

4451 Ecology in the Tropics

3 credit hours

Prerequisites: BIOL 2324, BIOL 2308 or PSYC 2350 or MATH 1216 and application to the department.

This course will provide students with an opportunity to study ecology of a tropical environment, the highlight of which will be a field trip to a tropical location where students will be able to immerse themselves into a tropical environment. Prior to departure students will present and attend seminars on subjects pertinent to the ecology of the tropical field site to be visited. Further, students will design a research project on some aspect of tropical ecology prior to departure to the tropical site, collect data for the project while in the tropics and write a report on the research upon return to Saint Mary's University.

Note: Students are responsible for travel and living costs associated with the course, as well as tuition. Enrolment is limited and admission is by application to the Biology Department, contact the chair for details. This course occurs over a period of 10-12 days and nights at an off-campus location.

4500 Research Thesis

6 credit hours

Prerequisite: honours standing.

Research project carried out by the student under the supervision of a member of the Department. The student will submit a thesis and present it orally.

Lab 6 hrs. a week. 2 semesters.

4549 Honours Seminar

6 credit hours

Prerequisite: honours standing.

Seminars followed by discussions based on recent advances in biology. In consultation with the honours advisor, the honours students will select and prepare the topics for presentation to biology faculty and students.

4876 - 4899 Directed Study in Biology

3 credit hours

Prerequisite: Permission of instructor on a directed studies form available from the Chairperson of Biology.

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)

Chairperson,
Professors
Associate Professors

M. Lamoureux,
R. Singer, K. Vaughan
J. Clyburne (Canadian Research
Chair [Tier II] in Environmental
Science & Materials, cross
appointed with ENVS), M.

Assistant Professors

Lamoureux, A. Piorko, C. Pye
Christa Brosseau, J. Masuda, K.
Singfield

Adjunct Professors
Professors Emeriti
Dean Emeritus

D. Gamble, W. Jones, J. MacNeil
J. Murphy, J. Young
W. Bridgeo

Department website:

www.smu.ca/academic/science/chemist/

The program offerings of the Department of Chemistry are designed to meet two main objectives:

- a. to provide a rigorous core education in the theory and practice of chemistry for students pursuing a Bachelor of Science degree with Honours, Major, or Concentration in Chemistry;
- b. to provide students in other disciplines an introduction to the principles and practices of this central science, contributing to their fundamental understanding and appreciation of the physical world.

Our Bachelor of Science with Major in Chemistry and Bachelor of Science with Honours in Chemistry degrees are **nationally accredited programs by the Canadian Society for Chemistry (CSC) governing board**, ensuring that the

program has the potential to prepare graduates to practice their profession in a competent scientific manner. Honours graduates from the program are well prepared to continue their education at the graduate level in related fields of study. Majors graduates are also well equipped to further their education or to enter into the scientific work force, contributing to such areas as research, education, government, and industry at various levels of responsibility.

In addition to having a strong commitment to teaching, the Chemistry Department Faculty members are committed to engaging undergraduate students in their research activities. Opportunities exist for motivated and capable students to enrich their program by contributing to the research work and dissemination of research results through employment as research assistants and participation in research conferences.

Major in Chemistry - Requirements:

The requirements for the degree of Bachelor of Science with Major apply as listed in this Academic Calendar under the heading of Faculty of Science, Bachelor of Science – Major. The specific list of Chemistry courses which satisfies the required minimum forty-two (42) credit hours in the Major subject is as follows:

- CHEM 1210 General Chemistry I
- Three (3) credit hours from: CHEM 1211, 1212 or 1213 General Chemistry II
- CHEM 2312 Physical Chemistry I
- CHEM 2313 Physical Chemistry II

- CHEM 2332 Introductory Analytical Chemistry: Wet Methods
- CHEM 2333 Introductory Analytical Chemistry: Instrument Methods
- CHEM 2344 Organic Chemistry I
- CHEM 2345 Organic Chemistry II
- CHEM 3322 Inorganic Chemistry I
- CHEM 3324 Inorganic Chemistry II
- Three (3) credit hours from: CHEM 3451 Introductory Biochemistry, or CHEM 4452 Biochemistry: Metabolism I
- Nine (9) credit hours in CHEM at the 3400 level or above;
- MATH 1210 and MATH 1211;
- Three (3) credit hours in Mathematics (above MATH 1213) or Computer Science (above CSCI 1200-level).
- PHYS 1100 and PHYS 1101

Major in Chemistry - Suggested Program

The following program is recommended by the Department of Chemistry for students wishing to graduate with a Bachelor of Science with Major in Chemistry

Year 1:

- CHEM 1210 General Chemistry I
- Three (3) credit hours from: CHEM 1211, 1212 or 1213 General Chemistry II
- MATH 1210 Introductory Calculus I
- MATH 1211 Introductory Calculus II
- PHYS 1100 University Physics I
- PHYS 1101 University Physics II
- ENGL 1205 Introduction to Literature
- Three (3) credit hours in Humanities subjects
- Six (6) credit hours in Arts subjects

Year 2:

- CHEM 2312 Physical Chemistry I
- CHEM 2313 Physical Chemistry II
- CHEM 2332 Introductory Analytical Chemistry: Wet Methods
- CHEM 2333 Introductory Analytical Chemistry: Instrumental Methods
- CHEM 2344 Organic Chemistry I
- CHEM 2345 Organic Chemistry II
- Three (3) credit hours in Mathematics or Computing Science
- Three (3) credit hours in non-chemistry science electives
- Six (6) credit hours in electives

Year 3:

- CHEM 3322 Inorganic Chemistry I
- CHEM 3324 Inorganic Chemistry II
- Three (3) credit hours from: CHEM 3451 Introductory Biochemistry; CHEM 4452 Biochemistry: Metabolism I
- Six (6) credit hours in Arts courses
- Six (6) credit hours of non-chemistry science electives
- Nine (9) credit hours of electives

Year 4:

- Nine (9) credit hours in CHEM at the 3400 level or above
- Twelve (12) credit hours non-chemistry electives
- Nine (9) credit hours of electives

Double Major in Chemistry and Other Science - Requirements:

The requirements for the degree of Bachelor of Science with Double Major apply as listed in this Academic Calendar under the heading of Faculty of Science, Bachelor of Science – Double Major. The specific list of Chemistry courses which satisfies the required minimum thirty-six (36) credit hours in Chemistry is as follows:

- CHEM 1210 General Chemistry I
- Three (3) credit hours from: CHEM 1211, 1212 or 1213 General Chemistry II
- CHEM 2312 Physical Chemistry I
- CHEM 2313 Physical Chemistry II
- CHEM 2344 Organic Chemistry I
- CHEM 2345 Organic Chemistry II
- Six (6) credit hours from the following:
 - CHEM 2332 Introductory Analytical Chemistry: Wet Methods
 - CHEM 2333 Introductory Analytical Chemistry: Instrument Methods
 - CHEM 3322 Inorganic Chemistry I
 - CHEM 3324 Inorganic Chemistry II
- Three (3) credit hours from:
 - CHEM 3451 Introductory Biochemistry
 - CHEM 4452 Biochemistry-Metabolism I
- Nine (9) credit hours in Chemistry at the 3400 level or above.
- MATH 1210 and MATH 1211;
- Three (3) credit hours in Mathematics (above MATH 1213) or Computer Science (above CSCI 1200-level).
- PHYS 1100 and PHYS 1101

Honours in Chemistry – Requirements:

The requirements for the degree of Bachelor of Science with Honours apply as listed in this Academic Calendar under the heading of Faculty of Science, Bachelor of Science – Honours and Double Honours. The specific list of Chemistry courses which satisfies the required minimum sixty (60) credit hours in Chemistry is a follows:

- CHEM 1210 General Chemistry I
- Three (3) credit hours from: CHEM 1211, 1212 or 1213 General Chemistry II
- CHEM 2312 Physical Chemistry I
- CHEM 2313 Physical Chemistry II
- CHEM 2332 Introductory Analytical Chemistry: Wet Methods
- CHEM 2333 Introductory Analytical Chemistry: Instrumental Methods
- CHEM 2344 Organic Chemistry I
- CHEM 2345 Organic Chemistry II
- CHEM 3322 Inorganic Chemistry I
- CHEM 3324 Inorganic Chemistry II
- Three (3) credit hours from: CHEM 3432 Instrumental Analysis I or CHEM 4433 Instrumental Analysis II

- Three (3) credit hours from: CHEM 3443 Organic Reaction Mechanisms or CHEM 4444 Synthesis in Organic Chemistry
- Three (3) credit hours from: CHEM 3445 Organic Spectroscopy, CHEM 4421 Organometallic Chemistry or CHEM 4422 Advanced Topics in Organic Chemistry
- Three (3) credit hours from: CHEM 3451 Introductory Biochemistry or CHEM 4452. Biochemistry: Metabolism I
- CHEM 4412 Quantum Chemistry
- CHEM 4498 Selected Research Topics in Chemistry
- CHEM 4500 Research Thesis
- Three (3) credit hours in CHEM at the 3400 level or above;
- MATH 1210 and MATH 1211;
- MATH 2310 and MATH 2311
- PHYS 1100 and PHYS 1101

Double Honours in Chemistry and Other Science - Requirements:

The requirements for the degree of Bachelor of Science with Double Honours apply as listed in this Academic Calendar under the heading of Faculty of Science, Bachelor of Science – Honours and Double Honours. The specific list of Chemistry courses which satisfies the required minimum forty-eight (48) credit hours in Chemistry (if thesis completed in Chemistry)* is as follows:

*Note: The minimum required number of credit hours in Chemistry is reduced to forty-two (42), with the removal of CHEM 4500 from this list, if the thesis is completed in the other science.

- CHEM 1210 General Chemistry I
- Three (3) credit hours from: CHEM 1211, 1212 or 1213 General Chemistry II
- CHEM 2312 Physical Chemistry I
- CHEM 2313 Physical Chemistry II
- CHEM 2344 Organic Chemistry I
- CHEM 2345 Organic Chemistry II
- Six (6) credit hours from:
 - CHEM 2332 Introductory Analytical Chemistry: Wet Methods
 - CHEM 2333 Introductory Analytical Chemistry: Instrument Methods
 - CHEM 3322 Inorganic Chemistry I
 - CHEM 3324 Inorganic Chemistry II
- CHEM 4412 Quantum Chemistry
- CHEM 4498 Selected Research Topics In Chemistry (or six (6) credit hours in CHEM at the 2000 level or above if thesis in other science)
- CHEM 4500 Research Thesis
- Nine (9) credit hours in CHEM at the 3400-level or above
- MATH 1210 and MATH 1211
- MATH 2310 and MATH 2311
- PHYS 1100 and PHYS 1101

Honours in Chemistry and Major in Other Science - Requirements:

The requirements for the degree of Bachelor of Science with Honours in Chemistry and Major in another science apply as listed in this Academic Calendar under the heading of

Faculty of Science, Bachelor of Science – Honours and Major Program. The specific list of Chemistry courses which satisfies the required minimum forty-eight (48) credit hours in Chemistry is the same as that listed above for the Double Honours, thesis completed in Chemistry.

Concentration in Chemistry – Requirements:

The requirements for the degree of Bachelor of Science General with Concentration in Chemistry apply as listed in this Academic Calendar under the heading of Faculty of Science, Bachelor of Science – General (with a Concentration). The specific list of Chemistry courses which satisfies the required minimum thirty (30) credit hours in Chemistry is as follows:

- CHEM 1210 General Chemistry I
- Three (3) credit hours from: CHEM 1211, 1212 or 1213 General Chemistry II
- Twelve (12) credit hours from the following:
 - CHEM 2312 Physical Chemistry I and CHEM 2313 Physical Chemistry II
 - CHEM 2332 Introductory Analytical Chemistry: Wet Methods
 - CHEM 2333 Introductory Analytical Chemistry: Instrumental Methods
 - CHEM 2344 Organic Chemistry I
 - CHEM 2345 Organic Chemistry II
 - CHEM 3322 Inorganic Chemistry I
 - CHEM 3324 Inorganic Chemistry II
- Twelve (12) credit hours in CHEM at the 3400 level or above

SPECIAL NOTE

Students must achieve a passing grade in the lab component of a chemistry course in order to be eligible to receive credit for the course. All of the Chemistry courses listed on these pages have a 3-hour per week lab period except the following courses: CHEM 1220, CHEM 1221, CHEM 2380, and CHEM 4498.

Graduate-Level Courses

The Department offers instruction in Chemistry at the graduate level. For details on graduate courses, see the *Graduate Academic Calendar*.

Course Descriptions

0010 Introduction to Chemistry

0 credit hours

The fundamental laws and principles of chemistry are explored and applied in the study of selected non-metals, metals and their compounds.

Note: This is a preparatory course. It does not carry a credit value; therefore, it cannot be counted in the number of credits required for a degree, diploma or certificate.

1210 General Chemistry I

3 credit hours

Prerequisite: Nova Scotia Chemistry 12 Academic or equivalent.

An introduction to general topics in chemistry including composition and properties of matter, reaction stoichiometry, chemical reactions, atomic structure, the periodic table, chemical bonding, molecular geometry and gases. The course is intended for students interested in the physical sciences, life sciences and for students in the engineering program.

1211 General Chemistry II for Physical Sciences

3 credit hours

Prerequisite: CHEM 1210 and MATH 1210 (which may be taken concurrently).

A continuation of the introduction to general topics in chemistry including chemical equilibrium and applications to aqueous systems, physical equilibrium, thermodynamics, reaction kinetics, molecular structure, electrochemistry and organic chemistry. Emphasis is placed on applications to the physical sciences, including chemistry, geology and physics.

Note: This course is intended for students in the physical sciences.

Note: Credit is only given for one of CHEM 1211, 1212, or 1213.

1212 General Chemistry II for Life Sciences

3 credit hours

Prerequisite: CHEM 1210 and MATH 1210 (which can be taken concurrently). Note: CSCI 1226 or CSCI 1227 may be taken in lieu of MATH 1210.

A continuation of the introduction to general topics in chemistry including chemical equilibrium and applications to aqueous systems, physical equilibrium, thermodynamics, reaction kinetics, molecular structure, electrochemistry and organic chemistry. Emphasis is placed on applications to the life sciences, including biology.

Note: This course is intended for students in the life sciences. This course satisfies the requirement for the Chemistry Major or Honours only if MATH 1210/1211 is completed successfully

Note: Credit is only given for one of CHEM 1211, 1212, or 1213.

1213 General Chemistry II for Engineering

3 credit hours

Prerequisite: CHEM 1210; and MATH 1210 (which may be taken concurrently).

A continuation of the introduction to general topics in chemistry including chemical equilibrium and applications to aqueous systems, physical equilibrium, thermodynamics, reaction kinetics, molecular structure, electrochemistry and organic chemistry. Emphasis is placed on applications to the related field of engineering.

Note: This course is intended for students in the engineering programs.

Note: Credit is only given for one of CHEM 1211, 1212, or 1213.

1220 Chemistry and Industry

3 credit hours

This course is intended as an introduction to general chemistry for students who have little background in science and mathematics. The course focuses on commercially important industries and technologies and the role and importance of chemistry in these industries. Particular emphasis is placed on the role of chemistry in innovative technologies. Topics may include chemistry and the industrial world, or chemistry and material science, and/or chemistry and high technology.

Note: Please note that this course may not be used to satisfy the requirement of a science elective under regulations 3.e., 6.e., 10.c., and 12.b. for B.Sc. degrees. There is no lab component for this course.

1221 Chemistry of Life

3 credit hours

This course is an introduction to the chemistry of everyday life for non-science major students who have an interest in improving their scientific literacy and understanding of the world around them. Theory is presented on a need-to-know basis as real-world subjects ranging from the chemistry of global warming to designer drugs are encountered.

Note: Please note that this course may not be to satisfy the requirement of a science elective under regulations 3.e., 6.e., 10.c., and 12.b. for B.Sc. degrees. There is no lab component for this course.

2100 Green Chemistry [ENVS 2100]

3 credit hours

Prerequisite: six (6) credit hours in CHEM at the 1000 level.

Green chemistry, or environmentally benign chemistry, is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances. This course will examine the chemical principles and processes in the development of technology and in the effects that this technology has on the environment. The course will avoid traditional approaches that only consider the treatment of pollution after it was created, and will focus on alternative routes that limit the production of waste.

2312 Physical Chemistry I

3 credit hours

Prerequisite: CHEM 1211, 1212 or 1213, and MATH 1211 .

In this introduction to Physical Chemistry, a study of the underlying physical principles that govern the properties and behaviour of chemical systems from a *macroscopic* viewpoint will be undertaken. Topics covered will include: Laws of Thermodynamics; Temperature; Work, Heat, Enthalpy; Entropy; Carnot Cycle; Free Energy, Colligative Properties of Solutions; Phase Equilibrium; Phase Diagrams of Pure Substances and Simple Mixtures; Chemical Potentials and Chemical Equilibrium.

2313 Physical Chemistry II

3 credit hours

Prerequisite: CHEM 1211 or 1212 or 1213, and MATH 1211.

In this second course in Physical Chemistry, the focus is on processes by which change occurs in chemical systems and the rates of these changes. The first part of the course examines molecular motion in gases and liquids and the mobility of ions in solution. In the second part, the focus is on the branch of Physical Chemistry called Kinetics. The rates and mechanisms of simple and complex chemical reactions will be examined, including polymerization and reactions at surfaces. Topics may include catalysis and kinetics of crystallization.

2332 Introductory Analytical Chemistry: Wet Methods [GEOL 2332]

3 credit hours

Prerequisite: CHEM 1211 or 1212 or 1213.

An integrated lecture-laboratory course with emphasis on basic analytical methods. The practical application of analytical methods will be stressed by analyzing geological and environmental samples. Lecture topics will include treatment of data, theory of gravimetric and titrimetric analyses and chemical equilibria.

2333 Introductory Analytical Chemistry: Instrumental Methods [GEOL 2333]

3 credit hours

Prerequisite: CHEM 2332.

An integrated lecture-laboratory course with emphasis on basic analytical methods. The practical application of analytical methods will be stressed by analyzing geological and environmental samples. Lecture topics will include an introduction to electrochemistry, spectroscopy, chromatography and extractions.

2344 Organic Chemistry I

3 credit hours

Prerequisite: CHEM 1211 or 1212 or 1213.

An introduction to organic chemistry designed for all students in life science, physical science, general science, engineering or non-science. Topics covered include the structure, nomenclature, physical properties, synthesis, reactions and spectroscopic properties of all classes of hydrocarbons: alkanes, alkenes, alkynes, arenes, alicyclic compounds, polyenes, as well as the principle heterocyclic compounds. The course emphasizes the mechanistic approach to the reactivity of organic compounds and provides a thorough introduction to stereochemistry and nuclear magnetic resonance.

2345 Organic Chemistry II

3 credit hours

Prerequisite: CHEM 2344.

A course for chemistry majors and other physical science students intending to go on to more advanced organic chemistry. Introduction to the mechanisms of the reactions

of monofunctional organic compounds. Introduction to stereochemistry. Simple spectroscopy. Macromolecules. Introduction to synthesis design.

2346 Organic Chemistry for Life Sciences

3 credit hours

Prerequisite: CHEM 1211 or 1212 or 1213..

A course for students in the life sciences. The course covers the chemistry of the principle functional groups in organic molecules with special emphasis on the relevance of organic functional group chemistry to molecules of biological importance. The functional group classes include: alcohols, thiols, phenols, ethers, epoxides, aldehydes, ketones, carboxylic acids, esters, amides, anhydrides, acid chlorides, nitriles, amines, amino acids, proteins, and carbohydrates. The course emphasizes the mechanistic approach to functional group reactivity and makes the connection to biochemistry at every opportunity. The stereochemical features of molecules of biological interest are emphasized.

Note: This course cannot be used to satisfy requirements for the Chemistry Major; Honours; or double Major or Honours. Students planning to go to some professional schools in Life Sciences are strongly advised to take CHEM 2344 and CHEM 2345.

2373 Environmental Chemistry I

3 credit hours

Prerequisite: CHEM 1211 or 1212 or 1213.

A first course in those aspects of chemistry useful for studying environmental science and engineering. The topics include: a review of selected concepts from the general chemistry course; thermodynamic concepts of enthalpy and free energy; vapour pressure of liquids; surface tension; binary mixtures; osmosis; dialysis; solvent extraction, electrochemical cells; first and second order kinetics, catalysis; absorption; degradation of aliphatic, aromatic and polycyclic organic compounds including trace organics, detergents, soaps and pesticides.

2374 Environmental Chemistry II

3 credit hours

Prerequisite: CHEM 2373.

The course attempts to bring into focus the chemistry which is particularly valuable to environmental science and engineering. The topics include: applications of equilibrium chemistry; colloids in liquid and gas phases; enzymes and their reactions with carbohydrates, proteins, fats and oils; nuclear fission; nuclear fusion; and the effect of radiation on man.

2380 Communication in Chemistry

3 credit hours

Prerequisite: ENGL 1205 and CHEM 1210

This course will provide the skills necessary to communicate scientific information in a logical, clear manner. Emphasis will be on written communication; students will learn proper format for reports, manuals, lab assignments, and scientific journal articles. Students will learn how to perform background research using the Library and electronic

resources, and will present technical documents during the term

Note: This course is intended primarily for chemistry students but is open to students in other disciplines. This course may not be used to satisfy the requirement of a science elective under regulations 3.e., 6.e., 10.c., and 12.b. for B.Sc. degrees.

3322 Inorganic Chemistry I

3 credit hours

Prerequisite: CHEM 1211 or 1212 or 1213.

This course will examine the structure and bonding of the main group elements. Topics covered will include electronic structure of atoms, bonding theories, ionic solids, and an introduction to point group symmetry and group theory; descriptive chemistry of the main group elements and their compounds.

3324 Inorganic Chemistry II

3 credit hours

Prerequisite: CHEM 3322.

This course examines the structure, bonding, and reactivity of transition metal complexes. Topics will include crystal field theory, ligand field theory, magnetism and electronic structure of coordination compounds; oxidation and reduction and substitution reactions of square planar and octahedral complexes. Ligands and an introduction to organometallic chemistry will also be covered.

3432 Instrumental Analysis I

3 credit hours

Prerequisite: CHEM 2333.

Emphasis will be placed on (i) separation techniques including high performance and gas chromatography; (ii) modern electro-chemical techniques including differential pulse voltammetry and stripping analysis; (iii) analogue circuits and devices and digital electronics.

3443 Organic Reaction Mechanisms

3 credit hours

Prerequisite: CHEM 2345.

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.

3445 Organic Spectroscopy

3 credit hours

Prerequisite: CHEM 2345.

An introduction to the 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.

3451 Introductory Biochemistry

3 credit hours

Prerequisite: CHEM 2345 or 2346.

This course reviews and/or presents an introduction to 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.

4412 Quantum Chemistry

3 credit hours

Prerequisite: CHEM 2312 and 2313, MATH 2310 and 2311.

The basic principles of quantum physics are used to develop an understanding of atomic and molecular structure.

4413 Physical Chemistry III

3 credit hours

Prerequisite: CHEM 2312, CHEM2313, MATH 2310 and MATH 2311.

An introduction to statistical thermodynamics and the study of chemical reaction rates and mechanisms.

4414 Symmetry and Chemical Applications of Group Theory

3 credit hours

Prerequisite: CHEM 4412 or permission of Instructor.

An introduction to 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.

4415 Introduction to Polymers

Prerequisite: CHEM 2312 and 2313

This introduction to long-chain polymer molecules integrates and builds on foundation concepts in thermodynamics, kinetics, bonding and structure, as well as synthesis, and analytical methods. Topics include chain confirmations, molecular weight averages, distributions and measurement; survey of different types of polymerization and polymerization kinetics: polymer solutions; phase behaviour, physical properties of glass and crystalline states; structure-property relationships and end-use applications.

4421 Organometallic Chemistry

3 credit hours

Prerequisite: CHEM 3324 or permission of the Instructor.

This course will deal with synthesis, structure, and reactivity or organotransition metal complexes. Topics will include transition metal-alkyls, -carbonyls, -alkenes, -alkynes and -bonded complexes, fundamental reactions and applications to organic synthesis and catalysis. Characterization of organometallic complexes using spectroscopic techniques

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(IR, Raman, NMR, and ESR) and X-ray crystallography will also be covered.

4422 Advanced Topics in Inorganic Chemistry

3 credit hours

Prerequisite: CHEM 3324 or permission of the Instructor.

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.

4433 Instrumental Analysis II

3 credit hours

Prerequisite: CHEM 2333.

Emphasis will be placed on (i) atomic spectroscopy including atomic absorption and emission; (ii) x-ray fluorescence; (iii) neutron activation analysis; (iv) mass spectrometry.

4444 Synthesis in Organic Chemistry

3 credit hours

Prerequisite: CHEM 2345.

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.

4452 Biochemistry: Metabolism I

3 credit hours

Prerequisite: CHEM 2345 or 2346.

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.

4453 Biochemistry: Metabolism II

3 credit hours

Prerequisite: CHEM 3451 or CHEM 4452

A course presenting principles of metabolism of molecules commonly referred to as the secondary metabolites, i.e. involved neither in energy nor in biosynthetic substrates formation. Thus biosynthetic pathways leading to formation of major secondary metabolite (or natural products) classes, i.e. fatty acids derivatives, polyketides, isoprenoids including sterols, alkaloids, and shikimic acid pathway products such as phenols, lignans, and flavonoids, will be presented. Some major enzymes involved in formation of these biomolecules as well as the methods of pathway and structure elucidation will be presented along with biological activity, ecological and taxonomic significance of metabolites. The laboratory component will provide an opportunity to complete an individual research project, including literature search, experimental work, analysis of results, and writing a comprehensive report.

4498 Selected Research Topics in Chemistry

6 credit hours

Prerequisite: Enrolment is permitted after declared Chemistry Majors or Honours students have successfully completed thirty (30) credit hours in Chemistry.

A weekly seminar course that covers a broad range of research topics that are of current relevance, including ethics in science. Speakers include faculty from within and outside Saint Mary's University and students will normally be expected to present two seminars.

4500 Research Thesis

6 credit hours

Prerequisite: Enrollment is permitted to declared Chemistry Honours students only.

Students will carry out a research project under the direction of one of the Chemistry Department faculty members and will prepare a thesis on their work. The thesis is presented orally.

4876 – 4899 Directed Study in Chemistry

3 credit hours

Prerequisite: Permission of instructor.

These courses cover advanced topics in chemistry chosen according to the needs and interests of the students and instructor. These courses provide an opportunity to study a particular subject in detail and require some measure of independence and initiative from the student.