Chemistry (CHEM)

Chemistry (CHEM) Courses

CHEM 5002 [0.25 credit] (CHM 8301)
Multinuclear Magnetic Resonance Spectroscopy
Principles of Nuclear Magnetic Resonance (NMR). NMR parameters to be studied are: chemical shift, spin-spin coupling, electric quadrupole coupling, spin-spin and spin-lattice relaxation rates. NMR and the periodic table. Dynamic NMR. Applications in chemistry and biochemistry. The Fourier Transform technique. Pulse sequences. Basic principles and applications of two-dimensional NMR.

CHEM 5003 [0.25 credit] (CHM 8325)
Solid State NMR Spectroscopy
Brief introduction to solid state NMR spectroscopy. Topics include dipolar coupling interactions, chemical shielding anisotropy, the quadrupolar interaction and averaging techniques such as magic angle spinning.

CHEM 5102 [0.25 credit] (CHM 8346)
Supercritical Fluids
Fundamental and practical aspects of the uses of supercritical fluids in the chemistry laboratory. Thermodynamic treatment of high pressure multicomponent phase equilibria, transport properties, solubilities, supercritical fluid extraction and chromatography for analytical purposes, reactions in supercritical fluids, equipment considerations, new developments.

CHEM 5108 [0.5 credit] (CHM 8302)
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.
Also offered at the undergraduate level, with different requirements, as CHEM 4103, for which additional credit is precluded.

CHEM 5109 [0.5 credit] (CHM 8302)
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. Also listed at the undergraduate level, with different requirements, as CHEM 4302, for which additional credit is precluded.
Lectures and seminars three hours a week.

CHEM 5206 [0.5 credit] (CHM 8302)
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.

CHEM 5207 [0.25 credit] (CHM 8302)
Macromolecular nanotechnology
Fundamentals of synthetic macromolecules related to nanoscale phenomena. Challenges and opportunities associated with polymers on the nanoscale. Topics include molecular recognition, self-assembled nanostructures, functional nanomaterials, amphiphilic architectures, nanocomposites, and nanomachines. Applications to sensing, drug delivery, and polymer based devices.
Also offered at the undergraduate level, with different requirements, as CHEM 4203, for which additional credit is precluded.
Lectures three hours a week.

CHEM 5208 [0.25 credit] (CHM 8302)
Bio Macromolecular nanotechnology
Fundamentals of biological macromolecules related to nanoscale phenomena. Challenges and opportunities associated with natural polymers on the nanoscale. Topics include molecular recognition, self-assembled nanostructures, scaffolds and templates, functional nanomaterials, amphiphilic architectures, nanocomposites, and nanomachines. Applications to sensing, biomaterials, drug delivery, and devices.
Also offered at the undergraduate level, with different requirements, as CHEM 4203, for which additional credit is precluded.
Lectures three hours a week.

CHEM 5304 [0.25 credit] (CHM 8349)
Free Radicals in Chemistry and Biology
Oxidative stress induced by free radicals plays a significant role in fatal and chronic diseases. The chemistry of bio-radicals will be described and related to pathobiological processes such as lipid peroxidation and atherosclerosis, protein nitration and cross linking, and DNA scission.

CHEM 5305 [0.5 credit] (CHM 8356)
Physical Methods in Inorganic Chemistry
Characterization of inorganic materials and coordination complexes by electronic absorption and electron paramagnetic spectroscopies, temperature and field dependent magnetic susceptibilities, and crystallography.

CHEM 5309 [0.25 credit] (CHM 8347)
Electron Transfer: Theory and Experiment
The development of classical, semi-classical and quantum mechanical electron transfer models is described. In addition, the course will examine recent experimental results and the application of electron transfer theory to biological systems.

CHEM 5406 [0.5 credit] (CHM 8164)
Organic Polymer Chemistry
Basic principles of industrial and synthetic polymers. Polymerization and polymer characterization. Topics to cover some important polymers with emphasis on synthesis, commodity plastics, engineering thermoplastics and specialty polymers. Also offered at the undergraduate level, as CHEM 4204, for which additional credit is precluded.
Prerequisite(s): CHEM 3201 and CHEM 3202 and/or CHEM 4203 or the equivalent. Students should have a basic knowledge of organic reaction mechanisms and stereochemistry.

CHEM 5407 [0.5 credit] (CHM 8134)
Spectroscopy for Organic Chemists
Analysis of proton NMR spectra. Fourier transform 13C NMR, strategies for structure elucidation, relaxation times, two-dimensional NMR. Aspects of mass spectrometry. Also offered at the undergraduate level, with different requirements, as CHEM 4202, for which additional credit is precluded.

CHEM 5408 [0.25 credit] (CHM 8350)
Introduction to Polymer Structure and Morphology
Flexible and rigid rod polymers: effect of molecular constitution and conformation; examples of polymer architectures and function; the amorphous state and glass transition; the crystalline state: typical crystal structures of polymers; polymorphism; crystallinity and long spacing. Thermal and solvent-induced crystallization; Lamellar and Spherulitic morphology.

CHEM 5409 [0.25 credit] (CHM 8351)
Morphology of Polymers and Composites
Liquid crystalline state of polymers; morphology of block copolymers and polymer blends; plasticizers and fillers for tailoring properties; depression of glass transition and melting temperature; phase stability of polymer composites; mechanical properties; self assembled systems; polymer nano-composites for electronic devices; common experimental techniques.

CHEM 5500 [0.25 credit] (CHM 8348)
Analytical Instrumentation
Principles of modern electronics, devices and instruments. Measurement of photonic and electrochemical signals. Conditioning of signals for feedback control and microcomputer interfacing. Computational data analysis techniques such as simplex optimization. Applications in chemical analysis include amperometric detector for capillary electrophoresis, and surface plasmon resonance immunosensor.

CHEM 5501 [0.25 credit] (CHM 8352)
Analytical Approach to Chemical Problems
Case study of analytical approach to various chemical problems in agricultural, biochemical, environmental, food processing, industrial, pharmaceutical and material sciences. Analytical methods include capillary electrophoresis, chemiluminescence, Fourier transform infrared spectroscopy, inductively coupled plasma emission spectroscopy, mass spectrometry, biochemical sensors, and fibre optics for remote sensing.

CHEM 5503 [0.5 credit] (CHM 8354)
Chemical Speciation in the Natural Environment
Metal-organic interactions in the aquatic environment. Evaluation of analytical techniques and their capability for quantitative determination of chemical species (as opposed to total element-determination) in the natural environment. Electrochemical techniques for determination of chemical speciation of nutrient and toxicant elements present in the natural environment.

CHEM 5705 [0.5 credit] (CHM 9109)
Ecotoxicology
Concepts of ecotoxicology, emphasizing whole ecosystem response to hazardous contaminants. Impacts of chronic and acute exposure of ecosystems to toxicants, the methods of pesticide, herbicide and pollutant residue analysis and the concept of bound residues.
Also listed as BIOL 6403 [BIO 9104].
Prerequisite(s): BIOL 6402 (BIO 9101)/CHEM 5708 (CHM 8156).

CHEM 5706 [0.5 credit]
Gas Phase Ion Chemistry

CHEM 5708 [0.5 credit] (CHM 8156)
Principles of Toxicology
Basic theorems of toxicology with examples of current research problems. Toxic risk is defined as the product of intensive hazard and research problems. Each factor is assessed in scientific and social contexts and illustrated with many types of experimental material.
Also listed as BIOL 6402 [BIO 9101].

CHEM 5709 [0.5 credit] (CHM 8157)
Chemical Toxicology
Introduction to modeling chemical hazards and exposures at the cellular level. The properties of toxic substances are compared to the responses of enzymatic systems. These interactions are defined as Quantitative Structure-Activity Relationships and used to interpret hazardous materials under regulations such as WHMIS.
Also listed as BIOL 5709 [BIO 8113].
Prerequisite(s): BIOL 6402/CHEM 5708 (BIO 9101/CHM 8156).

CHEM 5801 [1.0 credit] (CHM 8256)
Seminar I
A seminar course in which students are required to present a seminar on a topic not related to their research program. In addition, students are required to attend the seminars of their fellow classmates and actively participate in the discussion following the seminar.

CHEM 5802 [1.0 credit] (CHM 8257S)
Seminar II
A seminar course in which students are required to present a seminar on their Ph.D. research topic in their research program. In addition, students are required to attend the seminars of their fellow classmates and actively participate in the discussion following the seminar.

CHEM 5805 [1.0 credit] (CHM 8167)
Seminar in Toxicology
This course introduces the seminar format and involves student, faculty and invited seminar speakers. The student will present a seminar and submit a report on a current topic in toxicology.
Also listed as BIOL 6405.

CHEM 5900 [0.5 credit] (CHM 8158)
Directed Special Studies
Under the direction of an approved member of Faculty, the student will undertake advanced study of a field of chemistry unrelated to their thesis topic. Approval of the Associate Chair, Graduate and Postdoctoral Affairs Chemistry is required and will only be granted under unusual conditions.

CHEM 5901 [0.25 credit] (CHM 8304)
Advanced Topics in Organic Chemistry
Topics of current interest in organic chemistry. The content of this course may vary from year to year.

CHEM 5902 [0.25 credit] (CHM 8302)
Advanced Topics in Inorganic Chemistry
Topics of current interest inorganic chemistry. The content of this course may vary from year to year.

CHEM 5903 [0.25 credit] (CHM 8309)
Advanced Topics in Physical/Theoretical Chemistry
Topics of current interest in physical/theoretical chemistry. The content of this course may vary from year to year.

CHEM 5904 [0.5 credit] (CHM 8104)
Scientific Data Processing and Evaluation
Optimization of scientific measurements, calibration, uni-variate and multi-variate analysis of scientific data, “intelligent” spreadsheets for scientific data processing and presentation, noise reduction using spreadsheets, correction for signal drifts; examples from chemistry, spectroscopy and other scientific disciplines.
Prerequisite(s): CHEM 4301, or permission from the Department. .
Also offered at the undergraduate level, with different requirements, as CHEM 4303, for which additional credit is precluded.

CHEM 5905 [0.5 credit] (CHM 5105)
Radiochemistry
A study of nuclear stability and decay; chemical studies of nuclear phenomena. Applications of radioactivity.
Prerequisite(s): permission of the Department.
Also offered at the undergraduate level, with different requirements, as CHEM 4502, for which additional credit is precluded.

CHEM 5909 [3.0 credits] (CHM 7999)
M.Sc. Thesis

CHEM 6909 [8.0 credits] (CHM 9999)
Ph.D. Thesis

Summer session: some of the courses listed in this Calendar are offered during the summer. Hours and scheduling for summer session courses will differ significantly from those reported in the fall/winter Calendar. To determine the scheduling and hours for summer session classes, consult the class schedule at central.carleton.ca

Not all courses listed are offered in a given year. For an up-to-date statement of course offerings for the current session and to determine the term of offering, consult the class schedule at central.carleton.ca