Mining Equipment Design, Benchmarking and Performance
★3.5 *(fi 6)* (either term, 3-1s-0). A study of selected surface and underground mining equipment designs, enhancements and appropriateness for operation within given mining conditions. Strategies for machine dynamic performance benchmarking and evaluation, as tools for planning, maintenance and operations scheduling are considered for good and poor operating environments. Prerequisite: consent of Instructor.

MIN E 623 Rock Slope Stability in Surface Mining
★3.5 *(fi 6)* (either term, 3-1s-0). Economic, operational and geological factors affecting slope design. Design stages; collection of structural and strength data. Data synthesis, interpretation, design values. Methods of design, deterministic and probabilistic methods. Bench design. Controlled blasting; stabilization techniques. Monitoring. Spoil pile stability. Prerequisite: MIN E 323 or equivalent.

MIN E 631 Surface Mine Design and Optimization
★3.5 *(fi 6)* (either term, 3-1s-0). Surface mining methods, mechanics of surface mine layouts design, haul roads design, waste dump design, theory of Lerchs-Grossman's, floating cone, conditional simulation, neural network and heuristic algorithms for surface mine optimization. Large scale applications of these algorithms for designing and optimizing surface mine layouts and subsequent advance mining systems design. Students undertake design projects under Instructor's direction. Prerequisites: MIN E 413 or consent of Instructor.

MIN E 632 Mining Equipment Engineering and Management
★3.5 *(fi 6)* (either term, 3-1s-0). Surface and underground mining equipment engineering and management approaches are investigated. Use of the observational method to equipment management is introduced. Theory and application of planning, operations and maintenance strategies will be discussed with appropriate case studies. Students undertake retrofit and/or hybrid design assignments for selected equipment operational issues. Prerequisite: MIN E 520, MIN E 622 or consent of Instructor.

MIN E 640 Simulation of Industrial Systems
★3.5 *(fi 6)* (either term, 3-1s-0). Formulation of models of engineering problems and industrial systems for experimentation using a general purpose simulation language. Statistical and operational validation of simulation results. Prerequisite: consent of Instructor.

MIN E 650 Special Topics in Mining Engineering
★3 *(fi 6)* (either term, 3-0-0). Special studies of developments of current interest within the mining industry in exploration, mining methods, mine planning, mine simulation, environment, regulations, economics and management; e.g. tar sands mining, ocean mining, in situ gasification.

MIN E 685 Advanced Energy and Mineral Economics
★3 *(fi 6)* (either term, 3-0-0). Application of advanced statistical and probability theory in mineral resource investment risk and uncertainty analysis in random multivariable states. Numerical modelling of mineral resource stochastic processes using derivative mine valuation concepts. Case studies include application of simulation and numerical modelling packages for mineral resources, coal and oil and gas properties analysis. Prerequisite: consent of Instructor.

MIN E 710 Mining
★3 *(fi 6)* (either term, 3-0-0). Readings and discussion of selected topics in mining engineering.

MIN E 900 Directed Research
★3 *(fi 6)* (either term, unassigned). An engineering project for students registered in a Masters of Engineering program.

231.193　Mining and Petroleum Engineering, MP E
Department of Civil and Environmental Engineering
Faculty of Engineering

Note: See also Mining Engineering (MIN E), Materials Engineering (MAT E), and Petroleum Engineering (PET E) listings.

The following courses were renumbered effective 1997-98:

Old	New	Old	New
MMP E 392	MP E 292	MMP E 508	MP E 408
MMP E 422	MP E 322	MMP E 597	MP E 497
MET E 431	MP E 331	MMP E 599	MP E 499
MMP E 490	MP E 390		

Undergraduate Courses

MP E 322 Rock Structures and Intact Rock Properties
★3.5 *(fi 6)* (second term, 3-1s-0). Rock texture and fabric; compaction, fracture

and deformation properties, effect of environment and time, strength theories. State of stress in the Earth's crust and its measurement. Formation, geometry and classification of depositional, diastrophic and non-diastrophic structures including bedding, jointing, faulting, folding, cleavage. Representation of structures on maps and stereographic projections. Prerequisite: CIV E 270 or consent of Instructor.

MP E 499 Undergraduate Seminar
★1 *(fi 2)* (first term, 1-0-0). Special lectures and discussion on topics in engineering.

231.194 Modern Languages and Cultural Studies, MLCS

Department of Modern Languages and Cultural Studies
Faculty of Arts

Undergraduate Courses

O MLCS 201 Reading European Cultures
★3 *(fi 6)* (either term, 3-0-0). Basic questions of culture in Europe, their common denominator, and historical foundations from the Middle Ages to the present.

O MLCS 205 Folklore
★3 *(fi 6)* (either term, 3-0-0). Basic concepts and practices of folklore (stories, customs, beliefs, objects) from the language groups of MLCS.

L MLCS 210 Language(s) of Culture
★3 *(fi 6)* (either term, 3-0-0). Introduction to the major issues within the discipline of Cultural Studies from an international perspective, and provision of the necessary terminology and theoretical tools for examining general topics and case studies with emphasis on the question of languages.

L MLCS 300 Introduction to Translation
★3 *(fi 6)* (either term, 3-0-0). Translation problems and strategies illustrated with examples from a variety of languages. Prerequisite: ★6 in a foreign language at the 150-level or above.

MLCS 301 Topics in Literary Representations of Science and Technology
★3 *(fi 6)* (either term, 3-0-0). Representation of science and technology in both literary and non-literary texts. This course is taught in English. Prerequisites: ★6 in a language other than English and ★6 at the 200-level in any subject.

MLCS 302 Ecology and Culture
★3 *(fi 6)* (either term, 3-0-0). Exploration of how the notion of ecology is articulated in terms of both cultural and natural environments and represented in a variety of texts. This course is taught in English. Prerequisites: ★6 in a language other than English and ★6 at the 200-level in any subject.

O MLCS 311 Russia and its Neighbours: Nations in Dialogue and Conflict
★3 *(fi 6)* (either term, 3-0-0). Cultural and political relations between Russia and the West, with emphasis on the Soviet period since 1945 and after perestroika.

O MLCS 312 Russian and Non-Russian Cultural and Political Space
★3 *(fi 6)* (either term, 3-0-0). Cultural and political relations between Russian and non-Russian components of the Imperial and Soviet empires, and between their equivalents in the successor states. Identity, cultural formation, metahistory.

MLCS 321 Topics in History of Language: The Origin and Development of Germanic, Romance, Slavic
★3 *(fi 6)* (either term, 3-0-0). A survey of the historical development of the Germanic, Romance, and Slavic language families from their Proto-Indo-European beginnings to the medieval and early modern era. Prerequisite: ★6 at the 200-level or above in a language taught in Modern Languages and Cultural Studies, or consent of the Department.

MLCS 371 Cultural Studies and Applied Linguistics
★3 *(fi 6)* (either term, 3-0-0). Basic concepts in cultural studies and linguistics applied to the analysis of a specific text genre in different cultures. Prerequisite: ★6 at the 200-level or above in any language other than English.

L MLCS 400 The History of Translation
★3 *(fi 6)* (either term, 3-0-0). A broad historical perspective on the contributions made by translators to the intellectual and cultural history of the world through consideration of the Germanic, Romance and Slavic traditions. The role of the translator and basic principles governing the various traditions are examined to gain insight into different types of translation (religious, literary, technical) and significant moments in the history of translation. Prerequisite: ★6 in a Language Other than English at the 200-level or above or consent of Department.

MLCS 441 The Capital City in Language, Literature, and Visual Culture
★3 *(fi 6)* (either term, 3-0-0). Examines the notion of the capital city as it is represented in different national cultures. Prerequisite: ★6 at the 300-level, of which ★3 must be in a language taught in Modern Languages and Cultural Studies.

MLCS 461 The Cultures of the Avant-Garde
★3 *(fi 6)* (either term, 3-0-0). The literary and artistic avant-garde in Germanic, Romance and Slavic cultures, circa 1900-1930. Prerequisite: ★6 at the 300-level or above, of which ★3 must be in a language taught in Modern Languages and Cultural Studies.

MLCS 472 Language Use and Cross-Cultural Relations
★3 *(fi 6)* (either term, 0-3s-0). Study of social phenomena from a cross-cultural perspective through discourse analysis. Prerequisite: ★6 at the 300-level, of which ★3 must be in a language taught in Modern Languages and Cultural Studies, or consent of Department.

MLCS 473 Cultural Representations, World Media and Ethics
★3 *(fi 6)* (either term, 0-3s-0). A discursive approach to the study of cultural representations and ethical issues in world media. Prerequisite: ★6 at the 300-level, of which ★3 must be in a language taught in Modern Languages and Cultural Studies, or consent of Department.

MLCS 495 Honors Thesis
★3 *(fi 6)* (either term, 0-3s-0).

MLCS 499 Special Topics
★3 *(fi 6)* (either term, 3-0-0).

Graduate Courses

MLCS 507 Topics in Major Contemporary Currents in Literary and Cultural Theory
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: Reading knowledge of one relevant language other than English. Note: This course is equivalent to C LIT 507 and EASIA 507.

MLCS 541 The Capital City in Language, Literature, and Visual Culture
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MLCS 555 Teaching Strategies for Postsecondary Language Instructors
★3 *(fi 6)* (either term, 3-0-0). Designed to help graduate teaching assistants to develop practical expertise in language instruction at the college and university levels. Prerequisite: consent of Department.

MLCS 561 The Cultures of the Avant-Garde
★3 *(fi 6)* (either term, 3-0-0). The literary and artistic avant-garde in Germanic, Romance and Slavic cultures, circa 1900 to 1930. Prerequisite: consent of Department.

MLCS 570 Applied Linguistics
★3 *(fi 6)* (either term, 3-0-0). Applied linguistics, including second language acquisition, sociolinguistics, discourse analysis, second language pedagogy, and bilingualism.

MLCS 572 Language Use and Cross-Cultural Relations
★3 *(fi 6)* (either term, 0-3s-0). Prerequisite: consent of Department.

MLCS 573 Cultural Representations, World Media and Ethics
★3 *(fi 6)* (either term, 0-3s-0). Prerequisite: consent of Department.

MLCS 581 Applied Linguistics: Second Language Research
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MLCS 582 Applied Linguistics: Sociolinguistics
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MLCS 583 Applied Linguistics: Discourse Analysis
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MLCS 599 Directed Reading
★3 *(fi 6)* (either term, 3-0-0).

MLCS 600 Translation Theories
★3 *(fi 6)* (either term, 3-0-0). The multiple ways in which linguistics, literary criticism, philosophy, cultural theories and feminist theories have informed the practice of translation and contributed to the production of different translation theories. In their presentations and papers, students are encouraged to use examples taken from languages with which they are familiar.

MLCS 601 Special Topics in Translation
★3 *(fi 6)* (either term, 3-0-0).

MLCS 698 Topics in Applied Linguistics
★3 *(fi 6)* (either term, 3-0-0).

MLCS 699 Topics in Literary and Cultural Studies
★3 *(fi 6)* (either term, 3-0-0).

MLCS 900 Directed Research Project
★6 *(fi 12)* (variable, unassigned).

MLCS 901 MA Research Project
★3 *(fi 6)* (either term, 3-0-0).

231.195   Music, MUSIC
Department of Music
Faculty of Arts

Note: The ability to read music is required for all courses numbered 207 and greater except MUSIC 248, 348, 448, and 548.

Undergraduate Courses

MUSIC 100 Rudiments of Music
★3 *(fi 6)* (either term, 3-0-0). Fundamentals of music theory approached through aural and written training. Note: Not available for degree credit to students enrolled in a BMus (all routes) degree program.

❓ MUSIC 101 Introduction to Western Art Music
★3 *(fi 6)* (either term, 3-0-0). A study of music literature with an emphasis on listening and analytical tools. A brief survey of the history of Western music will be included. Note: Not open to BMus (all routes) students.

MUSIC 102 Introduction to World Music
★3 *(fi 6)* (either term, 3-0-0). Not available to students with credit in MUSIC 165.

❓ MUSIC 103 Introduction to Popular Music
★3 *(fi 6)* (either term, 3-0-0). A survey of popular music's development as a category of musical and cultural practice, an industry and an object of study, during the twentieth century.

MUSIC 122 Second Practical Subject
★3 *(fi 9)* (two term, 0.5-0-0). Restricted to BMus (all routes), BMus/BEd, and BEd students majoring in secondary music education. Twenty-six half-hour lessons for two terms. Prerequisite: consent of Department.

MUSIC 124 Applied Music
★3 *(fi 9)* (either term, 1-0-0). For non-BMus students. Thirteen one-hour lessons for one term. Prerequisite: consent of Department, based on audition.

MUSIC 125 Applied Music
★6 *(fi 15)* (two term, 2-0-0). Restricted to BMus (all routes) and BMus/BEd students.

MUSIC 126 Applied Music
★3 *(fi 9)* (two term, 0.5-0-0). For non-BMus students. Twenty-six half-hour lessons for two terms. Prerequisite: consent of Department, based on audition.

MUSIC 127 Applied Music
★6 *(fi 15)* (two term, 1-0-0). For non-BMus students. Twenty-six one-hour lessons for two terms. Prerequisite: consent of Department, based on audition.

MUSIC 129 Fundamental Keyboard Skills
★3 *(fi 6)* (two term, 0-2L-0). Prerequisite: consent of Department. Restricted to BMus (all routes), BMus/BEd, and BA (Honors) Music Major students.

MUSIC 132 Second Practical Subject
★3 *(fi 9)* (either term, 1-0-0). Restricted to BMus (all routes), BMus/BEd, and BEd students majoring in secondary music education. Thirteen one-hour lessons for one term. Prerequisite: consent of Department.

❓ MUSIC 140 Choral Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Choir or Madrigal Singers. Prerequisite: consent of Department, based on audition.

❓ MUSIC 141 Instrumental Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Band, Wind Ensemble, Academy Strings, Orchestral Winds, or Jazz Band I or II. Prerequisite: consent of Department based on audition.

❓ MUSIC 143 Indian Music Ensemble I
★3 *(fi 6)* (two term, 0-4L-0). The classical music of India, through group instruction in singing, tabla (drums), sitar (plucked lute), sarangi (bowed lute), bansuri (flute), harmonium, and ensemble performance. A set of instruments will be available. The ability to read music is not required. Prerequisite: consent of Department.

❓ MUSIC 144 West African Music Ensemble I
★3 *(fi 6)* (two term, 0-4L-0). Polyphonic and polyrhythmic music of West Africa, primarily through ensemble performance of the percussion and vocal music of the Ewe people of Ghana. A set of Ewe percussion instruments will be available. The ability to read music is not required. Prerequisite: consent of Department.

❓ MUSIC 148 Middle Eastern and North African Music Ensemble I
★3 *(fi 6)* (two term, 0-4L-0). The study of Middle Eastern and North African vocal and instrumental music (primarily Arab, Persian, and Turkish musical traditions) through group instruction and ensemble performance. No formal musical training (e.g., the ability to read music or instrumental competency) is required. Some traditional instruments will be available. Prerequisite: consent of the Department.

MUSIC 151 Aural and Keyboard Skills I
★3 *(fi 6)* (two term, 0-3L-0). The development of basic musicianship skills through dictation and performance of pitch, rhythmic, and keyboard exercises. Prerequisite: MUSIC 100 or satisfactory completion of Dept. of Music Theory Placement Exam

and Aural Skills Exam for other than BMus students. Corequisite: MUSIC 155 or 156. Restricted to BMus (all routes), BMus/BEd, BEd Music Major/Minor, BA (Honors) Music Major, and BA Music Major/Minor students.

MUSIC 155 Music Theory I
★3 *(fi 6)* (either term, 3-0-0). A study of common-practice harmony, including elementary analysis with preliminary discussion of elements of formal contrapuntal writing and chorale texture. Prerequisite: MUSIC 100 or satisfactory completion of Department of Music Theory Placement Examination. Registration priority given to BMus (all routes), BMus/BEd, BEd Music Major/Minor, BA (Honors) Music Major, and BA Music Major/Minor students.

MUSIC 156 Music Theory II
★3 *(fi 6)* (either term, 3-0-0). Continuing the study of common-practice harmony and elementary formal analysis. Prerequisite: MUSIC 155. Registration priority given to BMus (all routes), BMus/BEd, BEd Music Major/Minor, BA (Honors) Music Major, and BA Music Major/Minor students.

MUSIC 201 Western Music and Contexts
★3 *(fi 6)* (either term, 3-0-0). Study of selected works and their significance in a variety of musical, social, and historical contexts. Prerequisite: MUSIC 101 or equivalent. Not open to BMus (all routes) students. Not applicable to BA Music Major students.

MUSIC 207 Instruments for Children
★3 *(fi 6)* (either term, 3-0-0). Laboratory experience with recorder ensemble, small winds, chording and percussion instruments. Prerequisites: MUSIC 150 or 156, and 151.

MUSIC 209 Woodwind Techniques I
★3 *(fi 6)* (first term, 3-0-0). Practical and theoretical instruction on single-reed instruments. Prerequisites: MUSIC 150 or 156, and 151. Corequisite or prerequisite: MUSIC 121 or 125, 124, or equivalent. Restricted to BMus (all routes), BMus/BEd, BEd Music Major/Minor, and BA (Honors) Music Major students.

MUSIC 211 Woodwind Techniques II
★3 *(fi 6)* (second term, 3-0-0). Practical and theoretical instruction on flute, oboe and bassoon. Prerequisite: MUSIC 209. Note: Restricted to BMus (all routes), BMus/BEd, BEd Music Major/Minor, and BA (Honors) Music Major students.

MUSIC 216 Brass Techniques I
★3 *(fi 6)* (first term, 3-0-0). Practical and theoretical instruction on trumpet. Prerequisite: MUSIC 150 or 156, and 151. Corequisite or prerequisite: MUSIC 121 or 125, or 124 or equivalent. Note: Restricted to BMus (all routes), BMus/BEd, BEd Music Major/ Minor, and BA (Honors) Music Major students.

MUSIC 217 Brass Techniques II
★3 *(fi 6)* (second term, 3-0-0). Practical and theoretical instruction on brass instruments. Prerequisite: MUSIC 216 or proficiency examination. Note: Restricted to BMus (all routes), BMus/BEd, BEd Music Major/Minor, and BA (Honors) Music Major students.

MUSIC 220 Percussion Techniques
★3 *(fi 6)* (first term, 3-0-0). Practical and theoretical instruction on percussion instruments. Prerequisites: Music 150 or 156, and 151, or equivalent. Corequisite or prerequisite: MUSIC 121 or 125, or 124, or equivalent. Restricted to BMus (all routes), BMus/BEd, BEd Music Major/Minor, and BA (Honors) Music Major students.

MUSIC 222 Second Practical Subject
★3 *(fi 9)* (two term, 0.5-0-0). Restricted to BMus (all routes), BMus/BEd, and BEd students majoring in secondary music education. Twenty-six half-hour lessons for two terms. Prerequisite: consent of Department.

MUSIC 224 Applied Music
★3 *(fi 9)* (either term, 1-0-0). For non-BMus students. Thirteen one-hour lessons for one term. Prerequisites: MUSIC 121 or 125, or 124 or equivalent and consent of Department.

MUSIC 225 Applied Music
★6 *(fi 15)* (two term, 2-0-0). Restricted to BMus (all routes) and BMus/BEd students. Prerequisite: MUSIC 121 or 125, or 124 or equivalent.

MUSIC 226 Applied Music
★3 *(fi 9)* (two term, 0.5-0-0). For non-BMus students. Twenty-six half-hour lessons for two terms. Prerequisite: consent of Department, based on audition.

MUSIC 227 Applied Music
★6 *(fi 15)* (two term, 1-0-0). For non-BMus students. Twenty-six one-hour lessons for two terms. Prerequisite: consent of Department, based on audition.

MUSIC 230 Choral Techniques and Pedagogy
★3 *(fi 6)* (first term, 3-0-0). Prerequisites: MUSIC 150 or 156, and 151, or equivalent. Note: Restricted to BMus (all routes), BMus/BEd, BEd Music Major/Minor, and BA (Honors) Music Major students.

MUSIC 232 Second Practical Subject
★3 *(fi 9)* (either term, 1-0-0). Restricted to BMus (all routes), BMus/BEd, and BEd students majoring in secondary music education. Thirteen one-hour lessons for one term. Prerequisite: consent of Department.

MUSIC 239 Vocal and Instrumental Chamber Ensemble
★3 *(fi 6)* (two term, 0-2L-0). Prerequisite: consent of Department, based on audition.

O MUSIC 240 Choral Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Choir or Madrigal Singers. Prerequisite: consent of Department, based on audition.

O MUSIC 241 Instrumental Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Band, Wind Ensemble, Academy Strings, Orchestral Winds, or Jazz Band I or II. Prerequisite: consent of Department, based on audition.

O MUSIC 243 Indian Music Ensemble II
★3 *(fi 6)* (two term, 0-4L-0). For description see MUSIC 143. Prerequisite: consent of Department.

O MUSIC 244 West African Music Ensemble II
★3 *(fi 6)* (two term, 0-4L-0). For description see MUSIC 144. Prerequisite: consent of Department.

MUSIC 245 Introduction to Music Technologies
★3 *(fi 6)* (either term, 0-3L-0). Computer technology with a focus on MIDI, synthesis, and software programs for sequencing, music notation, audio recording and transformation, and music on the Internet. Prerequisites: MUSIC 151 and 156, or consent of Department. Registration priority will be given to BMus (all routes), BMus/BEd, BEd Music Major/Minor, BA (Honors) Music Major and BA Music Major students.

O MUSIC 246 Opera Workshop
★3 *(fi 6)* (two term, 0-4L-0). The coaching and staging of opera literature. Prerequisite: consent of Department, based on audition.

O MUSIC 247 Conducting Ensembles
★3 *(fi 6)* (two term, 0-4L-0). Graduate Choral Conductors' Ensemble (Vocal), Graduate Choral Conductors' Ensemble (Instrumental), or Graduate Recital Choir. Prerequisite: Consent of Department, based on audition. Note: Does not fulfill large-ensemble requirements in BMus (all routes) and BMus/BEd programs.

O MUSIC 248 Middle Eastern and North African Music Ensemble II
★3 *(fi 6)* (two term, 0-4L-0). No formal musical training (eg. the ability to read music or instrumental competency) is required. Some traditional instruments will be available. Prerequisite: consent of the Department.

MUSIC 251 Aural and Keyboard Skills II
★3 *(fi 6)* (two term, 0-3L-0). A continuation of MUSIC 151. Prerequisite: MUSIC 151. Corequisite: MUSIC 255 or 256 or consent of Department.

MUSIC 255 Music Theory III
★3 *(fi 6)* (either term, 3-0-0). A continuation of the study of common-practice music with an emphasis on form and contrapuntal principles. Prerequisites: MUSIC 150 or 155 and 156.

MUSIC 256 Music Theory IV
★3 *(fi 6)* (either term, 3-0-0). Theories of art music composed between 1900 and 1950. Prerequisite: MUSIC 255.

MUSIC 259 Introduction to Composition
★3 *(fi 6)* (first term, 3-0-0). Prerequisites: MUSIC 150 or 156, and 151 or equivalent. Note: Public performance of works completed in the course will be expected. Registration priority given to BMus (all routes), BMus/BEd, BA (Honors) Music Major, BEd Music Major/Minor, and BA Music Major students.

MUSIC 260 Composition
★3 *(fi 6)* (second term, 3-0-0). Prerequisite: MUSIC 259. Registration priority given to BMus, BA (Honors) Music Major, BEd Music Major/Minor, and BA Music Major students.

MUSIC 263 Instrumentation and Arranging
★3 *(fi 6)* (first term, 3-0-0). A study of the technical and expressive characteristics of the standard orchestral instruments. An introduction to historical developments in orchestration is included. Prerequisites: MUSIC 150 or 156 or equivalent. Formerly MUSIC 462.

MUSIC 281 Early European Music History
★3 *(fi 6)* (second term, 3-0-0). Middle Ages to 1750. Prerequisite: MUSIC 155. Not open to students with credit in MUSIC 271.

MUSIC 282 History of Western Art Music
★3 *(fi 6)* (first term, 3-0-0). 1750 to present. Prerequisite: MUSIC 156. Not open to students with credit in MUSIC 272 or 273.

MUSIC 303 Piano Pedagogy I
★3 *(fi 6)* (first term, 3-0-0). Prerequisites: MUSIC 221, 224, 225, or equivalent.

MUSIC 304 Piano Pedagogy II
★3 *(fi 6)* (second term, 3-0-0). Prerequisite: MUSIC 303.

MUSIC 311 Latin America and the Cultures of Popular Music
★3 *(fi 6)* (either term, 3-0-0). Popular music and its role in the formation of regional and national identities, with a focus on concepts such as high and low cultures, mass culture and mass media, cultural hybridity, diaspora, and creativity. Prerequisite: LA ST 205 or 210, or MUSIC 102 or 170, or consent of Department. Note: not to be taken by students with credit in LA ST 311.

MUSIC 313 History of Jazz
★3 *(fi 6)* (either term, 3-0-0). A historical survey of the main evolutionary trends in jazz through analysis of distinctive jazz styles and listening to recorded examples. Prerequisite: MUSIC 100 or satisfactory completion of the Department of Music Theory Placement Examination for other than BMus (all routes) and BMus/BEd students. Not available to students with credit in MUSIC 213.

MUSIC 314 Canadian Music
★3 *(fi 6)* (either term, 3-0-0). The history of music in Canada from colonial times to the present. Prerequisite: MUSIC 101 or equivalent. Not available to students with credit in MUSIC 215.

MUSIC 315 Introduction to Conducting
★3 *(fi 6)* (first term, 3-0-0). Development of basic conducting techniques and score reading. Prerequisites: MUSIC 150 or 156, and 151, or equivalent

MUSIC 320 Diction for Singers
★3 *(fi 6)* (either term, 0-3L-0). The application of the International Phonetic Alphabet (IPA) to singing in English, Italian, German and French. Prerequisite: MUSIC 125 (Voice), or consent of Department.

MUSIC 342 Specialized Ensemble I
★3 *(fi 6)* (two term, 0-4L-0). Prerequisite: consent of Department, based on audition.

O MUSIC 343 Indian Music Ensemble III
★3 *(fi 6)* (two term, 0-4L-0). For description see MUSIC 143. Prerequisite: consent of Department.

O MUSIC 344 West African Music Ensemble III
★3 *(fi 6)* (two term, 0-4L-0). For description see MUSIC 144. Prerequisite: consent of Department.

O MUSIC 347 Conducting Ensembles
★3 *(fi 6)* (two term, 0-4L-0). Graduate Choral Conductors' Ensemble (Vocal), Graduate Choral Conductors' Ensemble (Instrumental), or Graduate Recital Choir. Prerequisite: Consent of Department, based on audition. Note: Does not fulfill large-ensemble requirements in BMus (all routes) and BMus/BEd programs.

O MUSIC 348 Middle Eastern and North African Music Ensemble III
★3 *(fi 6)* (two term, 0-4L-0). No formal musical training (eg. the ability to read music or instrumental competency) is required. Some traditional instruments will be available. Prerequisite: consent of the Department.

O MUSIC 365 Introduction to Ethnomusicology
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 101 or 102 or consent of Department for students not in the BMus (all routes) or BMus/BEd program. Not available to students with credit in MUSIC 265.

MUSIC 403 Piano Literature I
★3 *(fi 6)* (first term, 3-0-0). Prerequisite: consent of Department.

MUSIC 404 Piano Literature II
★3 *(fi 6)* (second term, 3-0-0). Prerequisite: consent of Department.

MUSIC 413 Studies in the History of Jazz
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 313.

MUSIC 416 Instrumental Conducting
★3 *(fi 6)* (second term, 3-0-0). Prerequisite: MUSIC 315.

MUSIC 417 Choral Conducting and Pedagogy
★3 *(fi 6)* (second term, 3-0-0). Prerequisite: MUSIC 315.

MUSIC 420 Applied Music
★6 *(fi 15)* (two term, 1-0-0). For non-BMus students. Twenty-six one-hour lessons for two terms. Prerequisite: consent of Department, based on audition.

MUSIC 422 Second Practical Subject
★3 *(fi 9)* (two term, 0.5-0-0). Restricted to BMus (all routes), BMus/BEd and BEd students majoring in secondary music education. Twenty-six half-hour lessons for two terms. Prerequisite: consent of Department.

MUSIC 424 Applied Music
★3 *(fi 9)* (either term, 1-0-0). For non-BMus students. Thirteen one-hour lessons for one term. Prerequisites: MUSIC 224 or equivalent and consent of Department.

MUSIC 425 Applied Music
★6 *(fi 15)* (two term, 2-0-0). Restricted to BMus (all routes) and BMus/BEd students. Note: Students intending to enrol in MUSIC 526 are required to have successfully presented a public recital while enrolled in MUSIC 425. Prerequisite: MUSIC 225.

MUSIC 426 Applied Music
★3 *(fi 9)* (two term, 0.5-0-0). For non-BMus students. Twenty-six half-hour lessons for two terms. Prerequisite: consent of Department, based on audition.

Course Listings M

MUSIC 431 Band Techniques
★3 *(fi 6)* (either term, 0-3L-0). Musical and practical aspects of band conducting. Prerequisite: A conducting course or substantial conducting experience.

MUSIC 432 Second Practical Subject
★3 *(fi 9)* (either term, 1-0-0). Restricted to BMus (all routes), BMus/BEd, and BEd students majoring in secondary music education. Thirteen one-hour lessons for one term. Prerequisite: consent of Department.

MUSIC 433 The Organ and Its Literature I
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 434 The Organ and Its Literature II
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 435 Vocal Pedagogy
★3 *(fi 6)* (either term, 3-0-0). Prerequisites: MUSIC 221 or 225, or 224, or equivalent.

MUSIC 439 Vocal and Instrumental Chamber Ensemble
★3 *(fi 6)* (two term, 0-2L-0). Prerequisite: consent of Department, based on audition.

O MUSIC 440 Choral Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Choir or Madrigal Singers. Prerequisite: consent of Department, based on audition.

O MUSIC 441 Instrumental Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Band, Wind Ensemble, Academy Strings, Orchestral Winds, or Jazz Band I or II. Prerequisite: consent of Department, based on audition.

MUSIC 442 Specialized Ensemble II
★3 *(fi 6)* (two term, 0-4L-0). Prerequisite: consent of Department based upon audition.

O MUSIC 443 Indian Music Ensemble IV
★3 *(fi 6)* (two term, 0-4L-0). For description see MUSIC 143. Prerequisite: consent of Department.

O MUSIC 444 West African Music Ensemble IV
★3 *(fi 6)* (two term, 0-4L-0). For description see MUSIC 144. Prerequisite: consent of Department.

MUSIC 445 Electroacoustic Music
★3 *(fi 6)* (second term, 0-3L-0). Electroacoustic music techniques, history and repertoire. Prerequisite: consent of department. Registration priority will be given to BMus (all routes), BA (Honors) Music Major, BEd Music Major/Minor, BA Music Major and graduate students in Music.

O MUSIC 446 Opera Workshop
★3 *(fi 6)* (two term, 0-4L-0). The coaching and staging of opera literature. Prerequisite: consent of Department, based on audition.

O MUSIC 447 Conducting Ensembles
★3 *(fi 6)* (two term, 0-4L-0). Graduate Choral Conductors' Ensemble (Vocal), Graduate Choral Conductors' Ensemble (Instrumental), or Graduate Recital Choir. Prerequisite: Consent of Department, based on audition. Note: Does not fulfill large-ensemble requirements in BMus (all routes) and BMus/BEd programs.

O MUSIC 448 Middle Eastern and North African Music Ensemble IV
★3 *(fi 6)* (two term, 0-4L-0). No formal musical training (eg. the ability to read music or instrumental competency) is required. Some traditional instruments will be available. Prerequisite: consent of the Department.

MUSIC 451 Aural and Keyboard Skills III
★3 *(fi 6)* (two term, 0-3L-0). The development of advanced musicianship skills. Prerequisites: MUSIC 250 or 256, and 251, or equivalent.

MUSIC 455 Music Theory V
★3 *(fi 6)* (first term, 3-0-0). Theories of art music composed since 1950. Prerequisite: MUSIC 255.

MUSIC 456 Music Theory VI
★3 *(fi 6)* (second term, 3-0-0). Analysis of popular musics. Prerequisite: MUSIC 255.

MUSIC 457 String Literature
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 459 String Pedagogy
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 221, 224, 225, 226, 227, or consent of Department.

MUSIC 460 Composition
★6 *(fi 12)* (two term, 3-0-0). Emphasis on writing in larger forms. Public performance of works completed in the course will be required. Prerequisite: MUSIC 260 or equivalent, portfolio review, and consent of Department. Corequisite or prerequisite: MUSIC 263 or equivalent. Registration priority given to BMus, BA (Honors) Music Major, BEd Music Major/Minor, and BA Music Major students.

MUSIC 462 Topics in Orchestration
★3 *(fi 6)* (either term, 3-0-0). Contemporary acoustic and/or electroacoustic orchestration techniques and practices. Prerequisite: MUSIC 463 or equivalent, or consent of Department.

MUSIC 463 Orchestration
★3 *(fi 6)* (second term, 3-0-0). A detailed study of orchestration and its historical developments. Prerequisite: MUSIC 263.

O MUSIC 464 Topics in Ethnomusicology: Music and Religion
★3 *(fi 6)* (either term, 3-0-0). Explores music and sound as central aspects of religious concepts, meaning, and performance, with special emphasis on ritual. Prerequisite: consent of Department.

O MUSIC 465 Area Studies in Ethnomusicology
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

O MUSIC 466 Topics in Ethnomusicology
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

O MUSIC 467 Area Studies in Ethnomusicology: India and South Asia
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

O MUSIC 468 Area Studies in Ethnomusicology: The Arab World
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

O MUSIC 469 Area Studies in Ethnomusicology: Music and Islam
★3 *(fi 6)* (either term, 3-0-0). Addresses the sonic practices of Islamic rituals, Muslim discourses about music, and the relation of both to the rich diversity of religious and musical practices in Muslim societies around the globe. Prerequisite: consent of Department.

MUSIC 480 Survey of Contemporary Repertoire
★3 *(fi 6)* (either term, 3-0-0). Overview of acoustic and/or electroacoustic repertoire from c. 1950. Co- or Prerequisite: MUSIC 256.

MUSIC 481 Studies in Avant-Garde Music
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 256.

MUSIC 482 Studies in Music and Gender
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 483 Studies in Musical Genre
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 484 Studies in Music and Society
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 485 Composer Studies
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 487 Period Studies
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 501 Music History Seminar I
★3 *(fi 6)* (either term, 0-3s-0). Prerequisite: consent of Department.

MUSIC 502 Music History Seminar II
★3 *(fi 6)* (either term, 0-3s-0). Prerequisite: consent of Department.

MUSIC 504 Honors Essay
★3 *(fi 6)* (either term, 3-0-0). Restricted to BA Honors Music major students.

MUSIC 505 Bibliography and Methods of Research
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department. Registration priority given to MA students in music, MMus, BMus (Music History), BMus (World Music), and BA (Honors) Music Major students. If space remains, restricted to BMus (all routes) students only.

MUSIC 506 Tutorial Study
★3 *(fi 6)* (either term, 3-0-0). Independent research in a specific area of the student's interest. Prerequisite: consent of Department.

MUSIC 507 Writing About Music
★3 *(fi 6)* (either term, 3-0-0). Through lectures, assigned readings, and short written assignments, students will investigate technical aspects relevant to writing about music. Uses of grammar, rhetoric, and the graphic design of musical illustrations will be addressed in order to develop facility, as well as a clear and personal style of paper writing. The course will be team taught to cover conventional modes of written expression in music history, theory, and ethnomusicology. Prerequisite: MUSIC 505.

MUSIC 508 Seminar in Canadian Music
★3 *(fi 6)* (either term, 0-3s-0). Prerequisite: consent of Department.

MUSIC 520 Applied Music
★3 *(fi 9)* (two term, 0.5-0-0). For non-BMus students. Twenty-six half-hour lessons for two terms. Prerequisite: consent of Department, based on audition.

MUSIC 522 Second Practical Subject
★3 *(fi 9)* (two term, 0.5-0-0). Restricted to BMus (all routes), BMus/BEd and BEd students majoring in secondary music education. Twenty-six half-hour lessons for two terms. Prerequisite: consent of Department.

MUSIC 524 Applied Music
★3 *(fi 9)* (either term, 1-0-0). For non-BMus students. Thirteen one-hour lessons for one term. Prerequisites: MUSIC 424 or equivalent and consent of Department.

MUSIC 525 Applied Music
★6 *(fi 15)* (two term, 2-0-0). Restricted to BMus (all routes) students.

MUSIC 527 Applied Music
★6 *(fi 15)* (two term, 1-0-0). For non-BMus students. Twenty-six one-hour lessons for two terms. Prerequisite: consent of Department, based on audition.

MUSIC 532 Second Practical Subject
★3 *(fi 9)* (either term, 1-0-0). Restricted to BMus (all routes), BMus/BEd, and BEd students majoring in secondary music education. Thirteen one-hour lessons for one term. Prerequisite: consent of Department.

MUSIC 533 Hymnody and Service Playing I
★3 *(fi 6)* (either term, 0-3L-0). Prerequisite: consent of Department. Not available to students with credit in MUSIC 406.

MUSIC 534 Hymnody and Service Playing II
★3 *(fi 6)* (either term, 0-3L-0). Prerequisite: MUSIC 533 or consent of Department. Not available to students with credit in MUSIC 406.

MUSIC 535 Organ Construction, Tonal Design and the Art of Registration
★3 *(fi 6)* (either term, 0-3L-0). Prerequisite: consent of Department.

MUSIC 539 Vocal and Instrumental Chamber Ensemble
★3 *(fi 6)* (two term, 0-2L-0). Prerequisite: consent of Department, based on audition.

O MUSIC 540 Choral Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Choir or Madrigal Singers. Prerequisite: consent of Department, based on audition.

O MUSIC 541 Instrumental Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Band Wind Ensemble, Academy Strings, Orchestral Winds, or Jazz Band I or II. Prerequisite: consent of Department, based on audition.

MUSIC 542 Specialized Ensemble III
★3 *(fi 6)* (two term, 0-4L-0). Prerequisite: consent of Department based on audition.

MUSIC 545 Seminar in Computer Applications to Music
★3 *(fi 6)* (either term, 0-3s-0). Computer applications used in various genres, including acoustic and algorithmic composition, music notation, analysis, live electronics, electroacoustic/acousmatic music, and sound ecology. Prerequisites: Music 445 or equivalent or consent of Department.

O MUSIC 546 Opera Workshop
★3 *(fi 6)* (two term, 0-4L-0). The coaching and staging of opera literature. Prerequisite: consent of Department, based on audition.

MUSIC 555 Issues in Theory and Analysis
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 456.

MUSIC 556 Seminar in Music Theory
★3 *(fi 6)* (either term, 0-3s-0). Prerequisites: MUSIC 256 and consent of Department.

MUSIC 560 Composition
★6 *(fi 12)* (two term, 3-0-0). Public performance of works completed in the course will be required. Registration priority given to BMus, BA (Honors) Music Major, BEd Music Major/Minor, and BA Music Major students. Prerequisite: MUSIC 460 or equivalent, portfolio review, and consent of Department. Co- or prerequisite: MUSIC 263.

Graduate Courses

Note: The following undergraduate courses may be taken for credit by graduate students: MUSIC 320, 413, 433, 434, 445, 501, 502, 505, 507, 508, 525, 533, 534, 535, 542, 545, 555, 556, 560.

O MUSIC 543 Indian Music Ensemble V
★3 *(fi 6)* (two term, 0-4L-0). For description see MUSIC 143. Prerequisite: consent of Department.

O MUSIC 544 West African Music Ensemble V
★3 *(fi 6)* (two term, 0-4L-0). For description see MUSIC 144. Prerequisite: consent of Department.

O MUSIC 547 Conducting Ensembles
★3 *(fi 6)* (two term, 0-4L-0). Graduate Choral Conductors' Ensemble (Vocal), Graduate Choral Conductors' Ensemble (Instrumental), or Graduate Recital Choir. Prerequisite: Consent of Department, based on audition.

O MUSIC 548 Middle Eastern and North African Music Ensemble V
★3 *(fi 6)* (two term, 0-4L-0). No formal musical training (eg. the ability to read music or instrumental competency) is required. Some traditional instruments will be available. Prerequisite: consent of the Department.

MUSIC 557 Advanced Studies in String Literature
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 559 Advanced Studies in String Pedagogy
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 562 Advanced Topics in Orchestration
★3 *(fi 6)* (either term, 3-0-0). Contemporary acoustic and/or electroacoustic orchestration techniques and practices. Prerequisite: MUSIC 463 or equivalent, or consent of Department.

O MUSIC 564 Advanced Topics in Ethnomusicology: Music and Religion
★3 *(fi 6)* (either term, 3-0-0). Explores music and sound as central aspects of religious concepts, meaning, and performance, with special emphasis on ritual. Prerequisite: consent of Department.

O MUSIC 565 Area Studies in Ethnomusicology
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 365 or consent of Department.

O MUSIC 566 Topics in Ethnomusicology
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 365 or consent of Department.

O MUSIC 567 Advanced Area Studies in Ethnomusicology: India and South Asia
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

O MUSIC 568 Advanced Area Studies in Ethnomusicology: The Arab World
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

O MUSIC 569 Advanced Area Studies in Ethnomusicology: Music and Islam
★3 *(fi 6)* (either term, 3-0-0). Addresses the sonic practices of Islamic rituals, Muslim discourses about music, and the relation of both to the rich diversity of religious and musical practices in Muslim societies around the globe. Prerequisite: consent of Department.

MUSIC 580 Advanced Contemporary Repertoire
★3 *(fi 6)* (either term, 3-0-0). Overview of acoustic and/or electroacoustic repertoire from c. 1950. Co- or Prerequisite: MUSIC 256.

MUSIC 581 Advanced Studies in Avant-Garde
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 256.

MUSIC 582 Advanced Studies in Music and Gender
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 583 Advanced Studies in Musical Genre
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 584 Advanced Studies in Music and Society
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 585 Advanced Composer Studies
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 587 Advanced Period Studies
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 601 Tutorial Study
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: consent of Department.

MUSIC 602 Tutorial Study
★3 *(fi 6)* (two term, 1.5-0-0). Prerequisite: consent of Department.

MUSIC 603 Practicum in Piano Teaching
★3 *(fi 6)* (either term, 2-0-3). Prerequisite: MUSIC 304 or consent of Department.

MUSIC 604 Piano Pedagogy
★3 *(fi 6)* (either term, 0-3s-0). Prerequisite: MUSIC 304 or consent of Department.

MUSIC 608 Seminar in 20th-Century Music
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 613 Seminar in Romantic Music
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 614 Proseminar in Musicology
★3 *(fi 6)* (either term, 0-3s-0). An overview of history, methodologies, and current issues in musicology. Prerequisite: MUSIC 505.

MUSIC 615 Seminar in Musicology I
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 616 Seminar in Musicology II
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 621 Applied Music
★6 *(fi 15)* (two term, 2-0-0).

MUSIC 623 Supplementary Applied Music
★3 *(fi 9)* (two term, 1-0-0). Prerequisite: consent of Department.

MUSIC 625 Applied Music
★3 *(fi 9)* (variable, 2-0-0). Thirteen hours of lessons over either the fall term or over two terms, plus attendance at weekly repertoire class.

MUSIC 630 Choral Conducting
★6 *(fi 12)* (two term, 3-0-0).

MUSIC 631 Advanced Band Techniques
★3 *(fi 6)* (either term, 3-0-0). Advanced musical and practical aspects of band conducting. Prerequisite: MUSIC 431 or equivalent, or substantial conducting experience, and consent of the Department.

MUSIC 632 Advanced Wind Band Conducting
★6 *(fi 12)* (two term, 2-0-0). Prerequisite: MUSIC 431 or equivalent, or substantial conducting experience, and consent of the Department.

MUSIC 633 Seminar in Choral Literature I
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 634 Seminar in Choral Literature II
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 637 Vocal and Instrumental Chamber Ensemble
★3 *(fi 6)* (either term, 0-2L-0). Prerequisite: consent of Department, based upon audition.

MUSIC 639 Vocal and Instrumental Chamber Ensemble
★3 *(fi 6)* (two term, 0-2L-0). Prerequisite: consent of Department, based upon audition.

Ⓞ MUSIC 640 Choral Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Choir or Madrigal Singers. Prerequisite: consent of Department, based upon audition.

Ⓞ MUSIC 641 Instrumental Ensemble
★3 *(fi 6)* (two term, 0-4L-0). Concert Band Wind-Ensemble, Academy Strings, Orchestral Winds, or Jazz Band I or II. Prerequisite: consent of Department, based upon audition.

MUSIC 645 Seminar in Computer Music Composition
★3 *(fi 6)* (either term, 0-3s-0). Application and programming of computer music software. Prerequisites: MUSIC 445 or equivalent, or consent of Department.

Ⓞ MUSIC 646 Opera Workshop
★3 *(fi 6)* (two term, 0-4L-0). The coaching and staging of opera literature. Prerequisite: consent of Department, based on audition.

MUSIC 650 Proseminar in Music Theory
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 651 Seminar in Music Analysis
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 653 Seminar in History of Theory
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 654 Seminar in Theory and Music
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 660 Advanced Composition I
★6 *(fi 12)* (two term, 3-0-0).

MUSIC 661 Advanced Composition II
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 660.

MUSIC 665 Issues in Ethnomusicology
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 666 Field Methods in Ethnomusicology
★3 *(fi 6)* (either term, 0-3s-0).

MUSIC 685 Graduate Keyboard Seminar
★3 *(fi 6)* (two term, 0-1.5s-0). Topics in performance-practice issues. Restricted to pianists and organists in the MMus and DMus programs.

MUSIC 699 Directed Research
★3 *(fi 6)* (either term, 3-0-0).

MUSIC 721 Applied Music
★6 *(fi 15)* (two term, 2-0-0).

MUSIC 725 Applied Music
★6 *(fi 15)* (two term, 2-0-0). Twenty-six hours of lessons over two terms, plus one hour of repertoire class per week.

MUSIC 737 Special Projects in Chamber Music
★3 *(fi 6)* (either term, 0-2L-0). Restricted to Doctor of Music students.

MUSIC 739 Special Projects in Chamber Music
★3 *(fi 6)* (two term, 0-2L-0). Restricted to Doctor of Music students.

MUSIC 760 Advanced Composition III
★6 *(fi 12)* (two term, 3-0-0). Restricted to DMus Composition students.

MUSIC 761 Advanced Composition IV
★3 *(fi 6)* (either term, 3-0-0). Prerequisite: MUSIC 760. Restricted to DMus Composition students.

MUSIC 903 Directed Research Project
★3 *(fi 6)* (either term, unassigned). This is a pass/fail course.

MUSIC 906 Directed Research Project
★6 *(fi 12)* (either term, unassigned). This is a pass/fail course.

MUSIC 909 Directed Research Project
★9 *(fi 18)* (either term, unassigned). This is a pass/fail course.

231.196   Musique, MUSIQ
Faculté Saint-Jean

Cours de 1er cycle

Ⓞ MUSIQ 100 Les rudiments de la musique
★3 *(fi 6)* (premier semestre, 3-0-0). L'étude de la notation musicale et des rudiments de la musique. Introduction à la lecture élémentaire. Note: Les étudiants en BMus ne peuvent pas suivre ce cours. Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 100.

Ⓞ MUSIQ 101 Introduction à la musique occidentale
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Une étude de la littérature musicale en insistant sur l'audition et les moyens analytiques. Un bref survol historique de la musique occidentale. Note : Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 101.

MUSIQ 103 Fondements de la musique
★3 *(fi 6)* (l'un ou l'autre semestre, 0-3L-0). L'acquisition et le développement de connaissances et d'habiletés musicales fondamentales nécessaires à l'enseignement élémentaire. Préalable(s): MUSIQ 100 ou l'équivalent mesurable par un test sur les rudiments de la musique.

MUSIQ 124 Musique appliquée
★3 *(fi 6)* (l'un ou l'autre semestre, 1-0-0). Leçons de chant individuelles pour les étudiants non inscrits au BMus. Préalable(s): l'approbation du professeur après audition. Note : Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 124.

Ⓞ MUSIQ 140 Ensemble choral
★3 *(fi 6)* (aux deux semestres, 0-4L-0). Cours de chant choral. Préalable(s): l'approbation du professeur après audition. Note : Un demi-cours qui s'étale sur les deux semestres. Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 140.

MUSIQ 151 Culture de l'oreille et facilité au clavier I
★3 *(fi 6)* (aux deux semestres, 0-3L-0). Perception auditive de matières couvertes en MUSIQ 155 et 156, par la mise en pratique de la lecture à vue, de la dictée et de l'harmonie au clavier. Préalable(s): MUSIQ 100 ou l'équivalent mesurable par un test de placement en théorie musicale de la Faculté et un examen sur les habiletés auditives sauf pour les étudiants du BMus. Note: un demi-cours qui s'étale sur les deux semestres. Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 151.

MUSIQ 155 Théorie musicale I
★3 *(fi 6)* (premier semestre, 3-0-0). Une étude de l'harmonie classique (c.-à-d. des XVIIe et XVIIIe siècles) qui inclut l'analyse élémentaire et une discussion préliminaire des éléments relatifs à l'écriture du contrepoint et à la texture chorale. Préalable(s): MUSIQ 100 ou l'équivalent mesurable par un test de placement en théorie musicale de la Faculté. Note : Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 155.

MUSIQ 156 Théorie musicale II
★3 *(fi 6)* (deuxième semestre, 3-0-0). La continuation de l'étude de l'harmonie classique et de l'analyse formelle élémentaire. Préalable(s): MUSIQ 155. Note : Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 156.

Ⓞ MUSIQ 201 Les chefs-d'oeuvre de la musique
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Une étude des plus grands chefs-d'oeuvre musicaux choisis pour représenter divers moyens d'expression et divers styles historiques. Préalable(s): MUSIQ 101 ou l'équivalent. Note : Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 201.

MUSIQ 224 Musique appliquée
★3 *(fi 6)* (l'un ou l'autre semestre, 1-0-0). Leçons de chant individuelles pour les étudiants non inscrits au BMus. Préalable(s): MUSIQ 124 ou l'équivalent et l'approbation du professeur. Note : Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 224.

O MUSIQ 240 Ensemble choral
★3 *(fi 6)* (aux deux semestres, 0-4L-0). Cours de chant choral. Préalable(s): l'approbation du professeur après audition. Note : Un demi-cours qui s'étale sur les deux semestres. Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 240.

O MUSIQ 315 Introduction à l'art de diriger
★3 *(fi 6)* (l'un ou l'autre semestre, 3-0-0). Préalable(s): MUSIQ 151 et 156, ou l'équivalent.

MUSIQ 424 Musique appliquée
★3 *(fi 6)* (l'un ou l'autre semestre, 1-0-0). Leçons de chant individuelles pour les étudiants non inscrits au BMus. Préalable(s) : MUSIQ 224 ou l'équivalent et l'approbation du professeur. Note : Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 424.

O MUSIQ 440 Ensemble choral
★3 *(fi 6)* (aux deux semestres, 0-4L-0). Cours de chant choral. Préalable(s): l'approbation du professeur après audition. Note : Un demi-cours qui s'étale sur les deux semestres. Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 440.

Cours de 2e cycle

MUSIQ 524 Musique Appliquée (Chant)
★3 *(fi 6)* (l'un ou l'autre semestre, 1-0-0). Leçons de chant individuelles pour les étudiants non inscrits au BMus. Préalable(s) : MUSIQ 424 ou l'équivalent et l'approbation du professeur. Note: Ce cours n'est pas accessible aux étudiants ayant ou postulant des crédits pour MUSIC 524.

231.197 Native Studies, NS

Faculty of Native Studies

Undergraduate Courses

NS 100 Introduction to Native Studies
★3 *(fi 6)* (either term, 3-0-0). This course will introduce the discipline and expectations of Native Studies to the student by emphasizing research and writing skills necessary in an academic environment. The subject matter for the course will come from such areas as the cultural histories and an analysis of contemporary conditions of Native societies in Canada.

O NS 105 Cree Language Challenge
★3 *(fi 6)* (either term, unassigned). This is an exam only course open to fluent speakers of the Cree language. Credit: Pass/Fail.

O NS 152 Introductory Cree
★6 *(fi 12)* (two term, 4-0-1). A general introduction to Plains Cree (Y dialect) grammar and vocabulary, with practice in speaking and work in the language laboratory. No prior knowledge of Cree is assumed. Not open to students with matriculation standing in Cree. Note: Students cannot receive credit for NS 152 and NS 153.

O NS 153 Introduction to the Structure of the Cree Language for Cree Speakers
★3 *(fi 6)* (second term, 4-0-0). A course designed specifically for fluent speakers of Cree who require an introduction to the Pentland othography writing system and formal training and practice with Cree grammatical structure. The focus is on literacy in the Plains Cree dialect. Note: Students cannot receive credit for NS 152 and NS 153. Prerequisite: NS 105.

O NS 154 Introduction to a Dene Language I
★3 *(fi 6)* (first term, 4-0-1). A general introduction to a Dene language, grammar and vocabulary, with practice in speaking and work in the language laboratory. No prior knowledge of the language is assumed. Not open to students with matriculation standing in a Dene language.

O NS 155 Introduction to a Dene Language II
★3 *(fi 6)* (second term, 4-0-1). A continuation of NS 154. Prerequisite: NS 154.

O NS 200 Aboriginal Canada: Looking Forward/Looking Back
★3 *(fi 6)* (either term, 2-1s-0). For students from faculties outside the School of Native Studies with an interest in acquiring a basic familiarity with Aboriginal/non-Aboriginal relationships. Consists of a survey of historical and contemporary relationships between Aboriginal people and newcomers, with the aim of expanding the understandings held by many Canadians about these relationships. Not available to Native Studies students.

O NS 210 Native Issues and Insights I
★3 *(fi 6)* (either term, 3-0-0). An overview of various background issues in Native Studies that continue to have a definite impact on the contemporary Canadian Aboriginal situation. The focus of the course will be from a Native Studies perspective and deal with issues such as Aboriginal rights, conditions regarding land claims, and colonialism.

O NS 211 Native Issues and Insights II
★3 *(fi 6)* (either term, 3-0-0). An overview of various major issues facing Canadian aboriginal peoples and governments today, including a comparison with issues for indigenous peoples elsewhere. The focus of the course will be from a Native Studies perspective and deal with issues such as land, self-government, economic development, education, and health.

O NS 240 Introduction to Aboriginal Legal Issues
★3 *(fi 6)* (either term, 3-0-0). This course is designed to give students an introduction to the development of Aboriginal rights law in Canada. It examines the colonial context of Canadian constitutional law, identifies sources of Aboriginal law, discusses the Treaty and Aboriginal rights and the nature of the fiduciary obligations of the Crown to Aboriginal people.

NS 252 Intermediate Cree
★6 *(fi 12)* (two term, 3-0-1). Introduction to more complex grammatical structures; translation to and from Cree; reading of selected texts; oral practice, including conversation and work on individual projects. Prerequisite: NS 152 or 153.

O NS 260 Contemporary Native Art
★3 *(fi 6)* (either term, 3-0-0). An introduction to the study of contemporary North American Native artists with emphasis on the philosophical and cultural statements made through their artistic expression. Special attention will be placed on living Canadian Native artists.

O NS 280 Selected Topics in Native Studies
★3 *(fi 6)* (either term, 3-0-0).

NS 290 Introduction to Research and Inquiry
★3 *(fi 6)* (either term, 3-0-0). Basic research skills and concepts required in Native Studies will be developed by exploring secondary sources.

O NS 300 Traditional Cultural Foundations I
★3 *(fi 6)* (either term, 3-0-0). Introduces students to the diversity of North American Native peoples. Native traditions are treated as aspects of dynamic cultural systems that have enabled Native peoples to survive and thrive in the centuries prior to European arrival, to resist assimilation efforts, and to persist as culturally distinct peoples. Prerequisites: NS 210 and 211 or consent of the Faculty.

NS 314 History of Indians of Western Canada
★3 *(fi 6)* (either term, 3-0-0). A survey of the evolution of Indian/European and Canadian relations in western Canada. Emphasis is on Indian historical perspectives and analyzing events and issues relevant to the various Indian groups of western Canada, including treaties and the history and development of reserves. Prerequisites: NS 210 and 211 or consent of the Faculty..

NS 320 Aboriginal Governments and Politics
★3 *(fi 6)* (either term, 3-0-0). The description, analysis, and principles of various aboriginal governments will be examined. The relative merits of constitutional, legislative, and administrative options for realizing aboriginal self-government will be compared. A study of the international and Canadian examples of local and regional Aboriginal governments in practice will be an important focus of this course. Prerequisites: NS 210 and 211 or consent of the Faculty.

NS 330 Native Economic Development
★3 *(fi 6)* (either term, 3-0-0). This course will review underlying factors which affect the economies of Native communities and examine different approaches to Native Economic development, including community, corporate and entrepreneurial business approaches. The Native perspective to Native Economic Development will be a principal theme. The objective of the course will be to assess approaches to the identification, planning, and implementation of economic development strategies for Native communities. Prerequisites: NS 210 and 211 or consent of the Faculty.

O NS 335 Native People and the Fur Trade
★3 *(fi 6)* (either term, 1-2s-0). Perspectives on the economic, cultural and geographical aspects of the Native fur trade, with an emphasis on the subarctic fur trade between 1670 and 1870, will be explored and examined critically. The influence of the changing relationships between Aboriginal peoples and mercantile trading interests will be assessed through lectures and seminars. Prerequisites: Any ★6 from NS 210, 211, 314, HIST 368 and 369, or consent of the Faculty.

O NS 340 Aboriginal Legal Issues
★3 *(fi 6)* (either term, 3-0-0). A general and critical overview of the legal issues affecting Native people, with particular reference to Alberta and the NWT. Special attention is given to the Constitutional Act of Canada, selected federal and provincial legislation, treaties, and major court cases to introduce current application of Native law. Prerequisites: NS 210 or 211, and NS 240 or consent of the Faculty.

NS 345 Management Issues in Native Communities
★3 *(fi 6)* (either term, 3-0-0). The course introduces the major management issues commonly faced by contemporary Native community, public administration, and business organizations as a result of their unique cultural, social, economic, demographic, and political environment. Students will acquire an orientation to the management process and to modern management theory and practices. In addition, opportunities will be made to develop and practice the managerial skills

involved in diagnosis, analysis and resolution of management issues frequently encountered in Native organizations. Prerequisites: NS 210 and 211 or consent of the Faculty.

NS 352 Advanced Cree
★6 (fi 12) (two term, 3-0-1). An intensive course designed to enable students to acquire considerable facility both in oral communication and in writing, employing both Roman and syllabic orthography. Prerequisite: NS 252.

NS 355 Native Oral Traditions and Indigenous Knowledge
★3 (fi 6) (either term, 3-0-0). This course considers oral traditions as aspects of broader, culturally-defined systems of knowledge, in which stories are vehicles for encoding and transmitting knowledge about the people, their culture, and their history. It focuses on new academic and community-based approaches, as well as the complementarity of oral traditions/indigenous knowledge and Western science. Students will explore the evolving roles of oral traditions for contemporary Native peoples. Prerequisites: NS 210 and 211 or consent of the Faculty.

O NS 370 The Métis: The Emergence of a People
★3 (fi 6) (either term, 3-0-0). An examination of the factors responsible for the emergence of Métis communities in different areas at different times, with the emphasis on Canada. The development of Métis people together with lifestyles that serve to distinguish them from others will receive much attention. Where applicable, comparisons with similar experiences elsewhere in the world will be made. Prerequisites: NS 210 and 211 or consent of the Faculty.

NS 372 Metis Politics
★3 (fi 6) (either term, 0-3s-0). An examination of various Metis political debates: identity, recognition, nationalism, political organizing, self governance structures, constitutionalization of rights, and theories of Indigenous politics. Prerequisite: NS 210 and 211 or consent of the Faculty.

O NS 375 Native Health Issues
★3 (fi 6) (either term, 3-0-0). This course is designed to introduce students to selected contemporary health care issues in Alberta Métis and Indian communities. A description of the existing health status of these populations will facilitate exploration of socio-economic issues of disease prevention, illness treatment and health promotion. Concepts of health, illness and disease from several points of view will provide a foundation for discussion of issues associated with Native control of health care planning delivery. Prerequisites: NS 210 and 211 or consent of the Faculty.

NS 376 Native Demography and Disease
★3 (fi 6) (either term, 3-0-0). This course focuses on the historic epidemic diseases that devastated Native communities following the arrival of Europeans in this hemisphere. Students will study evidence for health and disease and for the size of the Native population before contact, the epidemiology and impacts of infectious diseases that accompanied Europeans to the Americas, and the transition to a different disease
profile in the 20th century. Native and European approaches to well-being and disease will be considered. Prerequisites: NS210 and 211 or consent of the Faculty.

O NS 380 Selected Topics in Native Studies
★3 (fi 6) (either term, 3-0-0). Prerequisites: NS 210 and 211 or consent of the Faculty.

NS 390 Research Methods in Native Studies
★3 (fi 6) (either term, 3-0-0). A survey of different disciplinary methods for conducting Native Studies research and data analysis, this course will also review and critique strategies and techniques applied by social science researchers with indigenous people. Prerequisites: NS 210, 211, and one other 300 level NS course.

O NS 400 Traditional Cultural Foundations II
★3 (fi 6) (either term, 3-0-0). Uses case studies to examine the dynamic qualities of North American Native cultures and societies. Some have maintained their unique identities over time, while experiencing often-considerable culture change as they have coped with new circumstances, both positive and negative. Others have emerged as new socio-cultural entities. These dynamics operate at multiple levels, from that of the individual to those of larger cultural and social entities. Students will consider ways in which Native peoples are drawing upon earlier cultural forms in creative ways to meet modern needs. Prerequisite: NS 300 or consent of the Faculty.

O NS 403 Selected Topics in Native Studies
★3 (fi 6) (either term, 3-0-0). Prerequisite: One 300-level course or consent of the Faculty.

NS 404 Selected Topics in Native Studies
★3 (fi 6) (either term, 3-0-0). Prerequisite: One 300-level course or consent of the Faculty.

NS 405 Selected Topics in International Indigenous Studies
★3 (fi 6) (either term, 3-0-0). Prerequisite: One 300-level course or consent of the Faculty.

NS 420 Negotiation Strategies
★3 (fi 6) (either term, 3-0-0). An exploration of the theory and practice of negotiation and mediation from different perspectives, including perspectives from the dominant society and indigenous peoples. The strategies of litigation, and coercion to overcome conflict and achieve settlements of disputes will also be examined. These negotiation theories will then be applied to concrete dispute situations in Canada, including multi-party disputes over land, governance, development of resources and the environment. This course will be taught in a seminar format. Prerequisite: NS 320 or 340 or consent of the Faculty.

O NS 435 Management of Aboriginal Natural Resources
★3 (fi 6) (either term, 3-0-0). The application of knowledge of resource management to the traditional Native economic activities, especially hunting, fishing and trapping. Conservation problems which developed with the spread of the commercial economy will be analyzed by examining Aboriginal and European approaches to resource management. The use of conservation to rationalize the re-allocation of traditional resources are examined. Prerequisite: Any ★6 in EAS 290, 291, ENCS 201 or 260, and one 300-level NS course or consent of the Faculty.

O NS 440 Indigenous Treaties and Agreements
★3 (fi 6) (either term, 0-3s-0). An exploration of the historical and contemporary issues associated with treaties. Pre- and post-1867 Indian treaties and modern agreements in Canada will be examined. Prerequisite: One 300-level NS course or consent of the Faculty.

O NS 441 Indigenous Land Claims and Agreements
★3 (fi 6) (either term, 0-3s-0). An exploration of the historical and contemporary issues associated with indigenous land claims agreements. The background negotiations, and implementation of modern agreements in Canada will be the focus of this course. Recommend that NS 440 be taken. Prerequisite: One 300-level NS course or consent of the Faculty.

NS 442 Colonialism and the Criminal Justice System
★3 (fi 6) (either term, 0-3s-0). Focuses on pertinent aspects of the Canadian criminal justice process as it relates to the experiences of Aboriginal people. In particular, issues pertaining to historical and emerging trends such as restorative justice and 'native prisons' are explored and critically analyzed, both in terms of how the justice process functioned historically, as well as its links to contemporary social relations such as the state, the media and the military, but also the powerful role played by racism and discrimination in shaping Aboriginal experiences with the criminal justice process. Prerequisites: ★3 at the 300-level, as well as NS 210 and 211 or consent of the Faculty.

NS 445 Community Development Processes
★3 (fi 6) (either term, 3-0-0). In a seminar, students will identify, analyze and integrate community development philosophy, principles and practice. The relevance of traditional community development models to Native communities will be critically examined in light of the recent experiences of Native communities themselves. Prerequisite: one 300-level course (NS 330 or NS 345 recommended).

NS 450 Practicum in Native Studies
★3 (fi 6) (either term, unassigned). A supervised work-based experience that will permit students to apply Native Studies knowledge in a professional context thereby gaining an appreciation of the work environment. Prerequisites: NS 390 and permission of the Faculty.

O NS 485 Urban Aboriginal Issues and Identities
★3 (fi 6) (either term, 0-3s-0). Critically examines some of the core issues facing Aboriginal people living in Canada's cities, with a particular emphasis on how these issues affect the ways that urban Aboriginal communities are governed municipally, provincially and federally, as well as how they form their own self government institutions in urban areas. Prerequisites: ★3 at the 300-level, as well as NS 210 and 211 or consent of the Faculty.

O NS 490 Community-Based Research
★3 (fi 6) (either term, 0-3s-0). A seminar exploring the issues in the area of community-based research. The course will be organized primarily around the examination of case studies. Methodological concerns will focus on the political, cultural, ethical, and practical aspects of conducting community-based research in conjunction with Native groups and communities. Prerequisite: NS 390.

NS 498 Honors Paper or Project
★6 (fi 12) (two term, 0-3s-0). For students in the Honors program in Native Studies in their final year.

NS 499 Research Project
★3 (fi 6) (either term, 0-0-3). The research project is designed to provide students with a variety of options for carrying out their own research. The specific route taken will depend upon the resources of the School, opportunities available in the community, and the skills of the student. While the program is intended to be flexible, the main route around which students may design their projects will be research conducted in conjunction with a local native organization. Prerequisite: consent of the Faculty of Native Studies. Normally consent will not be given without credit in NS 390.

Graduate Courses

NS 503 Directed Readings in Native Studies
★3 *(fi 6)* (either term, 0-3s-0).

NS 504 Directed Advanced Readings in Native Studies
★3 *(fi 6)* (either term, 0-3s-0). Prerequisite: NS 503 or consent of the Faculty.

NS 599 Selected Research Topics in Native Studies
★3 *(fi 6)* (either term, 0-3s-0).

231.198   Neuroscience, NEURO

Faculty of Medicine and Dentistry

Note: Additional courses in Neuroscience are offered by members of the Centre for Neuroscience through individual departments such as Cell Biology, Pharmacology, Physiology, Psychiatry, Psychology, Surgery, and Zoology.

Undergraduate Courses

NEURO 375 Functional Neuroanatomy
★3 *(fi 6)* (first term, 3-0-0). The study of the human central nervous system (CNS), including its development and function from an anatomical perspective. The course will include some disorders of the CNS as they relate to structure and function. Prerequisite: PSYCO 275 or consent of the Department.

NEURO 410 Neurobiology of Aging and Neurodegenerative Disorders
★3 *(fi 6)* (second term, 3-0-0). Designed to provide senior undergraduate and graduate students in the Neuroscience program a comprehensive overview of the neurobiology of normal aging and neurodegenerative disorders. Both clinical and basic science aspects of major neurodegenerative disorders such as Alzheimer's disease, Parkinson's disease, Huntington disease, Prion disease and Motor neuron disease (ALS) will be covered. Video presentations of patients with neurodegenerative disorders will be presented to add clinical and psychological dimensions. Additionally, recent papers reporting new developments in each of the above disorders will be discussed. Invited lectures will be given by national/international experts on aspects of neurodegenerative disorders to amplify topics covered in the course. Prerequisites: PMCOL 371.

NEURO 443 Neuroendocrine Concepts
★3 *(fi 6)* (first term, 3-0-0). Regulation within the neuroendocrine system. Conceptual consideration of the diffuse neuroendocrine system, hypothalamopituitary interactions, neural integration, signal inactivation, feedback control, differential regulation, neurosteroids and hormones and behavior. Prerequisite: PHYSL 210 or equivalent, or PHYSL 371 or consent of instructor.

NEURO 450 Readings on Selected Topics in Neuroscience
★3 *(fi 6)* (either term, 3-0-0). An individual study course involving detailed reading on a selected topic in cellular, molecular, systems, or cognitive neuroscience. Students will select a member of the Centre for Neuroscience who will guide them through a course of reading on a specialized topic at an advanced level. Completion of this course requires an oral presentation to an examining committee. Restricted to students in the Honors program in Neuroscience. Registration must be approved by the Centre for Neuroscience. Prerequisites: PMCOL 371, PHYSL 372.

NEURO 451 Honors Research Project in Neuroscience
★3 *(fi 6)* (first term, 0-0-3). Research project involving laboratory experimentation done under the supervision of a member of the Centre for Neuroscience. Laboratory projects may involve current topics and methodologies encountered in specific areas of cellular, molecular, systems, or cognitive neuroscience. Completion of this course requires a written report of the project and an oral presentation to an examining committee. Restricted to students in the Honors program in Neuroscience. Registration must be approved by the Centre for Neuroscience. Prerequisites: PMCOL 371, PHYSL 372.

NEURO 452 Honors Research Project in Neuroscience
★3 *(fi 6)* (second term, 0-0-3). Research project involving laboratory experimentation done under the supervision of a member of the Centre for Neuroscience. Laboratory projects may involve current topics and methodologies encountered in specific areas of cellular, molecular, systems, or cognitive neuroscience. Completion of this course requires a written report of the project and an oral presentation to an examining committee at the end of the course. Restricted to students in the Honors program in Neuroscience. Registration must be approved by the Centre for Neuroscience. Prerequisites: PMCOL 371, PHYSL 372.

NEURO 472 Autonomic Nervous System
★3 *(fi 6)* (either term, 3-0-0). Lectures presented by members of the Centre for Neuroscience on neurophysiological, anatomical, clinical, pharmacological and cellular aspects of the autonomic nervous system. Topics include neural regulation of homeostasis and reproduction, disorders of autonomic function, sympathetically maintained pain, effects of spinal cord injury and current research issues. Prerequisites: PHYSL 210 or 211 or ZOOL 241 or equivalent and PMCOL 371 or 342 and/or consent of the course coordinator.

Graduate Courses

NEURO 500 Research in Neuroscience
★6 *(fi 12)* (two term, 0-0-6). A practical course in the neurosciences where students spend two months in each of at least three research laboratories approved by the Centre for Neuroscience Graduate Committee. Students are expected to complete a small research project, supervised by a member of the Centre, in each of the research areas chosen. Students are evaluated on both their performance in the laboratory and reports written. Prerequisite: consent of the Centre for Neuroscience. Credit may be obtained for only one of either NEURO 500 or NEURO 501.

NEURO 501 Graduate Research Project
★3 *(fi 6)* (either term, 0-0-6). Individual study. Restricted to students in the Neuroscience Graduate Program. Students will spend one term in the laboratory of a faculty member (other than the supervisor) and carry out a laboratory research project. Successful completion of a written report and an oral presentation is required at the conclusion of the project. Prerequisite: consent of the Centre for Neuroscience. Credit may be obtained for only one of either NEURO 500 or NEURO 501.

NEURO 572 Current Topics in Autonomic Neuroscience
★3 *(fi 6)* (either term, 3-0-0). The neurophysiological, anatomical, clinical, pharmacological and cellular aspects of the autonomic nervous system will be studied. Students will also be expected to deliver a lecture-type presentation and an extensive written report on one aspect of autonomic function such as neural regulation of homeostasis, disorders of autonomic function, sympathetically maintained pain, autonomic consequences of spinal cord injury and current research issues. Note that credit is given for either NEURO 472 or 572, not for both. Prerequisite: Consent of the Centre for Neuroscience.

NEURO 603 Graduate Colloquium in Neuroscience
★3 *(fi 6)* (second term, 0-2s-0). Graduate students present review seminars or lead discussions based on required readings in the neurosciences. Coordinated by a member of the Centre for Neuroscience. Centre members are invited to attend. Graded on a pass/fail basis.

231.199   Norwegian, NORW

Department of Modern Languages and Cultural Studies
Faculty of Arts

Notes
(1) The Department reserves the right to place students in the language course appropriate to their level of language skill.
(2) Placement tests may be administered in order to assess prior background. Students with a Norwegian language background should consult a Department advisor. Such students may be granted advanced placement and directed to register in a more advanced course more suitable to their level of ability. Students seeking to fulfill their Language Other than English requirement may begin at any one appropriate level, but must take the full ★6 in one language.
(3) The Department will withhold credit from students completing courses for which prior background is deemed to make them ineligible. For example, 100-level courses are normally restricted to students with little or no prior knowledge in that language. Should a student with matriculation standing, or those possessing prior background (such as native speakers or those for whom it is their first language) register in the 100-level course, credit may be withheld.
(4) See also Scandinavian (SCAND) listings.

Undergraduate Courses

O **NORW 111 Beginners' Norwegian I**
★3 *(fi 6)* (either term, 5-0-0). Designed to give basic practical skill in everyday spoken and written Norwegian. The oral approach, using the laboratory, is followed. Note: not to be taken by students with credit in NORW 100, or with native or near native proficiency, or with Norwegian 30 or its equivalents in Canada and other countries.

O **NORW 112 Beginners' Norwegian II**
★3 *(fi 6)* (either term, 5-0-0). Prerequisite: NORW 111 or consent of Department. Note: not to be taken by students with credit in NORW 100, or with native or near native proficiency, or with Norwegian 30 or its equivalents in Canada and other countries.

O **NORW 211 Second-Year Norwegian I**
★3 *(fi 6)* (either term, 4-0-0). Reading and study of selected texts in Norwegian literature and culture. Conversation and composition. Prerequisite: Norwegian 30 (or equivalent) or NORW 112 or consent of Department. Note: not to be taken by students with credit in NORW 200.

Ⓞ NORW 212 Second-Year Norwegian II
★3 *(fi 6)* (either term, 4-0-0). Prerequisite: NORW 211 or consent of Department. Note: not to be taken by students with credit in NORW 200.

231.200 Nursing, NURS

Faculty of Nursing

Undergraduate Courses

NURS 111 Anatomy
★3 *(fi 6)* (first term, 3-0-0). Introduction to the structure of the human body. Must be completed prior to the second term of studies. Note: NURS 140 and NURS 111 may not both be taken for credit. Course is for After Degree Nursing Program students only. Pre- or corequisite: NURS 112.

NURS 112 Physiology
★3 *(fi 6)* (first term, 3-0-0). Introduction to human physiology. Must be completed prior to the second term of the first year of studies. Note: NURS 150 and NURS 112 may not both be taken for credit. Course is for After Degree Nursing Program students only.

NURS 113 Physiology
★3 *(fi 6)* (second term, 3-0-0). Continuation of the study of human physiology. Must be completed prior to Spring/Summer of the first year of studies. Prerequisites: NURS 111 and 112. Note: NURS 151 and NURS 113 may not both be taken for credit. Course is for After Degree Nursing Program students only.

NURS 140 Anatomy
★3 *(fi 6)* (first term, 3-0-0). Introduction to the structure of the human body. Must be completed prior to year 2 of the Nursing program.

NURS 150 Physiology
★4 *(fi 8)* (first term, 4-0-0). An introduction to human physiology. Available only to Nursing students. Must be completed prior to year 2 of the Nursing program.

NURS 151 Physiology
★2 *(fi 4)* (two term, 1-0-0). Continuation of the study of human physiology. Available only to Nursing students. Must be completed prior to year 3 of the Nursing program.

NURS 190 Nursing in Context A
★5 *(fi 10)* (first term, 1.5-6s-3 in 6 weeks). Introduction to the professional discipline of nursing, communication theory, and context-based learning. The primary health care emphasis is on health promotion and disease prevention across the life span. Restoration and rehabilitation are introduced. Health assessment and basic nursing skills are introduced.

NURS 191 Nursing Practice I
★4 *(fi 8)* (second term, 1-15c-2 in 7 weeks). Beginning nursing practice with a focus on health promotion and interaction with clients across the life span in a variety of non-traditional settings. Prerequisites: NURS 190 and 194.

NURS 192 Transition to Professional Nursing I
★5 *(fi 10)* (first term, 1.5-6s-3 in 6 weeks). Introduction to the professional discipline of nursing, context based learning and selected nursing skills. Primary health care and a focus on health promotion and injury/disease prevention for individuals and families across the lifespan will be included. Note: available to students in the LPN Stream of the BScN Collaborative Program only.

NURS 193 Transition to Professional Practice
★6 *(fi 12)* (first term, 0-3s-24c in 7 weeks). Practice focuses on health promotion and injury/disease prevention of individual clients across the lifespan within the context of their families and occurs in non-traditional settings. Medication administration experience will be available as required. Pre-requisite: NURS 192. Note: Available to students in the LPN Stream of the BScN Collaborative Program only.

NURS 194 Nursing in Context A1
★5 *(fi 10)* (first term, 1.5-6s-3 in 6 weeks). A continuation of the study of concepts introduced in NURS 190 with a focus on teaching and learning principles and increased health assessment and basic nursing skills. Prerequisite: NURS 190.

NURS 195 Nursing Practice II
★4 *(fi 8)* (second term, 1-15c-2 in 7 weeks). Practice includes health status assessment of clients and appropriate health promotion and disease prevention interventions. Practice occurs in settings where clients live or in community agencies (non-acute) where services to clients are offered. Prerequisites: NURS 190 and 194.

NURS 215 Pharmacotherapeutics in Nursing
★3 *(fi 6)* (second term, 3-0-0). Focuses on the mechanisms of action of drugs, their therapeutic uses and side effect profile. General principles related to drug absorption, distribution, metabolism and excretion will be addressed. The nursing role in promoting optimal therapeutic regimens and in the management of side/adverse effects will be included. Corequisites for students in the LPN Stream of the BScN - Collaborative Program: NURS 292 and 295.

NURS 290 Nursing in Context B
★5 *(fi 10)* (first term, 1.5-6s-3 in 6 weeks). Within the context of primary health care, the focus shifts to restoration, rehabilitation and support of clients experiencing chronic and less acute variances in health. Discussion related to health promotion and disease prevention continues. Intermediate health assessment and nursing skills are introduced. Prerequisites: NURS 140, 150, 190, 191, 194, 195, and MMI 133.

NURS 291 Nursing Practice III
★7 *(fi 14)* (either term, 3-25c-3 in 7 weeks). Practice focuses on restoration, rehabilitation and support (including health promotion and disease prevention) of clients with chronic and less acute variances in health across the life span. Practice occurs primarily in primary-level acute care centres and continuing care agencies. Prerequisites: NURS 140, 150, 190, 191, 194, 195, and MMI 133. Pre- or corequisite: NURS 290.

NURS 292 Transition to Professional Nursing II
★5 *(fi 10)* (second term, 1.5-6s-3 in 6 weeks). A continuation of the study of concepts introduced in NURS 192. Scenarios will focus on community, the expectant family, the well child, and mental health. Selected laboratory skills will be included. Pre-requisites: NURS 193 and MMI 133. Note: Available to students in the LPN Stream of the BScN Collaborative Program only.

NURS 294 Nursing in Context B1
★5 *(fi 10)* (second term, 1.5-6s-3 in 6 weeks). Continuation of NURS 290 with increasing situational complexity. Prerequisites: NURS 290, (NURS 291 or 295).

NURS 295 Nursing Practice IV
★7 *(fi 14)* (either term, 3-25c-3 in 7 weeks). Practice focuses on restoration, rehabilitation and support (including health promotion and disease prevention) of clients with chronic and less acute variances in health across the life span. Practice occurs in homes or in community-based settings. Prerequisites: NURS 140, 150, 190, 191, 194, 195 and MMI 133. Pre- or corequisite: NURS 290.

NURS 301 Nursing Research
★3 *(fi 6)* (either term, 3-0-0 ; 6-0-0 in 7 weeks). Introduction to the process of research through a comparative analysis of selected studies exemplifying different theoretical, methodological, and analytical approaches. Emphasis is on the communicability of research, the needs of the research consumer, and the development of skills of critical appraisal. Prerequisite: Statistics elective. Note: (NURS 301 and STAT [★3]) and (NURS 397 and 497) may not both be taken for credit.

NURS 306 Nursing and Health Assessment
★6 *(fi 12)* (first term, 3-2s-3). Focus is on nursing as a discipline and the health assessment of the well adult, with modifications for age across the lifespan. The course provides a beginning foundation of assessment skills and techniques necessary for determining client health status including the principles of communication and of teaching and learning. Course content will be addressed within the context of a nursing framework and primary health care. Lifestyle, personal health practices, and health promotion are included. Pre or Corequisites for After Degree students NURS 111 and NURS 112. Corequisites for Bilingual Program students: NURS 217, 218 and MICRE 133. Prerequisites Bilingual Program students: ANATE 140, PHYSE 152, Note: Course is for After Degree Nursing Program and Bilingual Nursing Program students only.

NURS 307 Acute Care Nursing I
★6 *(fi 12)* (second term, 2-4s-2). The primary focus is the theoretical foundation for the client-centred care of adults and elderly clients and their families experiencing variations in health (acute and chronic illnesses). Comprehensive assessment and best practice interventions are addressed within the context of a primary health care framework and a nursing model. Corequisites for After Degree students: NURS 113, 215 and 308. Prerequisites for After Degree students: NURS 111,112, 306. Corequisites for Post-RPN students: NURS 215, 308 and MMI 133. Prerequisites for Post-RPN students: NURS 468. Corequisites for Bilingual Program students: NURS 215 and 308. Prerequisites for Bilingual Program students: SC INF 217, 218, NURS 306, and MICRE 133. Note: Course is for After Degree Nursing Program, Post-RPN Program, and Bilingual Nursing Program students only.

NURS 308 Acute Care Nursing Practice I
★6 *(fi 12)* (second term, 0-0-16c). The primary focus is the application of theory in the client-centred care of hospitalised adults and elderly clients and their families experiencing variations in health (acute and chronic illnesses). Practice occurs primarily in primary, secondary and tertiary acute care settings. Corequisites for After Degree students: NURS 113, 215 and 307. Prerequisites for After Degree students: NURS 111, 112, and 306 and MMI 133. Corequisites for Post-RPN students: NURS 215 and 307. Prerequisites for Post-RPN students: NURS 468. Corequisites for Bilingual Program students: NURS 215 and 307. Prerequisites for Bilingual Program students: SC INF 217, 218, NURS 306, and MICRE 133. Note: Course is for After Degree Nursing Program, Post RPN Program, and for Bilingual Nursing Program students only.

NURS 309 Mental Health Nursing
★6 *(fi 12)* (first term or Spring/Summer, 2-4s-2;5-10s-5 in 4 weeks). Focus is on theory related to the promotion of mental health and the nursing care of people with acute and chronic alterations in mental health. Corequisite: NURS 310.

Prerequisites for After Degree students: NURS 113, 215, 307, and 308. Prerequisites for Bilingual Program students: NURS 407 and 408. Note: Course is for After Degree Nursing Program and Bilingual Nursing Program students only.

NURS 310 Mental Health Nursing Practice
★6 *(fi 12)* (first term or Spring/Summer, 0-0-16c;0-0-35c in 4 weeks). Students will have opportunity to apply concepts of mental health nursing to the care of individuals experiencing acute and chronic alterations in mental health in hospital or community settings. Corequisite: NURS 309. Prerequisites for After Degree students: NURS 113, 215, 307, and 308. Prerequisites for Bilingual Program students: NURS 407 and 408. Note: Course is for After Degree Nursing Program and Bilingual Nursing Program students only.

NURS 390 Nursing in Context C
★5 *(fi 10)* (first term, 1.5-6s-3 in 6 weeks). Within the context of primary health care focus is on restoration, rehabilitation and support of clients experiencing more acute variances in health. Discussion related to health promotion and disease prevention continues. Advanced health assessment and nursing skills are introduced. Prerequisites: NURS 151, 291, 294, 295.

NURS 391 Nursing Practice V
★7 *(fi 14)* (either term, 3-26c-2 in 7 weeks). Practice focuses on restoration, rehabilitation, and support (including health promotion and disease prevention) of clients experiencing more acute variances in health across the life-span. Practice occurs in primary-, secondary-, and tertiary-level acute care settings. Prerequisites: NURS 151, 291, 294, 295. Pre- or corequisite: NURS 390.

NURS 394 Nursing in Context C1
★5 *(fi 10)* (either term, 1.5-6s-3 in 6 weeks). Continuation of NURS 390 with increasing situational complexity. Prerequisites: NURS 151, 390, (391 or 395).

NURS 395 Nursing Practice VI
★7 *(fi 14)* (either term, 3-27c-1 in 7 weeks). Practice focuses on restoration, rehabilitation and support (including health promotion and disease prevention) of clients across the life-span who are experiencing more acute variances in health. Practice occurs in homes, acute care settings, or in community-based settings. Prerequisites: NURS 151, 291, 294, 295. Pre- or corequisite: NURS 390.

NURS 397 Nursing Research and Statistics I
★2 *(fi 4)* (first term, 2-1.5s-0.5 in 7 weeks). Introduction to the process of research through critical appraisals of selected quantitative and qualitative studies. Emphasis is on understanding the research process and knowing how to critically read, analyze, and begin to apply the knowledge gained from research in practice. Focus is on the planning phase of the research process and descriptive statistics. Corequisite: NURS 390. Note: (NURS 397 and 497), and (NURS 301 and STAT [★3]) may not both be taken for credit.

NURS 399 Selected Topics in Nursing Research
★3 *(fi 6)* (two term, 0-3s-0). The focus is on nursing research, nursing practice, and nursing as a discipline and a profession. Prerequisite: Consent of the Faculty.

NURS 405 Community Nursing Theory
★6 *(fi 12)* (either term, 2-4s-2). Focus is on the philosophical and theoretical domains of nursing individuals, families and groups in the community across the lifespan. Students will also specifically explore theory related to the nursing care of the child-bearing family. Community nursing management and intervention consistent with the principles of primary health care will be explored and fostered. Corequisite: NURS 406 or SC INF 406. Prerequisites for After Degree students: NURS 309 and 310. Prerequisites for Post-RPN and for Bilingual Nursing Program students: NURS 215, 307 and 308. Note: Course is for After Degree Nursing Program, Post-RPN Program and Bilingual Nursing Program students only.

NURS 406 Community Nursing Practice
★6 *(fi 12)* (either term, 0-0-16c). Students will have the opportunity to apply concepts of community health nursing. Nursing practice will include health assessment and interventions with child-bearing families. Students will develop competence in both family and community assessments, the use of therapeutic communication skills and the planning, implementation and evaluation of community nursing interventions. Corequisite: NURS 405. Prerequisites for After Degree students: NURS 309 and 310. Prerequisite for Post-RPN students: NURS 215, 307 and 308. Note: Course is for After Degree Nursing Program and Post- RPN and Bilingual Nursing Program students only.

NURS 407 Acute Care Theory II
★6 *(fi 12)* (either term, 2-4s-2). A comprehensive approach to primary health care components in the care of clients in complex situations locally, nationally, and internationally. High acuity health assessments and interventions are introduced. Case management, interdisciplinary collaboration, community development, and sociopolitical action are emphasized. Corequisite: NURS 408. Prerequisites: NURS 405 and 406. Note: Course is for After Degree Nursing Program, Post-RPN Program, and Bilingual Nursing Program students only.

NURS 408 Acute Care Practice II
★6 *(fi 12)* (either term, 0-0-16c). Professional nursing practice focuses on a comprehensive application of primary health care principles to clients experiencing acute variances in health across the life span. Practice occurs in primary, secondary and tertiary level acute care settings. Corequisite: NURS 407. Prerequisites for After Degree and Post-RPN students: NURS 405 and 406. Prerequisites for

Bilingual Nursing Program students: NURS 405 and SC INF 406. Note: Course is for After Degree Nursing Program, Post-RPN Program, and Bilingual Nursing Program students only.

NURS 409 Leadership and Issues in Nursing
★3 *(fi 6)* (either term, 0-3s-0). Using the primary health care framework, a variety of current professional, social, political and global issues affecting the nursing profession and the Canadian health care system will be addressed. Key principles of leadership and management will also be addressed within the context of these issues. Corequisites for After Degree, Post RPN, and Bilingual Program students: NURS 407. Prerequisites for After Degree, Post RPN students: NURS 405 and 406. Prerequisites for Bilingual Nursing Program students: NURS 405 and SC INF 406.

NURS 415 Community Nursing for Post-RN Students
★5 *(fi 10)* (either term, 0-6s-3 in 7 weeks; 0-3s-3/2). Focus is on concepts related to family and community health. Community nursing management and interventions consistent with the principles of primary health care will be examined. Note: Formerly NURS 315. Not open to students with credit in NURS 315.

NURS 440 Nursing in the Global Community
★3 *(fi 6)* (first term, 0-3s-0). An exploration of health, primary health care, health systems, healthcare policy, and the role of nurses in a global context. Normally, this course is a prerequisite for students selecting International Nursing for NURS 494 and NURS 495.

NURS 461 Nursing Practice VII, Internship Route
★7 *(fi 14)* (Spring/Summer, 0-1s-34c in 10 weeks). During a Spring/Summer placement of 10 weeks in a sponsoring agency, the student will manage and care for clients in ambiguous, complex situations. Prerequisites: NURS 390, 391, 394, 395 an 397 or 301. Consent of the Faculty is also required.

NURS 468 Health Assessment
★4 *(fi 8)* (either term, 3-0-3). Focus is on the health assessment of the well adult, with normal aging modifications. The course provides a beginning foundation of assessment skills and technologies necessary for determining client health status within the context of a nursing framework. Factors influencing lifestyles and personal health practices are included. For Post-RN Program and Post RPN Program, students only. Note: Formerly NURS 368. Not open to students with credit in NURS 368.

NURS 470 Nursing in Complex Situations
★5 *(fi 10)* (either term, 0-6s-3 in 7 weeks; 0-3s-3/2). Nursing of aggregates and communities within the context of primary health care and international/intercultural care are discussed. Concepts of case management, interprofessional teamwork and the role of the nurse as manager are also addressed. Course is for Post RN program students only. Pre- or Co-requisite: NURS 415.

NURS 475 Community Practice for Post-RNs
★7 *(fi 14)* (either term, 0-3s-28c in 7 weeks;0-1.5s-15c). Nursing practice focuses on health promotion and disease prevention of clients across the life-span. Practice occurs in homes or community-based settings. Pre- or corequisite: NURS 415. Note: Formerly NURS 385. Not open to students with credit in NURS 385.

NURS 490 Nursing in Context D
★5 *(fi 10)* (either term, 1.5-6s-3 in 6 weeks; 1-3s-3/2). A comprehensive approach to primary health care components in the care of clients in complex, ambiguous situations. Case management and multidisciplinary leadership skills are emphasized. Students may have the opportunity to lead a multidisciplinary student group. Prerequisites: NURS 391, 394, 395.

NURS 491 Nursing Practice VII
★7 *(fi 14)* (either term, 0-3s-28c in 7 weeks). Management and care of clients in ambiguous, complex, situations occurring over a variety of settings. Pre- or corequisite: NURS 490. Prerequisite, NURS 391, 394 and 395.

NURS 492 Nursing Practice VII for Post RN Students
★7 *(fi 14)* (either term, 0-3s-28c in 7 weeks;0-1.5s-15c). Comprehensive approach to professional practice of nursing in an area of special interest to the student. Pre- or corequisite: NURS 415. Note: Course is for Post RN students only.

NURS 494 Nursing in Context D1
★3 *(fi 6)* (either term, 0-7s-3 in 4 weeks). Synthesis and focus of nursing knowledge and application of nursing research in a specified area of practice. To be permitted to enroll in this course, students must have passed all courses of their nursing program, except the co-requisite NURS 495, or SC INF 495.

NURS 495 Nursing Practice VIII
★9 *(fi 18)* (either term, 1-34c-0 in 10 weeks). Comprehensive and consolidated approach to professional practice of nursing. Co-requisite: NURS 494. Note: Course is for Collaborative Program, After Degree Program and Post-RPN Program students only.

NURS 497 Nursing Research and Statistics II
★4 *(fi 8)* (either term, 2-5s-1 in 6 weeks). Students continue to develop their skills to critically read, analyze, and begin to use knowledge gained from research in their practice. Building on the knowledge from NURS 397, this course focuses on understanding the implementation phase of research and inferential statistics.

Students also examine trends and issues in developing evidenced-based practice for the profession of nursing. Prerequisite: NURS 397. Corequisite: NURS 490. Note: (NURS 397 and 497), and (NURS 301 and STAT [★3]) may not both be taken for credit.

NURS 498 Special Study - Nursing
★1-12 *(variable)* (two term, variable).

NURS 499 Scholarly Project in Nursing
★6 *(fi 12)* (either term, 0-3s-0). Preparation and presentation of a nursing scholarly project. Prerequisites: NURS 399 and consent of the Faculty.

Graduate Courses

NURS 502 Nature and Development of Nursing Knowledge
★3 *(fi 6)* (either term, 0-3s-0). Enquiry into the nature, scope, and object of nursing knowledge; the distinct contribution of nursing art, philosophy, history, and science. Includes exploration of nursing theories/frameworks. Prerequisite: consent of Instructor.

NURS 503 Design and Conduct of Nursing Research
★3 *(fi 6)* (two term, 0-3s-1). Overview of research approaches to the investigation of nursing phenomena. The principles and process of quantitative and qualitative methods are emphasized. Opportunities are provided for critique and application of the research process. Pre- or corequisite: graduate-level Statistics course (★3) and consent of Instructor.

NURS 504 Statistics in Nursing Research
★3 *(fi 6)* (either term, 0-3s-2). Focus is on the nature and characteristics of the most commonly used statistical techniques, their applicability to specific health care problems within the context of nursing, and the interpretation of results. Students will be given an opportunity to develop skills and knowledge in the use of computing software (SPSS) and to reinforce learning through assignments, including the analysis of data sets and discussion/critique of published nursing research.

NURS 510 Advanced Health Assessment and Applied Pathophysiology (Adult)
★4 *(fi 8)* (either term, 0-3s-6c). The focus of this course is on developing advanced assessment skills for diagnostic reasoning and clinical decision making in relation to common variations in the health status of adults. Students will focus on specialized assessment and applied pathophysiology in relation to specific adult populations. Opportunities to apply diagnostic reasoning skills and formulate clinical decisions required for the development of specific health care management strategies is provided through seminars, laboratory practice, and a clinical practicum in a range of health care settings.

NURS 512 Assessment for Community and Population Health
★4 *(fi 8)* (either term, 0-3s-6c). The focus of this course is nursing assessment of communities and other populations as a foundation for program planning in health promotion and disease prevention. The content includes use of data about community capacity, health status characteristics, and the causes and distribution of disease. Emphasis will be placed on a socio-environmental approach to health, including the social determinants of health and disease.

NURS 513 Advanced Health Assessment and Applied Pathophysiology (Child)
★4 *(fi 8)* (either term, 0-3s-6c). The focus of this course is to develop advanced assessment skills for diagnostic reasoning and clinical decision making in relation to health promotion and common variations in the health status of children from infancy to 16 years of age. Students will focus on specialized assessment and applied pathophysiology in relation to specific pediatric populations. The opportunity to apply diagnostic reasoning skills and formulate clinical decisions required for the development of specific health care management strategies is provided in a range of health care settings in which children and their families are the primary focus.

NURS 521 Advanced Perinatal Physiology and Physical Assessment
★4 *(fi 8)* (either term, 0-3s-6c). The focus of this course is to develop perinatal physiology knowledge and advanced assessment skills for applied diagnostic reasoning and clinical decision-making in relation to an in-depth understanding of neonatal physiology and common variations in the health status of neonates. Students will focus on specialised assessment, applied pathophysiology, and current therapeutics in relation to the critically ill neonate. In selected environments where neonates and their families are the primary focus, the opportunity is provided to develop and apply diagnostic reasoning skills then formulate clinical decisions required for the development of specific healthcare management strategies. Prerequisite: Consent of program director.

NURS 524 Advanced Neonatal Intensive Care Nursing
★4 *(fi 8)* (either term, 0-3s-6c). Students will have the opportunity to integrate theory from physiological and psychological perspectives and to learn advanced clinical skills through case-management of high-risk infants and their families. This will take place through a series of hands-on labs and seminars focusing on patient scenarios. Clinical placement will be in a Level III nursery with follow-up

after discharge of the infant. Prerequisites: NURS 521 and pre- or co-requisite NURS 545 (preferably focused on child/neonate).

NURS 529 Advanced Neonatal Intensive Care Nursing Practicum
★6 *(fi 12)* (either term, 0-47c-0). During this practicum the students will acquire skill and experience in functioning in an advanced role under the preceptorship of selected nurses working in an expanded role and neonatologists. Prerequisite: NURS 521 and NURS 524.

NURS 531 Community Health: Practice and Research Perspectives
★3-4 *(either term, variable)*. Concepts and research in health promotion and disease prevention in community settings will be addressed. Emphasis will be given to implications for multidisciplinary practice related to community development, program planning and evaluation, and knowledge utilization. Only MN students are eligible to register in the clinical practicum. Prerequisite for MN students: NURS 512.

NURS 532 Family Health and Wellness
★3 *(fi 6)* (either term, 0-3s-0). This course is focused on models of family health and related research. Both the health of families and the family's influence on health will be examined. Measurement and assessment issues will be discussed. Applications to nursing and other health-related disciplines will be explored. Co-taught by Faculty of Nursing and Department of Human Ecology.

NURS 535 Promoting Health-enhancing Public Policy
★3-4 *(variable)* (either term, variable). The policy process, including context, strategies, and impact of policies on health. Emphasis on public policy related to the broad social determinants of health and approaches such as intersectoral collaboration, partnerships, coalitions, and public participation. Prerequisite: consent of Instructor.

NURS 542 Living with Chronicity: Issues and Concepts
★3 *(fi 6)* (either term, 0-3s-0). Students explore how persons with a chronic disease or disability and their families adapt to live with this disease or disability, how society influences that adaptation, and how that adaptation affects the integration of persons with a chronic disease or disability into society. Frameworks consistent with a health promotion perspective will also be examined.

NURS 545 Pharmacotherapeutics in Advanced Nursing Practice
★3 *(fi 6)* (either term, 0-3s-0). Graduate seminar on the principles of clinical pharmacology and their relevance to the promotion of health across the lifespan through advanced nursing practice. The psychotropics will be used as a model for the clinical application of these principles. Focus will be on the selection, prescription, and management of pharmacotherapy as adjunct to advanced nursing practice. Simulated and actual patient situations will be used to stimulate discussion and provide students with an opportunity to apply the basic principles of clinical pharmacology.

NURS 550 Professional Issues in Advanced Nursing Practice
★3 *(fi 6)* (either term, 0-3s-0). Advanced analysis of trends, problems and issues of the nursing profession, with emphasis on interdisciplinary and intersectorial components of the health care system and society. Prerequisite: consent of Instructor.

NURS 554 Leadership in Health and Nursing Services
★3 *(fi 6)* (either term, 0-3s-0). Theoretical concepts and research issues relative to leadership behavior in the health care system will be addressed as a basis for practice in senior position responsible for nursing services. Relevant leadership and administrative topics will be examined, including organization design, health services, integration, information and project management, fiscal accountability, consumer and stakeholder relations, and health policy development. Prerequisite: Undergraduate course in management or consent of Instructor.

NURS 556 Teaching in Nursing Practice
★3 *(fi 6)* (either term, 0-3s-0). The teaching and learning roles assumed by nurses and their learners in all nursing practice contexts are examined in this course. Utilizing reflection and critical thinking skills, students explore the theoretical dimensions of effective teaching and learning processes that are both deductive and inductive in nature. Regardless of the context or theoretical approach assumed for teaching and learning activities in nursing practice, the nature of the pedagogical relationship between the teacher and the learner is a featured focus in the course. Each student ultimately examines the evidence for how to best facilitate learning in an area of nursing practice that is personally and professionally relevant.

NURS 560 Topics in Advanced Study in Nursing
★1-12 *(variable)* (either term, variable). An elective course aimed at developing in-depth knowledge regarding a topic(s) related to advanced-level nursing. Learning experiences may include clinical experience. Prerequisite: consent of Instructor.

NURS 561 Guided Individual Study in Nursing
★1-12 *(variable)* (either term, variable). A course designed for in-depth, individual study of a topic related to advanced-level nursing. Learning experiences may include clinical experience.

NURS 565 Selected Topics in Individual Family Health Nursing (Adult)
★1-12 *(variable)* (either term, variable). Selected topics in a variety of advanced

nursing practice specialty areas for case management of adults and their family in complex health care situations are emphasized. The role of the advanced practice nurse is examined from the perspective of assessing, managing, monitoring, coordinating, and evaluating health status over time. Sections with a practicum component provide opportunities to assist adults and their family within the context of the health care team. Prerequisite: consent of Instructor.

NURS 567 Selected Topics in Individual Family Health Nursing (Child)
★1-12 *(variable)* (either term, variable). Selected topics in a variety of advanced nursing practice specialty areas for case management of infants, children, and their family in complex health care situations are emphasized. The role of the advanced practice nurse is examined from the perspective of assessing, managing, monitoring, coordinating, and evaluating health status over time. Sections with a practicum component provide opportunities to assist infants, children, and their family within the context of the health care team. Prerequisite: consent of Instructor.

NURS 570 Advanced Therapeutics and Applied Pathophysiology – Adult
★4 *(fi 8)* (either term, 0-3s-6c). The focus of this course is acquisition of knowledge and skills essential for clinical decision making for management of the individual and their family in various health care situations. Opportunities are provided to implement and evaluate preventative and therapeutic interventions, as well as health promotion strategies. Appropriate community, agency, and treatment resources that may assist in managing emergent to chronic health care situations are utilized. Prerequisite: NURS 510; pre- or corequisite NURS 545.

NURS 571 Advanced Therapeutics and Applied Pathophysiology – Child
★4 *(fi 8)* (either term, 0-3s-6c). The focus of this course is acquisition of the knowledge and skills essential for clinical decision making for the management of infants to children 16 years of age and their families in various health care situations. Opportunities are provided to implement and evaluate preventative and therapeutic interventions, as well as health promotion strategies. Appropriate community, agency, and treatment resources that may assist in managing emergent to chronic health care situations will be utilized. Prerequisite: NURS 513.

NURS 573 Advanced Practice in Mental Health/Psychiatric Nursing
★8 *(fi 16)* (either term, 0-6s-12c). The focus of this course is advanced practice in PMH nursing domains: helping role, diagnostic and monitoring function, administering and monitoring therapeutic interventions, management of rapidly changing situations, teaching-coaching functions, monitoring and ensuring the quality of health care practices, and organizational and work role competencies.

NURS 580 Advanced Theory and Practicum in Individual/Family Health Nursing (Adult)
★6 *(fi 12)* (either term, 0-2s-20c). The focus of this course is to provide a culminating practicum experience in the role of the advanced practice nurse in the student's selected specialty area. Integration of theory and research in relation to practice is facilitated by course seminars. Opportunity is provided to discuss issues relevant to the advanced nursing practice role. Prerequisite: NURS 570.

NURS 581 Advanced Theory and Practicum in Individual/Family Health Nursing (Child)
★6 *(fi 12)* (either term, 0-2s-20c). The focus of this course is practice of advanced nursing skills in the student's selected child health specialty area. Integration of theory and research in relation to practice is facilitated by course seminars. Opportunity is provided to discuss issues relevant to the advanced nursing practice role. Prerequisite: NURS 571.

NURS 582 Advanced Theory and Practicum in Community/Public Health Nursing
★4 *(fi 8)* (either term, 0-2s-10c). The focus of this course is practice of advanced nursing skills in community/public health nursing with a selected population related to program and policy development, program evaluation, and/or knowledge utilization. Prerequisite: NURS 531.

NURS 584 Advanced Theory and Practicum in Management
★6 *(fi 12)* (either term, 0-2s-20c). This practicum is designed to enhance contextual knowledge and skills relevant to leadership roles in the health system. Each student will be matched with a mentor who occupies a senior position in a health policy or delivery organization. Seminars will provide a forum for application of theory. Prerequisite: NURS 554 or equivalent.

NURS 586 Advanced Theory and Practicum for Teaching in Nursing Practice
★4 *(fi 8)* (either term, 0-2s-10c). This practicum is designed to enhance contextual knowledge and skills relevant to teaching roles in nursing practice which may focus on basic and continuing nursing education, patient education in particular, or health education in general. Based on what is both personally and professionally relevant, each student develops an individualized learning plan and is paired with a teaching preceptor in the area of nursing practice appropriate for the student learning goals. Seminars provide a forum to critically reflect about how teaching and learning can be effectively practiced in the various teaching practicum interests the students bring to the course.

NURS 600 Theory Development in Nursing
★3 *(fi 6)* (either term, 0-3s-0). Exploration of influence and implications of various

nursing models, paradigms, and conceptualizations of nursing practice on the development and structure of the discipline of nursing. Prerequisite: consent of Instructor.

NURS 604 Fundamentals of Aging
★3 *(fi 6)* (either term, 0-3s-0). A critical analysis of the issues and environments that influence the lives of older Canadians. Focus is on theories and knowledge about age-related normative and non-normative changes and their interaction with the physical, social, community and policy environments of older adults. (Course is cross-listed as HECOL 604). Credit will only be granted for NURS 604 or HECOL 604.

NURS 610 Contemporary Views of Nursing Science
★3 *(fi 6)* (either term, 0-3s-0). Enquiry into contemporary philosophic views of the nature of nursing science including natural science, human science, practical science, interpretive, and postmodern views. Prerequisite: consent of Instructor.

NURS 660 Topics in PhD Studies in Nursing
★1-12 *(variable)* (either term, variable). A course aimed at developing in-depth knowledge regarding a topic(s) related to PhD-level nursing. Learning experiences may include clinical experience.

NURS 661 Guided Individual Study in Nursing
★1-12 *(variable)* (either term, variable). A course designed for in-depth, individual study of a topic related to PhD-level nursing. Learning experiences may include clinical experience.

NURS 683 Design Problems in Nursing Research
★3 *(fi 6)* (either term, 0-3s-0). Appraisal of laws of scientific inquiry and designs used in nursing research. Prerequisite: consent of Instructor.

NURS 684 History and Politics of Nursing
★3 *(fi 6)* (either term, 0-3s-0). Exploration of the roots of nursing through analysis of the development of the profession within the larger social context. Examines developments at individual and collective levels including selected organizations, events, and individuals central to the evolution of the profession. Prerequisite: consent of Instructor.

NURS 699 Dissertation Seminar
★1 *(fi 2)* (either term, 0-1s-0). For PhD in Nursing students, registration required for two terms. Opportunity for discussion of proposed and ongoing research.

NURS 900 Guided Scholarly Project
★3 *(fi 6)* (either term, unassigned). A guided scholarly project which will focus on such areas as clinical outcomes, evidence-based practice, quality improvement, or knowledge diffusion.

231.201   Nutrition, NUTR

Department of Agricultural, Food and Nutritional Science
Faculty of Agriculture, Forestry, and Home Economics

Note: See also Agricultural, Food and Nutritional Science (AFNS), Animal Science (AN SC), Interdisciplinary (INT D), Nutrition and Food Sciences (NU FS) and Plant Science (PL SC) listings for related courses.

The following courses were renumbered effective 1995-96.

Old	New	Old	New
NU FS 301	NUTR 301	NU FS 302	NUTR 302

Undergraduate Courses

Ⓞ NUTR 100 Nutrition and Wellbeing
★3 *(fi 6)* (first term, 3-0-0). Principles of nutrition. The need for and functions of the major nutrients for humans. Cannot be taken by students with credit or currently registered in NU FS 305 or other Nutrition course. May include alternate delivery sections; refer to the Fees Payment Guide in the University Regulations and Information for Students section of the Calendar.

NUTR 301 Fundamentals of Nutritional Biochemistry and Metabolism I
★3 *(fi 6)* (first term, 3-0-3). Fundamentals of nutrition, emphasizing energy, carbohydrates, lipids and proteins. The lab will use common techniques to illustrate principles of human nutrition. Only open to students in the BSc in Nutrition and Food Science, Nutrition major. Given concurrently with NUTR 303. Students cannot obtain credit in NUTR 301 and 303. Prerequisites: BIOCH (203, 205) or (200 and 310 as a corequisite) and PHYSL 210 as a prerequisite (preferred) or as a corequisite.

NUTR 302 Fundamentals of Nutritional Biochemistry and Metabolism II
★3 *(fi 6)* (second term, 3-0-3). Fundamentals of nutrition with emphasis on vitamins and inorganic elements. The lab will use common techniques to illustrate principles of human nutrition. Only open to students in the BSc in Nutrition and Food Science Nutrition major. Given concurrently with NUTR 304. Students cannot obtain credit in NUTR 302 and 304. Prerequisites: NUTR 301 and [BIOCH (203, 205) or (200, 310)] and PHYSL 210 as a prerequisite (preferred) or as a corequisite.

⓪ NUTR 303 Fundamentals of Nutritional Biochemistry and Metabolism I
★3 *(fi 6)* (first term, 3-0-0). Fundamentals of nutrition, emphasizing energy, carbohydrates, lipids, and proteins. Given concurrently with NUTR 301. Students cannot obtain credit in NUTR 301 and 303. Prerequisites: BIOCH (203, 205) or (200 and 310 as a corequisite) and PHYSL 210 as a prerequisite (preferred) or as a corequisite.

⓪ NUTR 304 Fundamentals of Nutritional Biochemistry and Metabolism II
★3 *(fi 6)* (second term, 3-0-0). Fundamentals of nutrition with emphasis on vitamins and inorganic elements. Given concurrently with NUTR 302. Students cannot obtain credit in NUTR 302 and 304. Prerequisites: NUTR 303 and [BIOCH (203, 205) or (200, 310)] and PHYSL 210 as a prerequisite (preferred) or as a corequisite.

NUTR 400 Research Methods in Nutritional Science
★3 *(fi 6)* (first term, 3-3s-0). Familiarizes students with skills required for the formation of a research problem, and for the execution and presentation of empirical research. Lectures incorporate key concepts of experimental design, logistics of data collection and basic analysis and are complemented by work with a faculty advisor to develop a research proposal. Students will present their proposal in a seminar. Prerequisites: NUTR 301, 302, and ★90.

NUTR 401 Undergraduate Nutritional Science Independent Project
★3 *(fi 6)* (either term, 0-1s-5). An independent research project on an approved topic, supervised by a faculty member. Normally this is a continuation of work begun in NUTR 400. It includes implementation of a research project, data analysis and presentation of results orally and in writing. Prerequisite: NUTR 400.

NUTR 440 Current Topics in Nutritional Science
★3 *(fi 6)* (second term, 0-3s-3). Integrated exploration of issues pertaining to nutritional science. Open to fourth-year students in the Nutrition major only. Prerequisites: NUTR 301 and 302, and ★90.

NUTR 452 Nutritional Aspects of Chronic Human Diseases
★3 *(fi 6)* (second term, 3-0-0). A lecture and reading course for senior undergraduate students which will address the scientific basis for nutritional intervention in chronic human disease. Graduate students may not register for credit (see AFNS 552). Credit will only be given for one of AFNS 552, NUTR 452 and NU FS 452. Prerequisites: NUTR 301 or 303, and 302 or 304, or consent of instructor.

NUTR 466 Introduction to Dietetic Practice
★0 *(fi 1)* (either term or Spring/Summer, 3-0-0). Lectures and discussion to improve readiness of students to work independently in the development of professional practice skills in dietetics. Open only to students accepted into Integrated Dietetic Internship Program. Required before placement in NUTR 469, 470, 471 or 472. Prerequisites: (NU FS 223 or 323) and (NUTR 468 or NU FS 468). Requires payment of additional miscellaneous course fees (see §22.2.3).

NUTR 468 Clinical Nutrition
★3 *(fi 6)* (first term, 3-0-3). Basic principles of nutrition in clinical situations. The role of diet in the management of various diseases. The laboratory sessions include practical experience in providing individualized nutritional care for clients from various cultural backgrounds. Graduate students may not register for credit (see AFNS 568). Credit will only be given for one of AFNS 568, NUTR 468, and NU FS 468. Pre- or corequisite: NUTR 301.

NUTR 469 Introductory Professional Practice in Clinical Dietetics
★0 *(fi 1)* (either term or Spring/Summer, 4 weeks). Practical experience in provision of nutrition care, focusing on basic skills of assessment, planning, implementation and evaluation. Continuing care agencies, rural health centres and acute care hospitals. Students may take this course simultaneously with INT D 411. Open only to students accepted into the Integrated Dietetic Internship Program. Prerequisites: (NU FS 223 or 323) and (NUTR 468 or NU FS 468). Requires payment of additional miscellaneous fees (see §22.2.3).

NUTR 470 Professional Practice in Community Nutrition
★0 *(fi 1)* (either term or Spring/Summer, 12 weeks). Practical experience in assessing needs and planning, implementing and evaluating nutrition programs in a variety of community settings. Open only to students accepted into the Integrated Dietetic Internship Program. Prerequisite: (NU FS 223 or 323) and (NU FS 377 or 477). Requires payment of additional miscellaneous fees (see §22.2.3).

NUTR 471 Professional Practice in Food Service Management
★0 *(fi 1)* (either term or Spring/Summer, 12 weeks). Practical experience in assessment, planning implementation and evaluation of food service systems. Institutional, community and commercial settings. Open only to students accepted into the Integrated Dietetic Internship Program. Prerequisites: (NU FS 363 or 361) and NU FS 461 and (AREC 323 or AG EC 323 or alternate business course). Requires payment of additional miscellaneous fees (see §22.2.3).

NUTR 472 Professional Practice in Clinical Dietetics
★0 *(fi 1)* (either term or Spring/Summer, 15 weeks). Practical experience in a variety of acute, continuing care and ambulatory care settings. The student is expected to demonstrate professional competencies in assessment, planning, development and monitoring of nutrition care plans for patients and clients. Students cannot

obtain credit in both NU FS 472 and NUTR 472. Open only to students accepted into the Integrated Dietetic Internship Program. Prerequisites: NUTR 469, 470, 471 and 476. Requires payment of additional miscellaneous fees (see §22.2.3).

NUTR 476 Advanced Clinical Nutrition
★3 *(fi 6)* (second term, 3-0-3). The principles of diet therapy in selected areas of current interest. Emphasis on case studies, research, and practical problems in clinical dietetics. Graduate students may not register for credit (see AFNS 578). Credit will only be given for one of AFNS 578, NUTR 476, and NU FS 476. Prerequisites: NUTR 468 or NU FS 468. Pre- or corequisite: NUTR 302.

NUTR 477 Advanced Community Nutrition
★3 *(fi 6)* (first term, 3-0-3). Builds on concepts learned in introductory community nutrition that relate to health promotion, food security, policy, program planning and community nutrition throughout the lifecycle. Students will develop the skills to write a community grant application. Field trips to places and events that relate to community nutrition. Graduate students may not register for credit (see AFNS 577). Credit will only be given for one of AFNS 577 and NUTR 477. Prerequisites: NUTR 302 and NU FS 377.

NUTR 478 Advanced Nutrition: Energy, Carbohydrates, Lipids, and Proteins
★3 *(fi 6)* (either term, 3-0-0). Scientific literature and current issues in the areas of carbohydrates, lipids, and proteins. A major integrative group project is also required. Students cannot obtain credit in both NU FS 478 and NUTR 478. Prerequisites: NUTR 301 or 303, and NUTR 302 or 304.

NUTR 479 Advanced Nutrition: Vitamins and Inorganic Elements
★3 *(fi 6)* (first term, 3-0-0). A lecture and reading course in vitamins and inorganic elements. Introduction to seminar presentation and critical evaluation of current literature. Students will learn how to write a scientific paper. Graduate students may not register for credit (see AFNS 579). Credit will only be given for one of AFNS 579, NUTR 479 and NU FS 479. Prerequisites: NUTR 301 or 303 and NUTR 302 or 304.

NUTR 480 Sports Nutrition
★3 *(fi 6)* (either term, 3-0-0). Basic theory related to nutritional requirements for all levels of athletic performance. Application of sports nutrition concepts for recreational to elite level athletes. Course content includes energy systems, hydration, pre-and post-event nutrition, weight management and body composition issues of athletes and ergogenic aids. Prerequisite: NU FS 305 or (NUTR 301 or 303 and 302 or 304) and ★90.

Graduate Courses

Notes
(1) 400-level courses in NUTR may be taken for credit by graduate students with approval of the student's supervisor or supervisory committee. A 300-level courses may be taken for credit by graduate students with approval of the AFNS Graduate Program Committee. (See §174.1.1(1))
(2) See Agricultural, Food and Nutritional Science (AFNS) listing for related courses.

231.202 Nutrition and Food Sciences, NU FS

Department of Agricultural, Food and Nutritional Science
Faculty of Agriculture, Forestry, and Home Economics

Note: See also Agricultural, Food and Nutritional Science (AFNS), Animal Science (AN SC), Interdisciplinary (INT D), Nutrition (NUTR) and Plant Science (PL SC) listings for related courses.

Undergraduate Courses

⓪ NU FS 100 Introduction to Food Science and Technology
★3 *(fi 6)* (first term, 3-0-0). An introduction to the nature of food, food technology, food safety. Not open to students in the Nutrition and Food Science degree program who have taken or are currently taking any 200 or higher NU FS courses.

⓪ NU FS 200 Introduction to Functional Foods and Nutraceuticals
★3 *(fi 6)* (second term, 3-0-0). Principles of functional food concepts, health claims, regulations, consumer trends, value added food production, and processing technology, and marketing strategies in the food industry. Prerequisite: NU FS 100 or NUTR 100 or consent of Instructor.

NU FS 201 Physical Principles of Food Structure and Functionality
★3 *(fi 6)* (first term, 3-1s-0). Theory and application of physical principles important to understanding agri-food structure and physical functionality. Topics include food materials science, flow, and mechanical properties of foods. Physical concepts examined include mechanics, temperature, heat and thermodynamics. Prerequisite: CHEM 102 (or ★3 CHEM and MATH 113/114).

NU FS 223 Cultural Determinants of Food Choice
★3 *(fi 6)* (second term, 3-0-0). This course will examine contemporary dietary patterns. It will discuss how food choices are shaped by social, political and economic spheres. The roles of policy, the media and culture as determinants of healthy eating will be highlighted. Credit will only be given for one of NU FS 223 and 323. Prerequisite: NUTR 100.

O NU FS 283 Introduction to Food Engineering
★3 *(fi 6)* (second term, 3-0-3). Mass and heat balances, thermodynamics. Fluid mechanics, heat and mass transfer in food systems. Prerequisites: (NU FS 201 or ★6 of chemistry or physics) or consent of Instructor.

O NU FS 300 Fundamentals of Dairy Science
★3 *(fi 6)* (second term, 3-2s-0). Physiology of lactation, Biosynthesis and properties of milk components. Physical, chemical, microbiological, technological and nutritional aspects of milk. Prerequisite: ★3 in Biochemistry. Credit cannot be obtained for NU FS 300 and DAIRY 300.

NU FS 305 Introduction to the Principles of Nutrition
★3 *(fi 6)* (first term, 3-0-0). Basic principles of nutrition and metabolism of macronutrients and micronutrients. Students cannot obtain credit in NU FS 305 and NUTR 301, 302, 303, or 304. Prerequisites: NUTR 100 or NU FS 100, and ★6 in the sciences (recommended that ★3 be BIOCH).

O NU FS 312 Quality Assurance
★3 *(fi 6)* (second term, 3-0-1.5). Statistical methods in quality assurance, sampling plans, control charts, sensory evaluation and risk management in the food industry, HACCP, good manufacturing practices, food regulations, labelling requirements and ISO 9000 standards. Prerequisite: (NU FS 361 or 363) and introductory statistics.

NU FS 352 Current Topics and Controversies in Nutrition
★3 *(fi 6)* (either term, 3-0-0). An advanced course that explores current nutritional recommendations and topical areas of nutrition. Cannot be taken for credit by students in the Nutrition major. Prerequisite: NU FS 305.

O NU FS 353 Unit Operations in Food Processing
★3 *(fi 6)* (first term, 3-0-3). Processes used in food manufacturing. Refrigeration, evaporation, sedimentation, centrifugation, filtration, and contact-equilibrium separation methods. Prerequisite: NU FS 283.

O NU FS 356 Nutrition Across the Lifespan
★3 *(fi 6)* (second term, 3-0-0). A lecture course that examines the understanding of how nutrients act on a cellular, tissue and whole organism level to influence human growth, development and aging. Students cannot obtain credit in both NU FS 356 and 456. Prerequisite: ★3 of NUTR 301, 303 or NU FS 305.

NU FS 361 Food Microbiology
★3 *(fi 6)* (first term, 3-0-3). Environmental factors affecting the growth, activity and destruction of microorganisms in food and their application to control foodborne illness and spoilage in the food processing and food service industries. Given concurrently with NU FS 363, not open to students with credit in NU FS 363. Limited registration. Preference will be given to students in the Food Science and Technology major. Prerequisite: MICRB 265.

L NU FS 363 Food Microbiology
★3 *(fi 6)* (first term, 3-0-0). Environmental factors affecting the growth, activity, and destruction of microorganisms in food and their application to control foodborne illness and spoilage in the food processing and food service industries. Given concurrently with NU FS 361, not open to students with credit in NU FS 361. Prerequisite: BIOL 107 or 108 or ★3 in Microbiology.

L NU FS 372 Food Chemistry
★3 *(fi 6)* (first term, 3-0-3). Chemistry of food constituents. Laboratory emphasizes analytical techniques. Given concurrently with NU FS 373. Not open to students with credit in NU FS 373. Prerequisites: CHEM 161 and 263.

L NU FS 373 Food Chemistry
★3 *(fi 6)* (first term, 3-0-0). Chemistry of food constituents. Prerequisite: CHEM 161/263. Given concurrently with NU FS 372. Not open to students with credit in NU FS 372.

NU FS 374 Food Fundamentals and Quality
★3 *(fi 6)* (either term, 3-0-3). Chemical, physical, and sensory properties of food products and factors affecting food quality in relation to preparation, processing, and storage of foods in the home and institution. Prerequisite or Corequisite: NU FS 372 or 373.

O NU FS 377 Introduction to Nutrition in the Community
★3 *(fi 6)* (second term, 3-0-0). Examination of nutritional problems in contemporary communities. Community nutrition seeks to improve diets and nutritional status of whole populations by working at the community, provincial, national and international levels. Discussion of nutrition programs and resources. Credit will only be given for one of NU FS 377 and 477. Prerequisite: (NU FS 223 or 323) and (NU FS 305 or NUTR 301).

O NU FS 400 Undergraduate Reading Project
★3 *(fi 6)* (either term, 3-0-0). Individual study. Critical reviews of selected literature under the direction of a staff member. Note: For third- and fourth-year students

only. Students must obtain approval from Department before registration. May be taken more than once provided topic is different.

O NU FS 401 Undergraduate Research Project
★3 *(fi 6)* (either term, 0-0-6). Directed laboratory study under supervision of a staff member. Note: For third- and fourth-year students only. Students must obtain approval from Department before registration. May be taken more than once provided that topic is different.

O NU FS 402 Brewing, Enology, and Food Fermentations
★3 *(fi 6)* (second term, 3-1s-0). Biological, biochemical, and technical aspects of microbial and fungal fermentations used in the food and beverage industries, especially the lactic acid and alcohol fermentations. Graduate students may not register for credit (see AFNS 502). Credit will only be given for one of AFNS 502 and NU FS 402. Prerequisite: MICRB 265 or NU FS 361 or 363.

O NU FS 403 Processing of Milk and Dairy Products
★3 *(fi 6)* (first term, 3-1s-0). Technological principles of milk treatment and processes for fluid milk products; concentrated, dried, sterilized, and fermented dairy products; cheese, butter and ice cream. Graduate students may not register for credit (see AFNS 503). Credit will only be given for one of AFNS 503 and NU FS 403. Prerequisite: NU FS 374.

O NU FS 404 Meat and Meat Products
★3 *(fi 6)* (second term, 3-0-3/2). Biological, biochemical, chemical, and technological aspects of the processing of meat and meat products. Prerequisite: ★3 in Biochemistry.

O NU FS 406 Science and Technology of Cereal and Oilseed Processing
★3 *(fi 6)* (first term, 3-0-3/2). Biological, biochemical, chemical, and technological aspects of the processing of cereals and oilseeds. Prerequisite: ★3 in introductory Biochemistry or Biological Science or NU FS 374 or consent of Instructor.

O NU FS 427 Nutritional Toxicology and Food Safety
★3 *(fi 6)* (first term, 3-0-0). Provides students with an understanding of the principles of risk: benefit evaluations related to the metabolic consequences of exposure to foodborne chemicals and therapeutic agents, and to microbiological concerns about foods. Graduate students may not register for credit (see AFNS 527). Credit will only be given for one of AFNS 527 and NU FS 427. Prerequisites: ★3 Biochemistry and ★3 Microbiology or consent of instructor.

NU FS 428 Recent Advances in Nutraceuticals
★3 *(fi 6)* (second term, 0-3s-0). A seminar course involving critical evaluations of the current literature on food components, including functional foods and nutraceuticals. Students learn to interrelate the chemistry, health potential and toxicological implications of the components. Graduate students may not register for credit (see AFNS 528). Credit will only be given for one of AFNS 528 and NU FS 428. Prerequisite: (NUTR 301 or 302) or NU FS 305.

NU FS 430 Principles of Sensory Evaluation of Foods
★3 *(fi 6)* (either term, 3-0-3). Principles and methods of analysis of the sensory properties of foods; appearance, texture, aroma, and taste. Physiology of sensory receptors. Applications, advantages, and limitations of sensory methods. Prerequisites: Introductory statistics and NU FS 372 or 373.

NU FS 450 Food Product Development
★3 *(fi 6)* (either term, 3-0-3). Design of concept, formulation, processing, packaging and labeling of a new food product and development of quality assurance and marketing strategies. Prototype development in the laboratory and testing of consumer acceptability. Open to fourth-year students in the Nutrition and Food Science, Food Processing Business Management and Food Service Business Management Programs.

NU FS 454 Unit Operations in Food Preservation
★3 *(fi 6)* (second term, 3-0-3). Processes used in food preservation. Dehydration, refrigeration and freezing, sterilization and canning, irradiation. Effect of processing on food properties. Graduate students may not register for credit (see AFNS 554). Credit will only be given for one of AFNS 554 and NU FS 454. Pre- or corequisites: (NU FS 201 or 283) and (NU FS 361 or 363) and (NU FS 372 or 373) or consent of instructor.

NU FS 461 Foodservice Systems Management
★3 *(fi 6)* (either term, 3-0-3). Operational techniques and special problems encountered during the preparation and service of food in quantity, in both commercial operations and foodservice establishments. The laboratory sessions will provide experience in quantity food production. Prerequisites: NU FS 374 and (NU FS 223 or 323). AREC 323 or AG EC 323 recommended.

NU FS 463 Foodservice and Hospitality Project
★3 *(fi 6)* (second term, 0-1s-3). Directed foodservice research project or critical reviews of selected literature, under supervision of a staff member. Prerequisite: NU FS 461.

NU FS 480 Foodborne Pathogens
★3 *(fi 6)* (second term, 3-1s-0). Established and emerging causative agents of microbial foodborne illness, their significance and control in the food chain. Rationale for regulatory intervention to enhance the microbiological safety of

Course Listings N

foods. Graduate students may not register for credit (see AFNS 580). Credit will only be given for one of AFNS 580 and NU FS 480. Prerequisite: MICRB 265 or NU FS 361 or 363.

O NU FS 481 Advanced Foods
★3 *(fi 6)* (second term, 3-0-0). Critical evaluation of current literature on the effects of ingredients and processing on quality characteristics of foods. Graduate students may not register for credit (see AFNS 581). Credit will only be given for one of AFNS 581 and NU FS 481. Prerequisites: NU FS 374 and ★3 Biochemistry or consent of instructor.

NU FS 490 Current Topics in Food Science
★3 *(fi 6)* (first term, 3-0-0). Integrated exploration of issues pertaining to food science. Open to fourth-year students in the Food Science and Technology or Nutrition and Food majors. Prerequisite: NU FS 312, 353 and (NU FS 361 or 363).

NU FS 499 Advanced Agri-Chemical Analysis
★3 *(fi 6)* (second term, 3-0-3). Advanced analysis of food and agri-industrial materials with a focus on good laboratory practices (GLP), chromatographic techniques (HPLC, GC), mass spectrometry, and other modern techniques from sample preparation to analysis of data. Graduate students may not register for credit (see AFNS 599). Credit will only be given for one of AFNS 599 and NU FS 499. Prerequisite: NU FS 372 or consent of Instructor.

Graduate Courses

Notes
(1) 400-level courses in NU FS may be taken for credit by graduate students with approval of the student's supervisor or supervisory committee. 300-level courses may be taken for credit by graduate students with approval of the AFNS Graduate Program Committee. (See §174.1.1(1))
(2) See Agricultural, Food and Nutritional Science (AFNS) listing for related courses.

231.203   Obstetrics and Gynaecology, OB GY

Department of Obstetrics and Gynaecology
Faculty of Medicine and Dentistry

Undergraduate Courses

OB GY 546 Obstetrics and Gynaecology Student Internship
★6 *(fi 12)* (either term, 6 weeks). Student internship in obstetrics and gynaecology for students registered in the MD program.

231.204   Occupational Therapy, OCCTH

Department of Occupational Therapy
Faculty of Rehabilitation Medicine

Note: All OCCTH courses are open to Occupational Therapy students only except OCCTH 206 which are open to all students.

Undergraduate Courses

O OCCTH 206 Applied Interpersonal Communication
★3 *(fi 6)* (either term, 3-0-0). Interpersonal communication theory and application to health care. Integration and application of values and attitudes as they affect professional/client relationships. Students with credit in OCCTH 106 will not be permitted to take OCCTH 206.

OCCTH 307 Core I: Occupational Therapy Practice Delivery
★2 *(fi 4)* (either term, 26 hours). Fundamental concepts of occupational therapy and their applications in health care delivery. Students will be oriented to specific conceptual models and theoretical approaches used in the practice of Occupational Therapy. Corequisites: OCCTH 309, 362.

OCCTH 308 Psychosocial Assessment and Intervention in Occupational Therapy
★4 *(fi 8)* (two term, 52 hours). Introduction to the assessment of clinical disorders in psychiatry and the impact of psychosocial issues on mental health. Taught from an applied holistic approach through case studies, it links clinical conditions to assessment and intervention in the practice of Occupational Therapy. Corequisites: OCCTH 307, 309, 310.

OCCTH 309 Core 2: Therapeutic Occupation, Assessment and Intervention
★3 *(fi 6)* (either term, 39 hours in 9 weeks). Theory and practical classes in assessment and intervention. Practical experience in the therapeutic use of activities with emphasis on task analysis. Corequisites: OCCTH 307, 362.

OCCTH 310 Core 3: Application of Occupational Therapy Principles
★4 *(fi 8)* (either term, 52 hours). Application of Occupational Therapy principles through the use of intervention media and modalities for various physical and psychosocial domains. Students will complete an Objective Structured Clinical Examination (OSCE) during the course. Prerequisites: All Year 3 Fall Term academic courses. Corequisites: All Year 3 Winter Term academic courses.

OCCTH 311 Selected Health, Social and Policy Topics in Occupational Therapy
★2.5 *(fi 5)* (either term, 32.5 hours). An introduction to critical issues impacting the profession and its practice. Corequisite: OCCTH 307. Students with credit in REHAB 311 will not be permitted to take OCCTH 311.

OCCTH 323 Professionalism in Practice
★1 *(fi 2)* (two term, 13 hours). This practical course, underpinned by theoretical perspectives, provides the information that students need to meet the professional requirements as an occupational therapist.

OCCTH 324 Fieldwork Project
★1.5 *(fi 3)* (either term, 4 weeks). Credit. Practical application of Fall term courses. Students will be expected to complete specific projects designed to integrate the core knowledge of occupational therapy theory. Prerequisites: OCCTH 323 and attendance at Fieldwork Orientation. Corequisites: All Year 3 Fall Term OCCTH courses.

OCCTH 328 Fieldwork
★4.5 *(fi 9)* (either term, 8 weeks). Credit. Practical experience in approved facilities and community agencies. Prerequisites: consent of Department; OCCTH 324 and completion of all Year 3 academic courses; attendance at Professional Development Seminar.

OCCTH 362 Introduction to Research and Clinical Reasoning
★4 *(fi 8)* (either term, 52 hours). Introduction to research for the critical evaluation of the Occupational Therapy and related literature to facilitate the learning of specific strategies of clinical reasoning used in Occupational Therapy practice. Corequisites: OCCTH 307, 309.

OCCTH 408 Occupational Therapy Theory
★3 *(fi 6)* (either term, 0-3s-0). Selected conceptual models of occupational therapy are examined in terms of their philosophical base, conceptualization, and application to practice. Open only to post-diploma degree completion students unless department consent is granted.

OCCTH 414 Core 4: Advanced Application of Occupational Therapy Principles Across the Lifespan
★6 *(fi 12)* (either term). Application of occupational therapy principles and evidence-based practice, focusing on children and older adults using a lifespan approach, current theories, and complex integrated case studies. Prerequisites: OCCTH 310, 328. Corequisite: REHAB 455.

OCCTH 415 Core 5: Integration in Specialty Practice Areas
★4 *(fi 8)* (either term, 52 hours). Application of assessment and intervention strategies in the areas of psychiatry, neurology and work evaluation. Prerequisites: all clinical and completion of academic course work in Year 3 and Fall Term of Year 4. Corequisites: REHAB 454, INT D 410.

OCCTH 420 Analysis and Synthesis of Occupational Therapy Principles
★2 *(fi 4)* (either term, 0-2s-0). Focuses on clinical strategies for complex cases in physical and psychosocial domains of practice. Students will complete an Objective Structured Clinical Examination (OSCE) during the course. Prerequisites: completion of 3rd year courses in the Occupational Therapy Program.

OCCTH 428 Fieldwork
★3 *(fi 6)* (either term, 5 weeks). Credit. Practical experience in approved facilities and community agencies. Prerequisites: consent of Department; attendance at Professional Development Seminar; OCCTH 328 and completion of Year 4 Fall Term academic courses.

OCCTH 433 Fieldwork
★3 *(fi 6)* (either term, 5 weeks). Credit. Practical experience in approved facilities and community agencies. Prerequisites: consent of Department, OCCTH 428 and completion of Year 4 academic courses.

OCCTH 434 Fieldwork
★3 *(fi 6)* (either term, 5 weeks). Credit. Practical experience in approved facilities and community agencies. Prerequisites: consent of Department, OCCTH 433 and completion of Year 4 academic courses.

OCCTH 486 Student Selected Modules
★1 *(fi 2)* (either term, 13 hours). Students must successfully complete a minimum of five modules in different topics. Note: Course title is variable; course may be repeated. This is a CR/NC course.

OCCTH 498 Special Seminars
★3 *(fi 6)* (either term, 0-3s-0). Content varies from year to year. Topics will be announced prior to registration period. Prerequisite: consent of Department.

OCCTH 499 Individual Study
★3 *(fi 6)* (either term, 0-3s-0). A course intended to allow the senior undergraduate

student to pursue a topic of interest in more depth than the classroom structure permits. This may take the form of directed reading, laboratory or clinical experience. Prerequisite: Departmental consent.

Graduate Courses

Note: Open only to graduate students in Occupational Therapy program unless departmental consent is granted.

OCCTH 501 Theory & Practice of Enabling Occupation
★2 *(fi 4)* (either term, 0-2s-0). Conceptual models and theoretical approaches applied to occupational therapy
practice. Corequisites: OCCTH 502, 503, 510, 518, 562.

OCCTH 502 Evaluation of Occupational Performance
★3 *(fi 6)* (either term, 0-3L-0). Occupational therapy theoretical foundations, clinical reasoning, and practical approaches for the identification of occupational performance deficits. Students will learn the evaluation standards of rigour, and develop practical skills for identifying and evaluating individuals' performance problems and concerns in line with their disability, prognosis and environmental situations. Corequisites: OCCTH 501, 503, 510, 518, 562.

OCCTH 503 Professionalism and Supervision in Practice
★2 *(fi 4)* (two term, 0-2s-0). Underpinned by theoretical perspectives, a structure is provided for students to (a) selfevaluate and demonstrate professionalism and (b) work effectively with those for whom they have supervisory responsibilities.

OCCTH 504 Occupation, Health & Society
★2 *(fi 4)* (either term, 0-2L-0). The study of: a) occupation and its relationship to functioning, disability, health and wellbeing; and b) the role of occupation in society. Prerequisite: Completion of all Year 1 Fall Term courses. Corequisites: OCCTH 518, 544.

OCCTH 505 Theory and Instrumentation in Occupational Therapy Practice
★3 *(fi 6)* (either term, 0-3s-0). The theory of occupational therapy and its relationship to client assessment. Pre- or corequisite: EDPY 500 or equivalent.

OCCTH 506 Instrumentation Theory in Occupational Therapy
★2 *(fi 4)* (either term, 0-2s-0). Measurement principles and their application to occupational therapy. Restricted to students registered in the MSc in OT course-based route.

OCCTH 510 Theory, Evidence and Skills in Practice: Application
★1 *(fi 2)* (either term, 0-1L-0). Application of occupational therapy principles and skills, supported by evidence-based practice, in physical and mental health, functioning, participation and activities. Corequisites: OCCTH 501, 502, 503, 518, 544, 562.

OCCTH 512 Core 5: Integration in Speciality Practice Areas
★4 *(fi 8)* (either term, 52 hours). Application of assessment and intervention strategies in the areas of psychiatry and work evaluation. Corequisites: REHAB 454, INT D 410.

OCCTH 515 Integration in Specialty Practice Areas
★4 *(fi 8)* (either term, 0-4L-0). Service integration for specialty program planning and delivery in areas of psychiatric and work impacting disorders. Prerequisites: Completion of all clinical and academic course work in Year 1 and Fall Term of Year 2.

OCCTH 518 Influences on Occupational Performance: Mental Health
★4 *(fi 8)* (two term, 0-4L-0). Occupational performance deficits, resulting from mental health conditions, and occupational therapy interventions. Using case studies students will explore assessment and intervention approaches in occupational therapy practice. Corequisites: OCCTH 510, 520, 544, Int D 410.

OCCTH 519 Enabling Occupation: Mental Health
★2 *(fi 4)* (either term, 0-2s-0). An in-depth analysis of the process and practice of mental health treatment techniques used occupational therapy. Prerequisites: Completion of all Year 1 academic and fieldwork courses. Corequisites: OCCTH 530, 545.

OCCTH 520 Theory, Evidence and Skills in Practice: Integration
★1 *(fi 2)* (either term, 0-1L-0). Case based clinical reasoning to integrate occupational therapy theory and values in the selection of intervention media and modalities for physical and mental health, physical and mental health, functioning, participation, and activities. Prerequisites: Completion of all Year 1 Fall Term courses. Corequisites: OCCTH 544, 563.

OCCTH 521 Program Evaluation in Occupational Therapy
★3 *(fi 6)* (either term, 0-3s-0). Designed to equip the student with the resources and skills to evaluate occupational therapy program delivery.

OCCTH 524 Fieldwork–Learning in a Practice Context
★1.5 *(fi 3)* (either term, 4 weeks). Practical experience and application of knowledge and skills gained in fall term courses, in approved facilities and community agencies. Students will be expected to complete specific projects designed to assimilate the core knowledge of occupational therapy theory. Prerequisite: attendance at

Fieldwork Orientation. Corequisites: All Year 1 Fall Term academic courses and attendance at Fieldwork Orientation.

OCCTH 525 Fieldwork–Learning in a Practice Context
★3 *(fi 6)* (either term, 6 weeks). Practical experience and application of Year 1 courses in approved facilities and community agencies. Students will be expected to complete specific projects designed to integrate the core knowledge of occupational therapy theory. Prerequisites: consent of Department; attendance at mandatory fieldwork session(s); completion of all Year 1 academic courses.

OCCTH 526 Fieldwork - Learning in a Practice Context
★3 *(fi 6)* (either term, 6 weeks). Practical experience in approved facilities and community agencies. Prerequisites: Consent of Department; attendance at mandatory fieldwork session(s); completion of all Year 1 and Year 2 Fall Term academic courses; OCCTH 525.

OCCTH 527 Fieldwork–Learning in a Practice Context
★3 *(fi 6)* (either term, 6 weeks). Practical experience in approved facilities and community agencies. Prerequisites: consent of Department; attendance at mandatory fieldwork session(s); completion of all Year 2 academic courses; OCCTH 526.

OCCTH 528 Fieldwork - Learning in a Practice Context
★3 *(fi 6)* (either term, 6 weeks). Practical experience in approved facilities and community agencies. Prerequisites: consent of Department; attendance at mandatory fieldwork session(s); completion of all Year 2 academic courses; OCCTH 527.

OCCTH 530 Theory, Evidence and Skills in Practice: Synthesis
★1 *(fi 2)* (either term, 0-1L-0). The use and design of interventions for physical and mental health, functioning, participation, and activities supported by the analysis and synthesis of occupational therapy principles. Prerequisites: Completion of all Year 1 academic and fieldwork courses. Corequisites: OCCTH 545, 564.

OCCTH 531 Fieldwork
★3 *(fi 6)* (either term, 5 weeks). Credit. Practical experience in approved facilities and community agencies. Prerequisites: consent of Department and completion of EDPY 500; INT D 410; OCCTH 506, 512, 521; and REHAB 454 and 500.

OCCTH 536 Fieldwork
★3 *(fi 6)* (either term, 5 weeks). Credit. Practical experience in approved facilities and community agencies. Prerequisite: consent of Department and completion of OCCTH 531.

OCCTH 540 Theory, Evidence and Skills in Practice Evaluation
★1 *(fi 2)* (either term, 0-1L-0). Application and evaluation of occupational therapy intervention media and modalities for physical and mental health functioning, participation, and activities. Prerequisites: Completion of all Year 1 academic and fieldwork courses and Year 2, Fall Term academic and fieldwork courses. Corequisite: OCCTH 545.

OCCTH 543 Student Selected Modules
★1 *(fi 2)* (either term, 13 hours). Students must successfully complete a minimum of five modules in different topics. Note: Course title is variable; course may be repeated. This is a CR/NC course.

OCCTH 544 Practical Skills (Year 1)
★1.5 *(fi 3)* (two term, 0-0-1.5). Mobility techniques and assistive device construction. Corequisites: All Year 1 Fall and Winter Term academic and fieldwork courses.

OCCTH 545 Practical Skills (Year 2)
★2 *(fi 4)* (two term, 0-0-2). Therapeutic strategies in a) mental health; and b) environmental adaptation. Prerequisites: Completion of all Year 1 academic and fieldwork courses. Corequisite: OCCTH 519.

OCCTH 553 Influences on Occupational Performance: Human Systems III – Adaptability of the Nervous System
★3 *(fi 6)* (either term, 3-0-0). Principles of nervous system adaptation and plasticity over the lifespan, with an emphasis on nervous system response to injury and disease, and the biological basis for occupational performance. Prerequisites: Completion of all Year 1 academic and fieldwork courses. Corequisites: OCCTH 530, 557.

OCCTH 554 Enabling Occupation through Neurological Rehabilitation
★2 *(fi 4)* (either term, 0-2L-0). Occupational therapy for neurological conditions encountered in practice. Prerequisites: Completion of all Year 1 academic and fieldwork courses and Year 2, Fall Term academic and fieldwork courses. Corequisites: OCCTH 540, 558.

OCCTH 557 Enabling Occupation: Across the Lifespan
★6 *(fi 12)* (two term, 0-6L-0). Application of occupational therapy principles, supported by evidence-based practice, with an emphasis on children and older adults, using current theories and complex integrated case studies. Prerequisite: Completion of all Year 1 academic and fieldwork courses.

OCCTH 558 Enabling Occupation: Community
★2 *(fi 4)* (either term, 0-2s-0). Application and integration of occupational therapy principles and practice in community settings. The focus is on complex care and chronic degenerative conditions. Prerequisite: Completion of all Year 1 academic and fieldwork courses and Year 2, Fall Term academic and fieldwork courses.

OCCTH 559 Enabling Occupation: Return to Work
★2 *(fi 4)* (either term, 0-2s-0). The relationship between the client's occupational performance strengths and resources and the demands of work environments are investigated in relation to establishing meaningful roles. Prerequisite: Completion of all Year 1 academic and fieldwork courses and Year 2, Fall Term academic and fieldwork courses; Corequisite: OCCTH 540.

OCCTH 562 Evidence-Based Practice in Occupational Therapy
★3 *(fi 6)* (either term, 0-3s-0). Critical evaluation of occupational therapy and related literature including methodology and design. Corequisites: All Year 1 Fall Term academic and fieldwork courses.

OCCTH 563 Research Design and Knowledge Translation
★3 *(fi 6)* (either term, 3-0-0). Examination of: (a) research methodology and design as they (i) apply to the development of a project proposal and (ii) as they affect published findings in the literature; and (b) consideration of how knowledge is translated into occupational therapy practice. Prerequisites: Completion of all Year 1 Fall Term academic and fieldwork courses. Corequisites: OCCTH 518, 544.

OCCTH 564 Evaluation of Occupational Therapy Services
★2 *(fi 4)* (either term, 0-2s-0). The integration of social research procedures with occupational therapy models for evaluating the processes, structures and outcomes of programs and services to which occupational therapists contribute. Prerequisites: Completion of all Year 1
academic and fieldwork courses. Corequisite: OCCTH 565.

OCCTH 565 Research Proposal
★1 *(fi 2)* (either term, 0-1s-0). The development of a full proposal for a definitive occupational therapy research project to be carried out in OCCTH 900. The project may be a systematic review, or an evaluation of an occupational therapy program/service, or a qualitative/quantitative/mixed methodology research study. Prerequisites: Completion of all Year 1 academic and fieldwork courses. Corequisite: OCCTH 564.

OCCTH 583 Influences on Occupational Performance: Human Systems I
★3 *(fi 6)* (either term, 2-0-1). The study of: (a) physical human systems and occupational performance deficits resulting from illness, injury, and disease; and (b) the concurrent development of related assessment skills and occupational therapy interventions. Prerequisites: Completion of all Year 1 Fall Term academic and fieldwork courses. Corequisites: OCCTH 520, INT D 410.

OCCTH 584 Influences on Occupational Performance: Human Systems II
★2 *(fi 4)* (either term, 1-0-1). Occupational performance deficits resulting from illness, injury, and disease and the application of related assessment skills and occupational therapy interventions. Prerequisites: Completion of all Year 1 Fall and Winter Term academic and fieldwork courses.

OCCTH 586 Student Selected Modules
★1 *(fi 2)* (either term, 13 hours). Students must complete a minimum of three modules in different topics. Topics completed as undergraduate students in OCCTH 486 cannot be repeated. Note: Course title is variable; course may be repeated. This is a CR/NC course.

OCCTH 597 Research and Directed Studies
★3 *(fi 6)* (either term, 0-0-3). Work on a specific project under the supervision of a faculty member. Prior approval of the supervisor and the student's advisor required.

OCCTH 598 Special Seminars
★3 *(fi 6)* (either term, 0-3s-0). Content varies from year to year. Topics will be announced prior to registration period. Prerequisite: consent of Department. May be repeated.

OCCTH 599 Individual Study
★3 *(fi 6)* (either term, 0-3s-0). Designed to allow a student to pursue a topic of interest in more depth than permitted by existing courses. Prerequisite: Departmental approval of plan of study. May be repeated.

OCCTH 900 Directed Final Project
★6 *(fi 12)* (variable, unassigned). The synthesis of academic knowledge, with fieldwork experiences and directed to the exploration of a specific topic, relevant to occupational therapy. Students will demonstrate inquiry, reflection and critical thinking. Students will demonstrate inquiry, reflection and critical thinking through required participation in seminars, a written report and a conference style presentation.

231.205 Oncology, ONCOL
Department of Oncology
Faculty of Medicine and Dentistry

Undergraduate Courses

ONCOL 320 Introduction to Oncology
★3 *(fi 6)* (first term, 3-0-0). Provides an introduction to oncology with an emphasis on the molecular and cellular biology of cancer. Specific topics include the genetic basis of cancer, the control of cell proliferation, metastasis, tumour immunology, angiogenesis, epidemiology and cancer therapies. Prerequisite: BIOCH 200 with a minimum grade of C, or consent of the Department.

Graduate Courses

Note: See also PMCOL 505, MED 573, PHYS 475 and PHYS 477.

ONCOL 510 Issues in Psychosocial Oncology
★3 *(fi 6)* (first term, 3-0-0). The general objective of the course is to explore specific clinical and research issues in psychosocial oncology through guided independent study and presentation. The course is primarily designed to fit into masters and doctoral programs in a range of disciplines including psychology, educational psychology, social work, family studies, nursing, and pastoral care. It is also open to students in other disciplines who are considering a career in oncology. Issues in psychosocial oncology such as the mind-body connection, coping strategies, cancer and its impact on the family, grief and loss issues, and many other related topics will be explored. Course assignments will allow students from different disciplines to investigate their own areas of particular interest. Prerequisite: consent of Department.

ONCOL 520 Tumor Biology
★3 *(fi 6)* (second term, 3-0-0). The course will provide an introduction to the basic science of oncology. Topics to be covered comprise: the genetic basis of cancer, including the role of proto-oncogenes and tumor suppressor genes; mechanisms of carcinogenesis and radiation-sensitivity, including DNA repair and cell cycle control; the molecular basis of tumor metastasis, including cell motility, tumor cell invasion, and extravasation; tumor immunology and angiogenesis. Course offered in alternate years. Prerequisites: BIOCH 200, and one of the following: BIOCH 320 or 330 or ONCOL 320.

ONCOL 521 Structural Organization of the Cell and Cancer
★3 *(fi 6)* (second term, 0-3s-0). This course explores the relationship between the dynamic structural organization of the cell and neoplastic behavior through in-depth evaluation of both original and review literature. The objective of the course is to make students aware of how concepts in structural organization affect understanding of cancer and to show students how to critically evaluate, organize and present scientific information. Students are evaluated through seminar presentations, intensive discussion, and a term paper. Course offered in alternate years. Prerequisite: BIOCH 200, and one of the following: BIOCH 320 or 330 or ONCOL 320.

ONCOL 535 Clinical Radiobiology
★1.5 *(fi 3)* (either term, 1.5-0-0). An introduction to the physics, chemistry, and biology of radiation effects on cells and tissues. Concepts discussed are focused on those of relevance to the treatment of cancer with ionizing radiation. Prerequisite: consent of Department.

ONCOL 550 Medical Radiation Physics
★3 *(fi 6)* (first term, 3-0-0). Fundamentals of radiation physics, production and properties of ionizing radiation and their interactions with matter and tissue. Interactions of photons and of charged particles with matter. Concepts of radiation dosimetry (theoretical and experimental, cavity theory and ionization chambers). Consent of Department required.

ONCOL 552 Fundamentals of Applied Dosimetry
★3 *(fi 6)* (second term, 3-0-0). Theory and practical techniques of external beam radiotherapy and brachytherapy. Topics include single and multiple external beams, scatter analysis, inhomogeneity corrections, fundamentals of brachytherapy, and brachytherapy dosimetry systems. Prerequisite: ONCOL 550.

ONCOL 554 Laboratory in Medical Radiation Physics
★2 *(fi 4)* (Spring/Summer, 0-0-4). Practical aspects of medical physics as applied to radiation therapy. Exposure to the operation of various therapy units and dose measuring devices. Application of techniques to measure physical parameters of radiation beams. Introduction to radiation treatment planning with techniques for specific tumor sites. Prerequisite: ONCOL 550. Corequisite: ONCOL 552.

ONCOL 556 Laboratory in Imaging
★2 *(fi 4)* (Spring/Summer, 0-0-4). Provides clinical and practical experience with diagnostic imaging equipment, to adequately provide consultative support required of a clinical medical physicist in imaging. Perform calibration and quality assurance procedures on medical imaging modalities. Prerequisites: ONCOL 550 and 562. Corequisites: ONCOL 568 and 564.

ONCOL 558 Health Physics
★2 *(fi 4)* (first term, 2-0-0). Sources of radiation, basic dosimetry, and hazards of ionizing radiation. Basics of radiation safety. Techniques for the detection, use, and safe handling of radiation sources. Radiation safety codes, laws and regulations. Consent of Department required.

ONCOL 560 Technology in Radiation Oncology
★2 *(fi 4)* (first term, 2-0-0). Explore the use of computers and electronics in the diagnosis, tumour and normal tissue localization, treatment planning, treatment delivery, and treatment verification as applied to cancer patients. Computing tools for the Medical Physicist. Consent of Department required.

ONCOL 562 Theory of Medical Imaging
★3 *(fi 6)* (first term, 3-0-0). A system theory approach to the production,

analysis, processing and reconstruction of medical images. An extensive use of Fourier techniques is used to describe the processes involved with conventional radiographic detectors, digital and computed radiography. Review and application of image processing techniques used in diagnostic and therapeutic medicine. Consent of Department required.

ONCOL 564 Physics of Nuclear Medicine

★3 *(fi 6)* (second term, 3-0-0). Discussion of the fundamental physics of radioactivity, the use of unsealed sources in medical diagnosis and treatment. Unsealed source dosimetry, nuclear measurement instrumentation, spectrometry. Design and function of gamma cameras, single photon emission tomography, and positron emission tomography. Prerequisites: ONCOL 550 and 562.

ONCOL 566 Radiation Biophysics

★3 *(fi 6)* (first term, 3-0-0). Theories and models of cell survival, survival and curve and its significance, modification of radiation response. Radiobiology of normal and neoplastic tissue systems. Late effects of radiation on normal tissue and radiation carcinogenesis, genetic effects of ionizing radiation. Consent of Department required.

ONCOL 568 Physics of Diagnostic Radiology

★3 *(fi 6)* (second term, 3-0-0). Rigorous development of the physics of x-ray production, interaction and detection in diagnostic radiology, including mammography. In-depth analysis of analog and digital systems in radiography and fluoroscopy is given. The description and design of computed tomographic systems as well as the associated reconstruction algorithms from single to multislice helical systems are studied. Prerequisites: ONCOL 550, 562.

ONCOL 570 Directed Reading in Experimental Oncology

★3 *(fi 6)* (either term, 0-3s-0). Reading and discussion of current research literature on selected topics in experimental oncology under the direction of one or more faculty members. Topics presently available include cell adhesion mechanisms, cell cycle regulation, DNA repair, radiotherapy and susceptibility and resistance, oncogenes/tumor suppressor genes, and tumor cell metastasis. Notes: (1) Grades will be based on participation in group discussions and/or written reports from assigned readings with emphasis on critical evaluation of the subject matter. (2) Students in other graduate programs may register with the consent of Instructors. Prerequisite: consent of Department.

ONCOL 600 Graduate Medical Physics Seminar

★2 *(fi 4)* (two term, 0-1s-0). Weekly seminars given by faculty on topics of interest to the medical physics community that are not formally included with the other didactic courses. Includes medical statistics, anatomy/physiology for medical physics, site-specific cancer, experience in clinic, inverse treatment planning optimization, photodynamic therapy, proton and neutron therapy, and image fusion. No prerequisite.

ONCOL 620 Recent Advances in Cancer Research

★3 *(fi 6)* (first term, 0-3s-0). A directed reading and seminar course based on recent developments in the cellular and molecular biology of cancer. The students will critically review papers selected from the recent literature and give oral presentations. Prerequisites: ONCOL 520 and consent of Department. Offered in alternate years.

ONCOL 660 Current Topics in Cancer Research

★2 *(fi 4)* (second term, 0-1.5s-0). A general seminar/discussion course on recent advances in a wide range of topics related to cancer development and management. Selected topics include experimental therapeutics, molecular oncogenetics, tumour immunobiology, DNA repair, and cell cycle regulation. Notes: (1) all graduate students in the Department of Oncology are expected to attend the seminars whether or not they are registered in the course. (2) All graduate students in the Department of Oncology should register in the course in their second year and present a seminar based on their research project. (3) All graduate students registered in ONCOL 660 will write a paper on a selected topic. Restricted to graduate students in the Department of Oncology.

ONCOL 661 Current Topics in Cancer Research II

★1 *(fi 2)* (first term, 0-1s-0). A general seminar course based on recent advances in a wide range of topics related to cancer. Note: Oncology 661 should be taken in the first term of the year in which Oncology 660 is taken. Graduate students must obtain one credit from ONCOL 661 in order to meet the minimum requirements for the MSc and PhD programs in the Department of Oncology. Restricted to graduate students in the Department of Oncology.

231.206 Ophthalmology, OPHTH

Department of Ophthalmology
Faculty of Medicine and Dentistry

Graduate Courses

OPHTH 600 Seminar in Ophthalmology

★6 *(fi 12)* (two term, 0-3s-0). Open to graduate students, particularly those in

the Medical Sciences (Ophthalmology) program. Seminars are given by Residents in the Postgraduate Medical Education program in Ophthalmology. Tutorials are presented by staff or by visiting speakers. Topics covered include; pediatric ophthalmology/strabismus, contact lens/cornea/external eye disease, neuro-ophthalmology, orbit/oculoplastics, retina, principles of ocular surgery, glaucoma, ocular genetics. Specific topics will not be repeated more often than once each four years so that four consecutive enrolments are possible. Prerequisite: consent of Department.

OPHTH 601 Ocular Genetics

★3 *(fi 6)* (either term, 3-0-0). This course provides a comprehensive overview of various aspects of eye genetics including both basic science studies and clinical conditions. Clinical case studies and their investigation will form part of the course. Offered in alternate years. Format includes didactic lectures supplemented by brief student presentations and guest speakers. Grades are assigned according to participation and a final exam. Prerequisite: Familiarity with medical genetics and ophthalmology and the consent of the Department.

231.207 Oral Biology, OBIOL

Department of Dentistry
Faculty of Medicine and Dentistry

Undergraduate Courses

OBIOL 202 Oral Biology I

★4 *(fi 8)* (two term, 62 hours). Basic microscopic anatomy pertinent to the main body systems and a more detailed treatment of the structure and development of oral tissues, with special reference to the teeth and their supporting structures. Clinical examples and a demonstration lab will be used to enhance the teaching of basic anatomy.

OBIOL 302 Oral Biology II

★3 *(fi 6)* (first term, 45 hours). A multidisciplinary course that examines the unique physiology, biochemistry and nutrition of oral structures. Topics will include functions of the periodontal tissues, the termporomandibular joint, mastication, deglutition, speech, special reflexes involving cranial nerves, receptors of the stomatognathic system, and salivary glands and relevance of saliva to caries. Oral manifestations of metabolic disease, the physiology of pain, and the role of nutrition in the development of oral tissues and the maintenance of oral health will also be discussed.

OBIOL 305 Pathology

★3 *(fi 6)* (two term, 42 hours). Introduction to the principles of pathology with consideration of the more common diseases affecting the human body. Visual differentiation between normal and abnormal tissues; the physiological and pathological changes which affect the teeth, their supporting structures and the oral mucosa, including oral manifestations of selected systemic disturbances.

Graduate Courses

OBIOL 500 Oral Biology I

★3 *(fi 6)* (first term, 3-0-0). Functional anatomy of head and neck, development, structure, function and biochemistry of connective tissues associated with the jaws and cell biology. Course offered in alternate years.

OBIOL 501 Oral Biology II

★3 *(fi 6)* (second term, 3-0-0). A continuation of Oral Biology I. Craniofacial development and selected topics in physiology. Course offered in alternate years.

OBIOL 503 Advanced Oral Pathology

★3 *(fi 6)* (first term, 3-0-0). A review of diseases that affect the oral tissues and an exploration of recently acquired knowledge pertaining to them.

OBIOL 504 Oral Medicine

★3 *(fi 6)* (second term, 3-0-0). A study of the mechanisms of oral disease as a basis for rationale of treatment.

OBIOL 601 Seminars in Oral Biology

★2 *(fi 4)* (two term, 0-1s-0). Seminars will focus on the major areas of research of Oral Biology staff and students. Students must present one seminar on topics related to their field of research. Required for all MSc and PHD students.

OBIOL 607 Conference Seminars in Oral Biology I

★3 *(fi 6)* (first term, 0-3s-0). This course will include seminars and conferences on selected aspects of oral biology. Continuous evaluation of student preparation and participation throughout the course will be used for assessment. This is an optional course open to students outside the Faculty of Medicine and Dentistry by consent of the Chair, Department of Dentistry.

OBIOL 608 Conference Seminars in Oral Biology II

★3 *(fi 6)* (second term, 0-3s-0). This is a continuation of DENT 607.