Chemistry (CHEM)

Chemistry (CHEM) Courses

CHEM 0999 [0.0 credit]
CHEM4U

CHEM 1001 [0.5 credit]
General Chemistry I
Topics include atomic structure, periodic trends, structure and bonding, gas laws, intermolecular forces, equilibrium, acids and bases, and buffers. Examples relate to health, energy, materials, and the environment.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 1005 (no longer offered), CHEM 1011, CHEM 1101.
Prerequisite(s): Ontario 4U/M in Chemistry (or equivalent) strongly recommended.
Lectures and tutorial four hours a week, laboratory three hours every other week.

CHEM 1002 [0.5 credit]
General Chemistry II
Topics include thermodynamics and spontaneity, kinetics, electrochemistry, organic chemistry, transition metal complexes, and green chemistry. Examples relate to health, energy, materials, and the environment.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 1006 (no longer offered), CHEM 1012.
Prerequisite(s): CHEM 1001.
Lectures and tutorial four hours a week, laboratory three hours every other week.

CHEM 1003 [0.5 credit]
The Chemistry of Food, Health and Drugs
Aspects of chemistry relating to food, food additives, drugs (illicit and beneficial) and their relation to metabolism and health. Topics may include: proteins, carbohydrates, fats, vitamins, cofactors, enzymes, steroids, electrolyte and pH balance, trace elements. Available only as a free option for Science students.
Prerequisite(s): a course in Chemistry (e.g. Ontario Grade 11).
Lectures three hours a week.

CHEM 1004 [0.5 credit]
Drugs and the Human Body
No science background required. Topics include drug origins, laws, metabolism and dependence, pharmaceutical industry, over the counter medications, placebo effect, antibiotics, pain killers, stimulants, alcohol, marijuana, hallucinogens, birth control and steroids. Students in Science programs may use this course only as a free elective.
Lectures three hours a week.

CHEM 1007 [0.5 credit]
Chemistry of Art and Artifacts
The chemistry of arts and artifacts created throughout the ages (Paleolithic, Neolithic, Bronze, Iron, Middle and Modern) will be examined. Basic chemical principles will be explored and reviewed when required. Students in Science programs may use this course only as a free elective.
Lectures three hours a week.

CHEM 1008 [0.5 credit]
Inquiry in Chemistry Research
Students experience the journey of research in chemistry by using inquiry-based principles to answer complex societal questions. Students practice developing research questions and study designs, perform data analysis, and are introduced to scientific literacy and communication, EDI, and meta-cognition.
Includes: Experiential Learning Activity
Prerequisite(s): first year standing in Chemistry.
Workshop 3 hours a week

CHEM 1011 [0.5 credit]
Enriched General Chemistry 1
This is a maths-intensive specialist course intended for chemistry majors or students planning to pursue courses in chemistry at the 3000-level and above. Topics include atomic structure, periodic trends, structure and bonding, gas laws, intermolecular forces, equilibrium, acids and bases, and buffers.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 1001, CHEM 1005 (no longer offered), CHEM 1101.
Lectures and tutorial four hours a week, laboratory three hours every other week.

CHEM 1012 [0.5 credit]
Enriched General Chemistry 2
This is a maths-intensive specialist course intended for chemistry majors or students planning to pursue courses in chemistry at the 3000-level and above. Topics include thermodynamics and spontaneity, kinetics, electrochemistry, organic chemistry, transition metal complexes, and green chemistry.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 1002, CHEM 1006 (no longer offered).
Prerequisite(s): CHEM 1011.
Lectures and tutorial four hours a week, laboratory three hours every other week.

CHEM 1101 [0.5 credit]
Chemistry for Engineering Students
Topics include stoichiometry, atomic and molecular structure, thermodynamics and chemical equilibrium, acid-base chemistry, carbon dioxide in water, alkalinity, precipitation, electrochemistry, kinetics and basic organic chemistry. Laboratory component emphasizes techniques and methods of basic experimental chemistry.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 1000 (no longer offered), CHEM 1001, CHEM 1005 (no longer offered), CHEM 1011.
Prerequisite(s): Ontario 4U/M in Chemistry or equivalent.
Lectures three hours a week, laboratory three hours every other week.

CHEM 2103 [0.5 credit]
Physical Chemistry I
Basic principles of thermodynamics. Development of the laws of thermodynamics, enthalpy, entropy and free energy, and their applications to phase equilibria, electrochemistry, and kinetics. Brief introduction to quantum mechanics.
Includes: Experiential Learning Activity
Precludes additional credit for BIOC 2300.
Prerequisite(s): CHEM 1006 (no longer offered) with a minimum grade of B-, or CHEM 1002 or CHEM 1012, MATH 1004, MATH 1104 or MATH 1107, (PHYS 1001 and PHYS 1002) or (PHYS 1007 and PHYS 1008) or (PHYS 1003 and PHYS 1004).
Lectures three hours a week, problems one hour a week, laboratory three hours a week.

CHEM 2104 [0.5 credit]
Physical Chemistry II
Further development of thermodynamic equations and their applications to mass changes, chemical potential, chemical equilibria, transport properties and advanced phase equilibria. Use of partial differentials and development of Maxwell's relations will also be covered.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 3100 (no longer offered).
Prerequisite(s): CHEM 2103 or BIOC 2300, and MATH 1005 or MATH 2007.
Lectures three hours a week, problems one hour a week, laboratory three hours a week.

CHEM 2203 [0.5 credit]
Organic Chemistry I
Introduction to stereochemistry, spectroscopy and chemical reactions of alkanes, alkenes, alkynes, and alkyl halides. Reaction mechanisms and the interpretation of IR, NMR and mass spectra is explored. Training in the handling and purification of organic compounds, organic chemical reactions,and the use of infrared spectroscopy.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 2207.
Prerequisite(s): CHEM 1006(no longer offered) with a minimum grade of B-, or CHEM 1002 or CHEM 1012.
Lectures three hours a week and laboratory three hours a week.

CHEM 2204 [0.5 credit]
Organic Chemistry II
Introduction to stereochemistry, spectroscopy, mechanisms, and chemical reactions of alcohols, ethers, epoxides, conjugated pi-systems, aromatic compounds, aldehydes, ketones, amines and carboxylic acids and their derivatives. Further training in the handling and purification of organic compounds, organic chemical reactions, and the use of infrared spectroscopy.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 2208.
Prerequisite(s): CHEM 2203.
Lectures three hours a week and laboratory three hours a week.

CHEM 2207 [0.5 credit]
Introduction to Organic Chemistry I
Introduction to stereochemistry, spectroscopy and chemical reactions of alkanes, alkenes, alkynes, and alkyl halides. Reaction mechanisms and the interpretation of IR, NMR and mass spectra is explored.
Precludes additional credit for CHEM 2203.
Prerequisite(s): CHEM 1006 (no longer offered) with a minimum grade of B-, or CHEM 1002 or CHEM 1012.
Lectures three hours a week.

CHEM 2208 [0.5 credit]
Introduction to Organic Chemistry II
Introduction to stereochemistry, spectroscopy, mechanisms, and chemical reactions of alcohols, ethers, epoxides, conjugated pi-systems, aromatic compounds, aldehydes, ketones, amines and carboxylic acids and their derivatives.
Precludes additional credit for CHEM 2204.
Prerequisite(s): CHEM 2207 or CHEM 2203.
Lectures three hours a week.

CHEM 2302 [0.5 credit]
Analytical Chemistry I
Introduction to quality assurance measures, calibration strategies and the fundamentals of solution-based analytical measurement processes. Qualitative and quantitative analysis using potentiometric and electrolysis techniques including ion selective electrodes, coulometry, amperometry and voltammetry. Redox, acid/base and EDTA titrations in the context of various buffer systems.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 1006 (no longer offered) with a minimum grade of B-, or CHEM 1002 or CHEM 1012 or CHEM 1101 and (MATH 1007 or MATH 1004).
Lectures three hours a week, laboratory three hours a week.

CHEM 2303 [0.5 credit]
Analytical Chemistry II
Spectrophotometric analysis using UV-Vis, fluorescence and FTIR instrumentation. Modern separation methods including CE, GC and LC. Recent techniques and applications using mass spectrometry. Applications of all of the above to real-world analysis including the advancement of environmental, biochemistry and health-related research.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 1006 (no longer offered) with a minimum grade of B-, or CHEM 1002, or CHEM 1012, or CHEM 1101, and (MATH 1007 or MATH 1004).
Lectures three hours a week, laboratory three hours a week.

CHEM 2400 [0.5 credit]
Independent Research I
Students carry out a laboratory research project under the supervision of a faculty member from the Department of Chemistry. A research report must be submitted by the last day of classes for evaluation by the Chair and Faculty supervisor.
Includes: Experiential Learning Activity
Prerequisite(s): restricted to Honours students having second-year standing in a Chemistry program with an overall CGPA of 10.0 or higher, and approval of the Chair and a Faculty supervisor.
Laboratory research for at least three hours a week over two terms.

CHEM 2501 [0.5 credit]
Introduction to Inorganic and Bioinorganic Chemistry
The basic concepts of inorganic chemistry, including the origins of elemental properties, simple theories of bonding, intermolecular forces, main group and transition metal chemistry, coordination chemistry. Inorganic ions in biochemistry, including ion transport and storage, oxygen carriers and hydrolases, redox proteins.
Prerequisite(s): CHEM 1006 (no longer offered) with a minimum grade of B-, or CHEM 1002 or CHEM 1012.
Lectures three hours a week, tutorial one hour a week.

CHEM 2800 [0.5 credit]
Foundations for Environmental Chemistry
A basis of chemistry needed to understand the environment: composition of the atmosphere and natural waters; equilibrium; surface properties; kinetics and spectroscopy; physical and chemical properties of chemicals in the environment. Limited enrolment course. Priority is given to students in Environmental Science/ Engineering.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 1006 (no longer offered) with a minimum grade of B- or CHEM 1002, or CHEM 1012, or CHEM 1101, (MATH 1007 or MATH 1004).
Lectures three hours a week, laboratory three hours a week.

CHEM 3101 [0.5 credit]
Quantum Chemistry
Classical equations of motion, harmonic oscillator, diatomic and polyatomic molecules, molecular mechanics, quantum mechanics, Schrödinger equation and wave functions, vibrational spectra, hydrogen atom, quantum numbers, electronic spectra, bonding in small molecules.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 2103 and MATH 2008.
Lectures three hours a week, tutorial one hour per week.

CHEM 3102 [0.5 credit]
Methods in Computational Chemistry
Use of computers in the modeling and simulation of chemistry. Introduction to computer programming for analysis and visualization of chemical data. Calculation of chemical properties and modeling of chemical reactions using quantum chemistry.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 3101 or PHYS 3701.
Lectures and problems three hours a week.

CHEM 3107 [0.5 credit]
Experimental Methods in Nanoscience
Thin film production and characterization, scanning electron microscopy, synthesis of metal nanoparticles and particle size determination, computational modeling of nanostructures.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 3100.
Laboratory four hours a week.

CHEM 3201 [0.5 credit]
Advanced Organic Chemistry I
Instrumental methods for determining organic structures. Selected organic reactions with emphasis on mechanisms and reactive intermediates.
Prerequisite(s): CHEM 2204 or CHEM 2208.
Lectures three hours a week, tutorial one and a half hours per week.

CHEM 3202 [0.5 credit]
Advanced Organic Chemistry II
Continued mechanistic survey of additional organic reactions with emphasis on synthetic usefulness and stereochemistry. Interspersed with selected topics such as instrumental methods, photochemistry, literature of organic chemistry, natural and synthetic polymers, heterocycles, terpenes and alkaloids.
Prerequisite(s): CHEM 3201 or equivalent.
Lectures three hours a week, tutorial one and a half hours per week.

CHEM 3205 [0.5 credit]
Experimental Organic Chemistry
A laboratory-based course including advanced concepts and techniques in organic synthesis, structure determination, and the rates and mechanisms of reactions. Students are responsible for literature surveys, acquisition of theoretical background, and design of experimental procedures.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 2204 and CHEM 3201.
Laboratory four hours a week.

CHEM 3305 [0.5 credit]
Advanced Analytical Chemistry Laboratory
Advanced instrumentally based techniques of analysis. Emphasis on identification and quantitation of low-level contaminants in environmental matrices using chromatographic and spectroscopic methods, including sampling, cleanup, measurement and reporting of results.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 2302 or CHEM 2303.
Laboratory four hours a week.

CHEM 3400 [0.5 credit]
Independent Research II
Students carry out a laboratory research project supervised by a Chemistry faculty member. A research report must be submitted by the last day of classes for evaluation by the Chair and Faculty supervisor; expectations of student performance and evaluation exceed that of CHEM 2400.
Includes: Experiential Learning Activity
Prerequisite(s): restricted to Honours students having third-year standing in a Chemistry program with an overall CGPA of 10.0 or higher, and approval of the Chair and a Faculty supervisor.
Laboratory research for at least three hours a week over two terms.

CHEM 3503 [0.5 credit]
Inorganic Chemistry I
Symmetry, identification of Raman and infrared active vibrations, symmetry-adapted molecular orbital theory of polyatomic molecules, electron deficient bonding, bonding in coordination complexes, solid state bonding, ionic lattices. Laboratory will introduce the student to a range of synthetic techniques and physical methods of characterization.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 3507.
Prerequisite(s): CHEM 2501.
Lectures three hours a week, tutorial one hour a week and laboratory four hours a week.

CHEM 3504 [0.5 credit]
Inorganic Chemistry II
Physical properties of coordination complexes, ligand substitutions and electron transfer reaction mechanisms, organometallic chemistry: bonding, nomenclature and catalysis. Laboratory will introduce the student to a range of synthetic techniques and physical methods of characterization.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 3508.
Prerequisite(s): CHEM 3503.
Lectures three hours a week, tutorial one hour a week and laboratory four hours a week.

CHEM 3507 [0.5 credit]
General Inorganic Chemistry I
Symmetry, identification of Raman and infrared active vibrations, symmetry-adapted molecular orbital theory of polyatomic molecules, electron deficient bonding, bonding in coordination complexes, solid state bonding, ionic lattices.
Precludes additional credit for CHEM 3503.
Prerequisite(s): CHEM 2501.
Lectures three hours a week, tutorial one hour a week.

CHEM 3508 [0.5 credit]
General Inorganic Chemistry II
Physical properties of coordination complexes, ligand substitutions and electron transfer reaction mechanisms, organometallic chemistry: bonding, nomenclature and catalysis.
Precludes additional credit for CHEM 3504.
Prerequisite(s): CHEM 3503 or CHEM 3507.
Lectures three hours a week, tutorial one hour a week.

CHEM 3600 [0.5 credit]
Introduction to Nanotechnology
Nanoscale units, bulk vs. nanoproperties, electrons, atoms and ions, metals, band structure, electrical conduction, biosystems, molecular devices, quantum mechanics and optics, tools for measuring nanostructures. Production of nanostructures: self assembly, nanoscale crystal growth, polymerization. Applications to sensors, magnets, electronics, drug delivery. Toxicology of nanostructures.
Prerequisite(s): CHEM 3100.
Lectures three hours a week.

CHEM 3700 [0.5 credit]
Industrial Applications of Chemistry
Uses of chemistry in a number of industries: fertilizers, electrochemical, metallurgical, petrochemical, pulp and paper, plastics, pharmaceutical. Interaction of chemistry with economic, political, engineering, environmental, health, legal considerations. Guest lecturers.
Prerequisite(s): (BIOC 2300 or CHEM 2103) and one of CHEM 2207 or CHEM 2203.
Lecture three hours a week.

CHEM 3701 [0.5 credit]
Chemistry in Practice for the 21st Century
Students explore different sectors of chemical industry; developments in sustainability; principles, analytical frameworks, and applications of green chemistry; environmental protections; and Canadian regulatory frameworks. Students investigate novel issues in industrial chemistry, build scientific literacy skills, and practice communicating scientific information to diverse audiences.

Prerequisite(s): third-year standing in a BSc or BHSc program.
Workshop three hours a week.

CHEM 3800 [0.5 credit]
The Chemistry of Environmental Pollutants
Inorganic and organic environmental pollutants: their toxicology, production, use pattern and known effects on the environment. Aspects of risk and regulation. Chemistry involved in water and sewage treatment.
Prerequisite(s): CHEM 2207 or CHEM 2203 or CHEM 2800.
Lectures three hours a week.

CHEM 3999 [0.0 credit]
Co-operative Work Term
Includes: Experiential Learning Activity

CHEM 4100 [0.5 credit]
Advanced Topics in Physical Chemistry I
Principles of Group Theory as applied to Chemistry. Point groups, character tables, symmetry orbitals, molecular orbitals, aromaticity, allowed and forbidden reactions, sandwich complexes. Selection rules in spectroscopy, molecular vibrations.
Prerequisite(s): CHEM 3102.

CHEM 4101 [0.5 credit]
Advanced Topics in Computational Chemistry
Computer simulation of materials, liquids, and biomolecules in the framework of intermolecular forces and statistical thermodynamics. Introduction to chemoinformatics and machine learning methods in chemistry.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 3102.
Also offered at the graduate level, with different requirements, as CHEM 5122, for which additional credit is precluded.
Lectures 3 hours a week.

CHEM 4103 [0.5 credit]
Surface Chemistry and Nanostructures
Surface structure, thermodynamics and kinetics, specifically regarding adsorption/desorption and high vacuum models. Nanoscale structures and their formation, reactivity and characterization. Thin films, carbon nanotubes, self-assembled monolayers and supramolecular aggregates.
Prerequisite(s): CHEM 3600 and CHEM 3107.
Also offered at the graduate level, with different requirements, as CHEM 5108, for which additional credit is precluded.
Lectures three hours a week.

CHEM 4104 [0.5 credit]
Physical Methods of Nanotechnology
An overview of methods used in nanotechnology. Principles of scanning probe techniques ranging from surface physics to biology. State of the art methods to create nanostructures for future applications in areas such as nanolithography, nanoelectronics, nano-optics, data storage and bio-analytical nanosystems.
Prerequisite(s): CHEM 3600 and CHEM 3107.
Lectures three hours a week.

CHEM 4201 [0.5 credit]
Macromolecular Nanotechnology
Biological and synthetic macromolecules related to nanoscale phenomena. Challenges and opportunities associated with natural and synthetic polymers on the nanoscale. Molecular recognition, self-assembled nanostructures, scaffolds and templates, functional nanomaterials, amphiphilic architectures, nanocomposites, and nanomachines. Applications to sensing, biomaterials, drug delivery, and polymer based devices.
Prerequisite(s): CHEM 3600 or permission of the department.
Also offered at the graduate level, with different requirements, as CHEM 5207, CHEM 5208, for which additional credit is precluded.
Lectures three hours a week.

CHEM 4202 [0.5 credit]
Advanced Topics in Organic Chemistry I
Topics include 2-dimensional 1H and 13CNMR spectroscopy and structure determination of complex organic molecules.
Prerequisite(s): CHEM 3201.
Also offered at the graduate level, with different requirements, as CHEM 5407, for which additional credit is precluded.

CHEM 4203 [0.5 credit]
Synthetic Organic Chemistry
The application of reactions to the synthesis or organic molecules. Emphasis on design of synthetic sequences, new reagents, and stereoselectivity. Topics include advanced methods for synthesis and reactions of alkenes, carbonyls, and enolates, functional group interconversion, oxidation and reduction, protecting groups, rearrangements, and metal-catalyzed cross-coupling.
Prerequisite(s): CHEM 3201 and CHEM 3202.
Lectures and seminars three hours a week.

CHEM 4204 [0.5 credit]
Organic Polymer Chemistry
Introduction to basic principles of polymer chemistry, industrial and synthetic polymers, different types of polymerization and polymer characterization. Study of commodity plastics, engineering thermoplastics, and specialty polymers, with emphasis on their synthesis.
Prerequisite(s): CHEM 3201 or equivalent.
Also offered at the graduate level, with different requirements, as CHEM 5406, for which additional credit is precluded.
Lectures three hours a week.

CHEM 4205 [0.5 credit]
Reactivity and Mechanism in Organic Chemistry
The application of frontier molecular orbital theory (HOMO-LUMO interactions) to organic reactions, including thermal and photochemical cycloadditions of pi-systems (including 1,3-dipoles) and rearrangements. Reactions of radicals and carbenes; conformational analysis, stereochemical effects, and methods for the determination of reaction mechanisms.
Prerequisite(s): CHEM 3202 and CHEM 3503 (may be taken concurrently).
Lectures and seminars three hours a week.

CHEM 4206 [0.5 credit]
Natural Products Chemistry
A survey of the major classes of natural products with respect to their structural elucidation, synthesis, biosynthesis and bioactivity, with emphasis on compounds that have medicinal importance.
Prerequisite(s): CHEM 3201 and CHEM 3202,.
Lectures and seminars three hours a week.

CHEM 4207 [0.5 credit]
Bio-Organic Chemistry
The course covers chemical and biosynthetic methods applied to the major classes of biomolecules and their derivatives, including: carbohydrates, amino acids, peptides, proteins, nucleic acids, lipids, terpenes, heterocycles and natural products. Content will focus on reactions and mechanisms that contribute to their biological activities.
Also listed as BIOC 4207.
Prerequisite(s): CHEM 3201 or permission of the department.
Also offered at the graduate level, with different requirements, as CHEM 5010., for which additional credit is precluded.
Lectures three hours a week.

CHEM 4301 [0.5 credit]
Advanced Topics in Analytical Chemistry I
Analytical chemistry of trace and ultratrace elements/compounds. Special requirements for quantitative determination by various instrumental methods. Control of contamination and blanks. Analytical method development to improve selectivity, sensitivity and detection limit. Strength and limitations of each instrument. Optimization of all operating parameters.
Prerequisite(s): CHEM 2103 and one of CHEM 2302 or CHEM 2303.
Also offered at the graduate level, with different requirements, as CHEM 5607, for which additional credit is precluded.
Lectures and seminars three hours a week.

CHEM 4302 [0.5 credit]
Advanced Topics in Analytical Chemistry II
Solutions and separations in analytical chemistry. Stability of aqueous solutions of standards and samples. Complex formation, multi-step and competing equilibria and their application to the design of selective methods of separation and determination. Electroanalytical techniques. Electroanalytical chemistry of aqueous solutions. Phase equilibria and solvent extraction.
Prerequisite(s): CHEM 2103 and one of CHEM 2302 or CHEM 2303.
Lectures and seminars three hours a week.

CHEM 4304 [0.5 credit]
Advanced Applications In Mass Spectrometry
Detailed breakdown of the physical, electrical and chemical operation of mass spectrometers. Applications in MS ranging from the analysis of small molecules to large biological macromolecules. Descriptions of the use of mass spectrometry in industry as well as commercial opportunities in the field.
Prerequisite(s): CHEM 2103 or BIOC 2300, and one of CHEM 2302 or CHEM 2303.
Also offered at the graduate level, with different requirements, as CHEM 5109, for which additional credit is precluded.
Lectures and seminars three hours a week.

CHEM 4305 [0.5 credit]
Environmental Chemistry and Toxicology
Overview of environmental chemistry and toxicology principles including chemical sources, fate, and effects in the environment. Examining organic reactions occurring in abiotic environments and biological systems, and studying aspects of toxicant disposition and biotransformation. Emphasis on contemporary problems in human health and the environment.
Prerequisite(s): CHEM 2203 or CHEM 2207, and CHEM 2800 or CHEM 2103, or BIOC 3101 or permission of the department.
Also offered at the graduate level, with different requirements, as CHEM 5606, for which additional credit is precluded.
Lectures three hours a week.

CHEM 4401 [0.5 credit]
Physical Aspects of Biochemistry
Chemistry, structure and function of nucleic acids, proteins, carbohydrates, and lipids. Thermodynamics of biological systems, chemical mechanisms and organic transformations. Intended for Chemistry Majors.
Includes: Experiential Learning Activity
Precludes additional credit for BIOC 2200, BIOL 2200, BIOC 3101, CHEM 3401 (no longer offered).
Prerequisite(s): CHEM 2103 and CHEM 2204.
Lectures three hours a week.

CHEM 4406 [0.5 credit]
Pharmaceutical Drug Design
Important elements of rational drug design. Ligand-receptor interactions, structure-activity relationships, molecular modeling of pharmacophores, structure and mechanism-based approaches to drug design. Enzyme inhibition in chemotherapy and design of anti-viral drugs.
Includes: Experiential Learning Activity
Prerequisite(s): CHEM 2103 and (CHEM 2203 or CHEM 2207), BIOC 3101 and (BIOC 3102 or BIOC 3008).

Lectures and laboratory five hours a week.

CHEM 4407 [0.5 credit]
Polymer Modeling
Polymer architectures; Flexible and rigid rod polymers; Rotational isomeric states (RIS); Molecular mechanics, Ramachandran Map, Helix parameters; internal and external parameters; regular and random coil structures; molecular dynamics; calculation of end-to-end distance, NMR chemical shifts; conformational entropy and properties.
Prerequisite(s): MATH 1107 and CHEM 2204 or permission of the department.
Lectures three hours per week.

CHEM 4502 [0.5 credit]
Radiochemistry
A study of nuclear stability and decay; chemical studies of nuclear phenomena. Applications of radioactivity.
Prerequisite(s): CHEM 2302, CHEM 2303, and CHEM 3100, or permission of the Department.
Also offered at the graduate level, with different requirements, as CHEM 5905, for which additional credit is precluded.
Lectures and seminars three hours a week.

CHEM 4503 [0.5 credit]
Advanced Topics in Inorganic Chemistry I
A quantitave basis for ligand field theory; unreal and real wavefunctions of d-orbitals; derivation of the energies of d-orbitals using variational principle, secular determinants, and ligned field operators; the effect of ligand field on free ion term symbols, wavefunction descriptions of terms symbols; applications.
Prerequisite(s): CHEM 3504 and CHEM 3101.
Lectures three hours a week.

CHEM 4504 [0.5 credit]
Advanced Topics in Inorganic Chemistry II
Reactivity of inorganic coordination compounds. Thermodynamic and kinetic factors affecting reactivity. Industrial and biochemical processes catalyzed by metal coordination compounds. Experimental methodologies, data analysis and rate law evaluation used to obtain reaction mechanisms leading to improved methods of catalysis.
Prerequisite(s): CHEM 3504 or equivalent.
Lectures three hours a week.

CHEM 4505 [0.5 credit]
Application of Physical Methods to Electron Transfer Chemistry
Spectroscopic techniques (i.e. UV-visible NIR, IR, EPR) and electrochemistry methods that are used to study photochemical and thermal intermolecular and intramolecular electron transfer in transition metal complexes are presented. Electron transfer theory and redox-active (non-innocent) ligands are discussed.
Prerequisite(s): CHEM 3504.
Lectures three hours a week.

CHEM 4700 [0.5 credit]
Special Topics in Chemistry
A topic of current interest in any branch of chemistry. Only one special topics course may be presented for credit.
Prerequisite(s): permission of the Department.

CHEM 4800 [0.5 credit]
Atmospheric Chemistry
Properties of natural atmospheric constituents; biogeochemical cycles involving gases; chemical reactions in the atmosphere; anthropogenic atmospheric pollutants (e.g., chlorofluorocarbons, sulphur and nitrogen oxides, photochemical smog sources and effects on the biosphere. Relation between the structure of molecules and their spectral and reactive properties.
Prerequisite(s): CHEM 2103 or CHEM 2800.
Lectures three hours a week.

CHEM 4907 [1.0 credit]
Honours Essay and Research Proposal
Students conduct an independent research study using library resources, and prepare a critical review and study proposal on a topic approved by a faculty supervisor. A written report and oral poster presentation of the work are required before a grade can be assigned.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 4908, FOOD 4907 and FOOD 4908.
Prerequisite(s): fourth year standing in an Honours Chemistry program and permission of the department.

CHEM 4908 [1.0 credit]
Research Project and Seminar
Senior students in Honours Chemistry carry out a research project under the direction of one of the members of the Department. A written report and an oral presentation of the work are required before a grade can be assigned.
Includes: Experiential Learning Activity
Precludes additional credit for CHEM 4907, FOOD 4907 and FOOD 4908.
Prerequisite(s): any two of CHEM 3107, CHEM 3205, CHEM 3305 and CHEM 3504, and permission of the department.
Laboratory and associated work equivalent to at least eight hours a week for two terms.