

Master of Science in Applied Science

Program Coordinator: Dr. Pawan Lingras

Participating Departments & Program Executive Representatives:

Dr. Genlou Sun	Biology
Dr. Jason Masuda	Chemistry
Dr. Jason Clyburne	Environmental Studies
Dr. Hai Wang	Finance, Information Systems and Management Science
Dr. Philip Giles	Geography
Dr. Pierre Jutras	Geology
Dr. Paul Muir	Mathematics and Computing Science
Dr. Tanya Peckmann	Anthropology

General Information

The Master of Science in Applied Science Program is a research thesis-oriented, multidisciplinary degree program. The objectives of the program are to provide graduate students with the opportunity to conduct research in a single or a multidisciplinary field of study with practical application; to produce graduates with valuable skills in research and communication preparing them for careers in related fields of research and development in industry or government, as well as for further graduate studies at the doctoral level. The normal duration of the Program for full-time students is two years. Students may also be admitted for part-time study with the permission of the Program Executive. Students may pursue their degree through a series of work and study terms; this Co-operative option is available for both full and part-time students in the Program. Students benefit from the able guidance of experts in related fields of study within the institution and from outside, as the composition of the supervisory committee reflects the Program's emphasis on the multidisciplinary approach to research. Collaborative research projects with experts at recognized external research institutions are encouraged and, in the case of Co-operative option of study, essential to the success of the student.

Admission Requirements

The MSc in Applied Science follows the general admission requirements and procedures of the Faculty of Graduate Studies and Research as outlined in Section 2 of the Graduate Studies Academic Calendar.

In addition, in order to be eligible to make an application for admission to the Program, applicants must have:

- a. successfully completed an honours Bachelor's degree in Science from a recognized institution or the equivalent.
- b. achieved a minimum cumulative quality point average of 3.0 (a 'B' standing) in their overall academic record.

Financial Support

Graduate Fellowships (value up to \$6,000 per year) and teaching assistantships (approximately \$3,400 per year) are available to eligible students. Students are also encouraged to seek support under the NSERC Industrial Postgraduate Scholarship (IPS) scheme (contact Dean of Graduate Studies and Research). Faculty supervisors, in the absence of an NSERC Postgraduate Scholarship or NSERC IPS or financial support from other external sources, will contribute to the support of accepted students from NSERC operating grants or research contract funds to ensure that students normally have a minimum support from all sources of \$14,000 for co-op option per annum for two years (this includes the co-op wage which is normally paid to students during the co-op work terms) and \$15,000 for non co-op option per annum for two years.

Program Requirements

Note Students not registered in any course work but working on their Program/Thesis must register in Program Continuation (FGSR 9000) if their program was initiated after 1 September 2004 or Thesis Continuation (THES 9999) if their program was initiated prior to 1 September 2004 for every semester (including summer) in which they are in their graduate program.

- a. Students must successfully complete the required core courses, which include the successful completion and defense of the research thesis: APSC 6600.0; APSC 6601; APSC 6602; APSC 6603.0; and APSC 6604.0.
- b. Non co-op students must successfully complete a total of 12 credit hours of graduate-level courses in addition to the required core courses.
- c. Co-op students must successfully complete a total of 12 credit hours in work terms in a cognate field.
- d. Students must achieve a minimum cumulative GPA of 3.0 (B) in the Program.
- e. The Supervisory Committee consists of the research thesis Supervisor and two other faculty members, not all of whom are from the same department and with at least one member an expert in a discipline sufficiently removed from the primary research focus. The Supervisory Committee membership should be submitted to and approved by the Program Executive within one month of the commencement of the program.
- f. The student must make an oral presentation of his/her research proposal to the Supervisory Committee and obtain approval of the proposed work and schedule by such Committee within eight months of commencing the Program.
- g. The student must meet with his/her Supervisory Committee in September beginning in their second year to assess the student's progress in research and course work. The annual assessment should be submitted and approved by the Program Executive by September 30.

h. As stated in the Academic Regulations Section of the Graduate Programs Academic Calendar, all degree requirements must be completed within 5 years and not sooner than 2 years for full-time students; and within 7 years and not sooner than 4 years for part-time students, after entry into the Master of Science in Applied Science Program.

i. Students must submit and successfully defend their research thesis before an Examination Committee, comprised of the Supervisory Committee and an External Examiner. Details on this process and the events leading to it are outlined in the *Graduate Student Handbook*, available on the FGSR website.

Graduate Courses Applied Science (APSC)

6600 Graduate Seminar

6 credit hours

The instructional part of this course focuses on research project definitions, project planning and scientific writing. Students are expected to read articles chosen for discussion, contribute to the critiquing process and make several presentations during the course. Students are expected to attend a designated number of seminars either at Saint Mary's University or at other surrounding research institutions. Students normally enroll in this course in the first year of the Master of Science in Applied Science program.

6601 Research Techniques I

3 credit hours

Research Techniques I is an interdisciplinary course designed to introduce students to a range of issues and concepts in research techniques across a range of scientific disciplines. This course is divided into four modules: 1) Research Design, Scientific Method and Model Building; 2) Data Collection and Experimentation; 3) Data Analysis and Statistics and 4) Data Interpretation and Communication. There are approximately 3 hours of lecture/seminar and associated laboratory/demonstration/seminar work per week.

6602 Research Techniques II

3 credit hours

This course is intended to help students learn research techniques that are specific to their discipline through a series of project modules. Each module may include instructions, seminars, laboratory work, and independent study. In each module, students will select a research problem and will be required to understand the theoretical basis underlying the analysis of the problem and the practical procedures necessary to solve the problem.

6603 Thesis I

6 credit hours

Prerequisite: APSC 6600 and APSC 6602

Thesis I constitutes the first segment of the student's thesis research project. Students normally register for this course in their first year in the program. Research is conducted under the guidance of the research thesis Supervisor in conjunction

with the other Supervisory Committee members. Successful completion of APSC 6603 includes a satisfactory evaluation and Annual Assessment of the student's written and oral presentation of his/her Research Progress Report by the Supervisory Committee. The Supervisor normally submits the completed evaluation to the Program Committee on or before September 30th of that year.

6604 Thesis II

6 credit hours

Prerequisite: APSC 6603.0

Thesis II constitutes the second segment of the student's thesis research project. Students normally register for this course in the Fall semester of their second year in the Program. Research is conducted under the guidance of the faculty Research Supervisor in conjunction with the Supervisory Committee.

6876 - 6899 Directed Studies

3 credit hours

These courses are taken during the first or second year of enrolment in the Master of Science in Applied Science program. The directed studies will be conducted under the supervision of a faculty member following approval by the Program Coordinator.

All of the following courses require permission of the instructor to register.

Biology (BIOL)

6606 Current Topics in Biology

3 credit hours

A journal article-based examination of developments in biology that are relevant to all biology graduate students. **NOTE:** This course is compulsory for all graduate students in biology and is normally taken in the first year.

6607 Advanced Molecular Biology

3 credit hours

The application of molecular techniques to broad biological problems is the focus of this course. It is suitable not only for students pursuing a degree in molecular biology but also to those who will use advanced techniques such as DNA sequencing, bioinformatics and genomics to approach larger aspects of biology, for example population genetics, taxonomic problems, paternity identification, etc.

6608 Biostatistics for Graduate Students

3 credit hours

Analysis of biological data at the advanced level. The course will build on previous biostatistics experience and include multivariate analysis, nonparametric methods, and model selection as well as manipulation and analysis of large, complex databases.

6609 Field Methods and Experimental Design

3 credit hours

Students will be exposed to standard methodologies for data collection under field conditions, including sampling protocols, technical devices available and types of numerical

and descriptive data that are typically collected. Design of both experimental and ecological research projects will be discussed.

6625 Theoretical Plant Ecology

3 credit hours

This course offers an advanced treatment of plant ecology, starting with theoretical principles but moving into empirical tests of theory. Topics covered include competition, facilitation, coexistence, ecosystem functioning, plant traits and modeling. Students will collaborate on a common experiment or field study during the course.

6690 - 6699 Directed Study in Biology

3 credit hours

These courses are intended to supplement the course offerings in biology and allow students to delve deeper into a subject of particular interest to them. Students must show some initiative and be willing to work independently.

Chemistry (CHEM)

6611 Selected Topics in Physical Chemistry

6 credit hours

This is a graduate-level directed study course in a specific area of physical chemistry. Topics can vary but reflect the expertise of the instructor and the research interests of the student(s).

6612 Quantum Chemistry

3 credit hours

The advanced principles of quantum physics are used to develop an understanding of atomic and molecular structure. This is a modified version of undergraduate course CHEM 4412. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6613 Physical Chemistry

3 credit hours

An advanced course on statistical thermodynamics and the study of chemical reaction rates and mechanisms. This is a modified version of undergraduate course CHEM 4413. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6614 Symmetry and Chemical Applications of Group Theory

3 credit hours

An advanced course on symmetry and group theory for the experimental chemist. Applications of point groups and space groups in organic chemistry, inorganic chemistry, molecular spectroscopy, atomic and molecular structure and crystallography. This is a modified version of undergraduate course CHEM 4414. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6621 Selected Topics in Inorganic Chemistry

6 credit hours

This is a graduate-level directed study course in a specific area of inorganic chemistry. Topics can vary but reflect the expertise of the instructor and the research interests of the student(s).

6622 Advanced Topics in Inorganic Chemistry

3 credit hours

Current topics and applications of inorganic chemistry will be covered, and may include the following: cluster chemistry, chemistry of the lanthanides and actinides, inorganic and organometallic materials, bioinorganic chemistry and inorganic photochemistry. This is a modified version of undergraduate course CHEM 4422. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6631 Selected Topics in Analytical Chemistry

6 credit hours

This is a graduate-level directed study course in a specific area of analytical chemistry. Topics can vary but reflect the expertise of the instructor and the research interests of the student(s).

6632 Instrumental Analysis I

3 credit hours

Emphasis will be placed on i) separation techniques including high performance and gas chromatography; ii) organic mass spectrometry; iii) analogue circuits and devices and digital electronics. This is a modified version of undergraduate course CHEM 3432. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6633 Instrumental Analysis II

3 credit hours

Emphasis will be placed on (i) atomic spectroscopy including atomic absorption and emission; (ii) x-ray fluorescence; (iii) modern electro-chemical techniques including differential pulse voltammetry and stripping analysis;; (iv) inorganic mass spectrometry. This is a modified version of undergraduate course CHEM 4443. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6641 Selected Topics in Organic Chemistry

6 credit hours

This is a graduate-level directed study course in a specific area of organic chemistry. Topics may include organic synthesis, stereochemistry, heterocyclic compounds and natural products, and reflect the expertise of the instructor and the research interests of the student(s).

6643 Organic Reaction Mechanisms

3 credit hours

A study of the more important mechanisms of reactions of organic molecules and the methods by which they are

elucidated: applications of kinetic data, isotope effects, linear free energy relationships, orbital symmetry control and acid and base catalysis. This is a modified version of undergraduate course CHEM 3443. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6644 Synthesis in Organic Chemistry

3 credit hours

A study of the principles involved in the planning and execution of the synthesis of organic molecules. Laboratory experiments are designed so that students learn to identify their products by the use of spectroscopic and other techniques. This is a modified version of undergraduate course CHEM 4444. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6645 Organic Spectroscopy

3 credit hours

An advanced course on interpretation of ^1H and ^{13}C nuclear magnetic resonance spectra. Infrared spectroscopy, mass spectrometry, and ultra-violet spectrophotometry will also be applied to the problems of organic and organometallic structural determination. This is a modified version of undergraduate course CHEM 3445. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6651 Biochemistry

3 credit hours

This course reviews and/or presents an advanced course on the chemistry and biochemistry of macromolecules such as proteins, enzymes, simple and complex carbohydrates, lipids, nucleic acids, and coenzymes. A relationship between the molecular structure of a given macromolecule, its properties, and its function in the living system is explored. The laboratory work concentrates on the isolation, purification, and analysis of naturally occurring macromolecules and includes study of their properties, using micro chemical measurements. This is a modified version of undergraduate course CHEM 3451. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6652 Biochemistry: Metabolism

3 credit hours

A course presenting principles of metabolism of biomolecules involved in energy production, formation of biosynthetic substrates and metabolism of nucleic acids. Both catabolic and anabolic processes as well as transport of biomolecules within cells and organs are considered. This is a modified version of undergraduate course CHEM 4452. Students attend the undergraduate lectures and are expected to complete at least the course requirements of the

undergraduate course as well as any supplementary graduate requirements as specified by the instructor.

6653 Selected Topics in Biochemistry

6 credit hours

This is a graduate-level directed study course in a specific area of biochemistry. Topics can vary but reflect the expertise of the instructor and the research interests of the student(s).

6690 - 6699 Directed Study in Chemistry

3 credit hours

These courses are intended to supplement the course offerings in chemistry and allow students to delve deeper into a subject of particular interest to them. Students must show some initiative and be willing to work independently.

Computing and Information Systems (CISY)

6624 Database Systems

3 credit hours

Students will examine the design, implementation and management issues associated with database systems. The problems which arise through incorrectly designed databases are identified and their resolutions discussed. Topics on transaction processing and databases on the WWW are also covered. Labs based on an RDBMS package are given to provide a vehicle for practical implementation.

6636 Decision Support Systems

3 credit hours

This course will introduce students to the specialized use of computer systems for supporting and enhancing managerial decision-making. Students will be introduced to the basic architecture of DSS, as well as issues involving design and implementation of various types of DSS (i.e., data mining, group DSS, expert systems). The course includes instruction in advanced features of Microsoft Excel. An application project will be completed either in teams or individually during the semester.

6690 Seminar in Computing and Information Systems

3 credit hours

This course deals with selected topics in computing and information systems. It is offered when in sufficient demand, and specific topics covered may vary depending on the interests of students and instructor.

6692 - 6699 Directed Study in Information Systems

3 credit hours

Intended to supplement or provide an alternative to the regular computing and information systems courses in order to meet the special needs and interests of students, these courses provides an opportunity to study a particular subject in detail and requires from the student some measure of independence and initiative.

Computing Science (CSCI)

6623 Cryptography

3 credit hours

An advanced course in the various aspects of data security. Possible topics: classical encryption methods such as Vignere and Vernan ciphers; the Data Encryption Standard; key distribution methods and public key encryption; and authentication using digital signatures. Applications of these methods in the design of protocols for data privacy and security will also be studied.

6651 Theory of Computation

3 credit hours

An advanced course in some of the fundamental theoretical concepts in computing science. Students will be introduced to the concepts of decidable, P, NP, NP-complete, and NP-hard problems. Two classes of languages of interest to computing scientists, namely, regular and context free languages, and corresponding automata for recognizing these languages, will also be studied. A brief discussion on the semantics of programming languages will be included. The concept of automata will be further extended using Turing machines. Turing machines will be used to explore the concept of decidability along with examples of decidable and undecidable problems.

6652 Algorithm Analysis

3 credit hours

Some of the key techniques of efficient algorithm design that will be discussed: divide and conquer; greedy methods; dynamic programming; graph traversal; and change of representation. Measuring algorithm performance and lower bounds for various problems will be studied. An introduction to complexity theory-P, NP, polynomial time reducibility, and NP-completeness- will also be provided

6661 Database Systems

3 credit hours

An advanced course in the design, implementation, use and maintenance of databases. Topics will include: data models such as the entity-relationship model, the relational model, and the object-oriented model; relational languages such as relational algebra, relational calculus, and SQL; the theory of normal forms of database design; use of indexes for efficient data retrieval; and database implementation using a commercial database management system. Other topics may be included, such as query optimization, database control, and distributed database systems.

6663 Numerical Software

3 credit hours

This course will study the software development process in the area of numerical software. Emphasis will be placed on software development and implementation aspects of a variety of numerical algorithms. The course will also examine a substantial number of software packages including some which are currently available in some of the large commercial software libraries, as well as a number of published software packages which have yet to appear in libraries and even a few experimental codes which have not yet appeared in the literature. The main project in the course will be the development of a large software package by the class working in programming teams in a selected area of

numerical algorithms. Other projects to be undertaken during the course include the modification of one or more existing mathematical software packages and the critical analysis of several existing software packages. A number of assignments related to the software packages considered will also be given.

6671 Computer Graphics

3 credit hours

This course provides an overview of the principles and methodologies of computer graphics, including the representation, manipulation, and display of two- and three-dimensional objects. Subtopics may include characteristics of display devices (i.e., raster, vector); representing primitive objects (lines, curves, and surfaces) and composite objects; two- and three-dimensional transformations (translation, rotation, scaling); hidden lines and surfaces; shading and colouring; interactive graphics and the user interface; animation techniques.

6674 Information Retrieval

3 credit hours

This course considers manipulations on a bibliographic database. Topics to be covered include an introduction and basic definitions, inverted file structures, automatic indexing, prototype systems, retrieval and refinements and natural language processing.

6676 Computer Vision and Digital Image Processing

3 credit hours

An advanced course in the concepts used in computer vision and digital image processing. Computer vision techniques extract information from an image, while image processing techniques modifies the image for viewing by the human eye. Topics covered include the following: sampling and resolution, image processing, edge detection, segmentation, discrete image transforms, restoration and enhancement, and image compression.

6677 Data Mining

3 credit hours

Data mining refers to a family of techniques used to detect interesting knowledge in data. With the availability of large databases to store, manage and assimilate data, the new thrust of data mining lies at the intersection of database systems, artificial intelligence and algorithms that efficiently analyze data. The course will use concepts from pattern recognitions, statistics, data analysis and machine learning. The size of databases and high complexity of techniques present many interesting computational challenges.

6682 Artificial Intelligence

3 credit hours

An advanced course in artificial intelligence (AI). The course will consider philosophical, mathematical, experimental, and implementation aspects of such topics as problem solving, searching, game playing, genetic algorithms, learning, neural networks, natural language processing, vision, knowledge representation, logic, expert systems, reasoning under uncertainty, fuzzy sets, planning, and robotics. In addition to a theoretical introduction, students will also gain experience using one or more of the popular AI tools.

6691 - 6699 Special Topics in Computing Science

3 credit hours

This course covers advanced topics in computing science chosen according to the interests of the students and instructor, and requires some measure of independence and initiative from the student.

Environmental Studies (ENVS)**6620 Restoration Ecology**

3 credit hours

This course offers an advanced treatment of contemporary issues in restoration ecology, including conservation genetics, invasive species, phytoremediation, restoration ethics, and ecological integrity. Experiential learning is emphasized and there may be opportunities for hands-on experience in actual restoration projects or in experimental microcosms. Students will also develop scientific writing skills by writing real grant proposals or review papers.

6650 Natural Resource Management

3 credit hours

This interdisciplinary course examines the management of natural resource industries such as fisheries, forestry, mining and energy, focusing on interactions between biophysical, ecological, socioeconomic, and technological components. The course will cover such topics as sustainable development and environment-economy interactions in the resource sector; approaches to integrated natural resource development; theoretical and practical aspects of managing resources and resource industries; economics of sustainable resource use; methods for analyzing the impacts of resource use.

6660 Methods of Environmental and Natural Resource Analysis

3 credit hours

This interdisciplinary course provides a “tool-kit” of methods for planning and evaluation in natural resource and environmental management. Emphasis is placed on methods to assess dynamics of change in biophysical, ecological, socioeconomic, and technological aspects of resource and environmental systems, and for analyzing the impacts of management interventions. Topics to be covered include computer-based techniques to acquire and manage information; bio-economic and simulation models; statistical and forecasting methods; economic valuation and ecological economics; sustainability indicators in resource and environmental systems; analysis of real-world case studies.

6690 - 6699 Directed Studies in Environmental Science

Students will pursue a short term research project in such areas as: oceanographic sampling and analysis, policy development or environmental impact assessment. Students must identify an appropriate supervisor; provide a project proposal; and at the end of the project, submit a written report.

Geography (GEOG)**5614 Integrated Coastal Zone Management**

3 credit hours

Spatial approaches to the integrated planning and management of the coastal zone within a sustainable development framework will be discussed and analyzed using case studies from intensively developed coastal zones in Europe, the Mediterranean, Southeast Asia, and North America. Emphasis will be placed on the use of geographical information systems as management and planning tools.

5623 Glacial Geomorphology

3 credit hours

The study of geomorphological processes and landforms in glaciated environments. Emphasis will be placed on descriptions and explanations of glacial processes and glacial landform development. Glacial history will form a minor component of the course.

5632 Social Geography of the City

3 credit hours

Examines the location of residential areas in cities, and the differentiation and segregation of those areas by income, occupation, race, ethnic status, and religion. Emphasis is placed on the historical evolution of social patterns, on the link between social areas and the physical fabric of the city, on competition between groups for amenity locations and facilities, and on the conflicts over noxious facilities.

5633 Fluvial Geomorphology

3 credit hours

This course examines processes and landforms associated with rivers. Topics include channel processes and morphology, sedimentology and depositional environments. Case studies of human impacts on river systems are also presented.

5636 Advanced Remote Sensing

3 credit hours

A course in advanced topics in remote sensing building upon the basic concepts and image processing skills learned in GEOG 3356. At the advanced level, remote sensing involves more numerical processing and statistical analysis, and greater understanding of physical principles of remote earth observation. Recent studies in remote sensing will be examined and discussed critically. Students will develop projects based on their background and interests using remote sensing for applied studies.

5639 Urban Historical Geography

3 credit hours

The geography of the city (its morphology and function) is employed as an indication of the landscape impression produced by various historical periods (conceived as cultures) during the evolution of urban forms in Europe and North America. Examples are taken in historical sequence from Greek to Industrial times.

5642 Urban Planning

3 credit hours

Examines the physical and environmental planning of urban areas, with special reference to current practice in Nova

Scotia. Topics include the emergence of modern town planning, the Planning Act, planning process, structure plans, general and partial urban allocation models, municipal plans, zoning, subdivision control, site planning, urban renewal, and new towns. The costs and benefits of planning are appraised.

5643 Natural Hazards

3 credit hours

This course considers natural hazards as a part of human-environment relations characterized by changing geographical patterns. Earthquakes, volcanic eruptions, landslides, severe weather, floods, coastal hazards, extraterrestrial body impacts are analyzed in a multi-scale perspective, along with their functional relationships. The human impact of natural hazards is discussed, with an emphasis on environmental perception, public awareness and action. Possibilities of forecasting are examined, as well as risk assessment and mitigation strategies.

5652 The Geography of Urban Transportation

3 credit hours

This course focuses on patterns and processes of movement within cities. Topics for consideration include: the role of transportation in shaping urban form, transportation problems in cities today, the urban transportation planning process, patterns of public transit and automobile use, environmental impacts of urban transportation, the communications-transportation trade-off.

5653 Coastal Geomorphology

3 credit hours

This course discusses both the physical processes that operate in the coastal zone and the resulting landforms. The actions of waves, tides, currents, sea level changes, wind, and humans in the formation of coastal features are considered. Additional topics include the long-term development and classification of coasts.

5686 Concepts in Geographical Information Systems (GIS)

3 credit hours

This course provides an introduction to geographic information systems (GIS). Consideration is given to GIS data structure, data input, quality, storage and editing, GIS analysis functions and an introduction to the implementation of a GIS. Although the course has a strong technical component, the central underlying theme is using GIS to improve decision making in natural, human and management sciences.

5696 Applications in Geographical Information Systems

3 credit hours

This course allows students to develop further their understanding of GIS and its applications. The course allows students to further develop their understanding of GIS and its applications. This course is project-oriented, focusing on the use of geographic information systems (GIS) to address practical problems in areas such as resource management, marketing, regional planning, natural hazards and geomorphology. Students will undertake a major research project using various GIS analytical functions, and develop skills relating to data creation, manipulation, quality assessment and presentation.

6602 Directed Studies in Urban/Regional Geography.

6 credit hours

A directed studies course on topics involving urban and regional geography.

6603 Directed Studies in Environmental Geography

6 credit hours

A directed studies course on topics involving environmental geography.

6604 Directed Studies in Marine Geography

6 credit hours

A directed studies course on topics involving marine geography.

6605 Directed Studies (General)

6 credit hours

A directed studies course on general topics in geography.

6612 Directed Studies in Urban/Regional Geography

3 credit hours

A directed studies course on topics involving urban and regional geography.

6613 Directed Studies in Environmental Geography

3 credit hours

A directed studies course on topics involving environmental geography.

6615 Directed Studies (General)

3 credit hours

A directed studies course on general topics in geography.

6624 Directed Studies in Marine Geography

3 credit hours

A directed studies course on topics involving marine geography.

6690 - 6699 Directed Study in Geography

3 credit hours

These courses are intended to supplement the course offerings in geography and allow students to delve deeper into a subject of particular interest to them. Students must show some initiative and be willing to work independently.

Geology (GEOL)

6400 International Field Camp

3 credit hours

This course is offered on an irregular basis in the form of a Geology field trip abroad, allowing the students to be exposed to geological features that cannot be found in Canada. In practical terms, this course will acquaint the student with modern methods of structural, stratigraphic, petrologic and/or geophysical analysis. After mastering these skills, students will undertake an independent geological report project. Students may be required to travel at their own expense.

6414 Tectonics

3 credit hours

This course describes the major features of the Earth and its place in the solar system. The evidence for plate tectonics,

the analysis of plate movements, and the characteristic rock associations formed in different tectonic environments are presented. Aspects of global change will be considered, including the evolution of tectonic processes through geologic time, changes in the atmosphere and oceans, and the importance of meteorite impacts.

6441 Mineral Resources

3 credit hours

A study of Earth's mineral resources, their classification, genesis and distribution in time and space. Important examples from Canada and abroad will be discussed. Topics will also include mineral exploration techniques, mining methods, metallurgical recovery, net smelter return, and ore reserve estimation/classification. Laboratories will examine a variety of base and precious metal ore deposit types. Mining/exploration practice and resource exploitation are also examined in terms of their environmental impacts.

6450 Advanced Igneous and Metamorphic Petrology

3 credit hours

The topics covered in this course include magmatic petrogenesis; magma types; petrographic provinces and their relations to their tectonic setting; differentiation indices; variation diagrams; distribution trends of major and trace elements; equilibrium and fractional crystallization in selected synthetic systems; phase equilibria in metamorphic systems; reaction balancing methods; porphyroblast-matrix relations; quantification of pressure-temperature-time trajectories. Laboratory work is centered on the acquisition and manipulation of microprobe data.

6465 Advanced Sedimentology

3 credit hours

This course examines current research on sedimentary rocks and basins and the methods used to understand them. The course is taught as a series of modules by multiple instructors who introduce the students to selected areas of research. Among the topics to be covered are modern carbonate and evaporite environments, exotic chemical sedimentary rocks and diagenetic cements, volcanogenic sedimentary rocks, sequence stratigraphy in carbonate and siliciclastic successions, applications of ichnology (trace fossils), the use of stable isotopes in the study of terrestrial carbonates, and the use of detrital minerals to interpret basin evolution.

6654 Applied Geochemistry

3 credit hours

The application of graphical and numerical tools for classifying Earth materials according to their chemical composition is studied through field-based and computer-based laboratories. This course examines geochemical sampling, instrumental analysis, statistical evaluation of real geochemical data, and the methods of proper reporting and quality control. The students are introduced to novel methods (fluid inclusion microanalysis, alteration mapping in ore deposits, reaction path modeling) and their application in characterizing geochemical processes on Earth.

6666 Petroleum Geology

3 credit hours

The origin, migration and accumulation of oil and natural gas. Types of oil bearing structures and basic principles in oil exploration.

6690 - 6699 Directed Studies in Geology

3 credit hours

Intended to supplement or provide an alternative to the regular geology courses in order to meet the special needs and interests of students. The course provides an opportunity to study a particular subject in detail and requires from the student some measure of independence and initiative.

Management (MGMT)

6687 New Venture Opportunities

3 credit hours

Students are led through the development of the major elements required for a business plan for a new venture, as well as developing an appreciation for new venture growth in the economy. As a planning and financing tool, the business plan outlines in detail and specifically finance, management and the overall feasibility of a possible new venture. Attention is given to customizing the plan to specific requirements of different financing (e.g., venture capital, bank finance, angel investors).

Management Science (MGSC)

6603 Statistical Applications in Management Science I

3 credit hours

This course brings together many of the theories and skills which the student has learned and uses them in designing, conducting, analyzing, and reporting the results of research designs. Statistical techniques used are: chi-square, analysis of variance, and multiple regression. Extensive use is made of computer-oriented statistical packages.

6615 Strategic Design and Improvement of Operations

3 credit hours

This course is aimed at the student who wants to deepen their understanding of the strategic role of operations and the design of operations to facilitate competitive advantage in both service and production environments. The strategic design and improvement of operations will be examined in the context of key performance priorities such as: cost, quality, flexibility, delivery, and time. Topics include: process design and improvement, implementation of operations improvement strategies, and integration of information technology and operations systems. The course will make significant use of cases and group work.

6618 Total Quality Management

3 credit hours

This course introduces the student to the concepts of total quality management, quality improvement, and statistical quality control as key ingredients of a quality strategy. The role of a quality strategy in improving the competitiveness of the firm in both local and international markets is emphasized. Using a case-oriented approach, students will be introduced to the philosophies of Deming, Juran and Crosby, the dimensions of product and service quality,

modern statistical improvement tools, and the relationship between quality strategy and the functional areas of the firm.

6690 Seminar in Management Science

3 credit hours

This course deals with selected topics in management science. It is offered when in sufficient demand, and specific topics covered may vary depending on the interests of students and instructor.

6692 - 6699 Directed Study in Management Science

3 credit hours

Intended to supplement or provide an alternative to the regular management science courses in order to meet the special needs and interests of students, these courses provides an opportunity to study a particular subject in detail and requires from the student some measure of independence and initiative.

Mathematics (MATH)

6690 - 6699 Directed Study in Mathematics

3 credit hours

This course is intended to supplement or provide an alternative to the regular mathematics courses in order to meet the special needs and interests of students. The course provides an opportunity to study a particular subject in detail and requires from the student some measure of independence and initiative.

Psychology (PSYC)

6790 - 6799 Directed Study in Psychology

3 credit hours

These courses are intended to supplement the course offerings in psychology and allow students to delve deeper into a subject of particular interest to them. Students must show some initiative and be willing to work independently.