Chemistry (CHEM) Courses

CHEM 5001 [0.25 credit] (CHM 8301) 
Analytical Mass Spectrometry
The principles of ion sources and mass spectrometers and their applications to problems in chemistry and biochemistry. Introduction to the chemistry of gaseous ions. Ion optics. Special emphasis on interpreting mass spectra.

CHEM 5002 [0.25 credit] (CHM 8301) 
Multinuclear Magnetic Resonance Spectroscopy

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 5004 [0.25 credit] (CHM 8326) 
NMR Spectroscopy
Advanced NMR techniques for both proton and carbon spectra, various decoupling and related experiments. Interpretation of NOSY, COSY and related data.

CHEM 5005 [0.25 credit] (CHM 8327) 
Physical Organic Chemistry
Hammet functions, transition state energies, stereochemistry of organic compounds, and mechanisms of organic reactions and their determination.

CHEM 5007 [0.25 credit] (CHM 8310) 
Introduction to Photochemistry
Basic principles of photochemistry including selection rules, energy transfer processes and the properties of excited state reactions. Lasers and their applications to measurements of the dynamics of elementary reactions.

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 offered at the undergraduate level, with different requirements, as CHEM 4304, for which additional credit is precluded.

CHEM 5110 [0.25 credit] (CHM 8176) 
Chemistry Education and Chemistry Education Research
Chemistry education including theories of learning, aligning intended outcomes with course activities and assessment, and troublesome areas of learning and teaching in chemistry. Key educational research areas are addressed, including types evidence, research methods, and central publications.

CHEM 5111 [0.25 credit] (CHM 8358) 
Advanced Topics in Biomolecular Sciences
Topics of current interest in biomolecular sciences and biological chemistry. Variable content from year to year.

CHEM 5112 [0.25 credit] (CHM 8359) 
Advanced Topics in Materials Chemistry
Topics of current interest in materials chemistry. Variable content from year to year.

CHEM 5113 [0.25 credit] (CHM 8165) 
Stereoselective Synthesis
Fundamentals of stereoselective synthesis and catalysis, including conformational analysis, substrate and catalyst control. Includes the use of allylic, chiral auxiliaries, directed reactions and chiral catalysts.

CHEM 5114 [0.25 credit] (CHM 8173) 
Introduction to Molecular Simulation and Statistical Mechanics (Part A)
Modern molecular simulation techniques including classical molecular dynamics and Monte Carlo simulations with the necessary statistical mechanics required to understand and interpret the results. Introduction to modern scientific computing environments via the Linux operating system.
Includes metal-catalyzed reactions. synthesis of pharmaceuticals and natural products. heterocyclic systems, with examples relevant to the Heterocyclic Chemistry

CHEM 5120 [0.25 credit] (CHM 8364)
Molecular Magnetism II
Introduction to the principals (Molecular Magnetism I) and advanced characterization of paramagnetic molecules (Molecular Magnetism II). Emphasis will be made on structure-property relationship. This course will contain variable content from year to year by discussing recent progress on molecular magnetism.

CHEM 5121 [0.25 credit] (CHM 8364)
Molecular Magnetism II
Introduction to the principals (Molecular Magnetism I) and advanced characterization of paramagnetic molecules (Molecular Magnetism II). Emphasis will be made on structure-property relationship. This course will contain variable content from year to year by discussing recent progress on molecular magnetism.

CHEM 5121 [0.25 credit] (CHM 8364)
Molecular Magnetism II
Introduction to the principals (Molecular Magnetism I) and advanced characterization of paramagnetic molecules (Molecular Magnetism II). Emphasis will be made on structure-property relationship. This course will contain variable content from year to year by discussing recent progress on molecular magnetism.

CHEM 5202 [0.25 credit] (CHM 8323)
Chemistry of the Main Group Elements
Fundamental and applied aspects of main group element chemistry. Topics may include non-metal chemistry, main group organometallic chemistry, application of main group element compounds to solid state synthesis (e.g. CVD and/or sol gel processes), uses of main group element compounds in synthesis.

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 4201, for which additional credit is precluded.

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 4201, for which additional credit is precluded.

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.
Includes: Experiential Learning Activity

sensors, and fibre optics for remote sensing.

emission spectroscopy, mass spectrometry, biochemical
infrared spectroscopy, inductively coupled plasma
material sciences. Analytical methods include capillary
food processing, industrial, pharmaceutical and
problems in agricultural, biochemical, environmental,

Case study of analytical approach to various chemical

Analytical Approach to Chemical Problems

CHEM 5501 [0.25 credit] (CHM 8357)

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.
Includes: Experiential Learning Activity
CHEM 5800 [0.5 credit]
Seminar in Biochemistry I
A graduate seminar on current topics in the field of Biochemistry. 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 Biochemistry. Includes: Experiential Learning Activity
Also listed as BIOL 5002.

CHEM 5802 [0.0 credit] (CHM 8257S)
Seminar II
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.
Includes: Experiential Learning Activity
Also listed as FOOD 5802.

CHEM 5804 [0.5 credit]
Modern Scientific Communication
Communication and other skills useful for chemistry graduates. Effective manuscript writing, creating graphics, CV development, networking, science communication, use of social media, outreach, EDI considerations.
Also listed as FOOD 5804.
Precludes additional credit for CHEM 5801 (no longer offered), FOOD 5801 (no longer offered).

CHEM 5805 [0.5 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.
Includes: Experiential Learning Activity
Also listed as BIOL 6405.

CHEM 5806 [0.5 credit]
Advances in Applied Biochemistry
A practical hands-on course in the field of Biochemistry. This course is run in a laboratory and will train students in highly specialized technique(s) in Biochemistry. The students will run experiments, gather data, assess and analyze the results and present the findings as a seminar.
Includes: Experiential Learning Activity
Also listed as BIOL 6405.

CHEM 5810 [0.5 credit]
Seminar I
Principles and practice of oral scientific communication for scientific and non-scientific audiences. Students are required to present short seminars geared towards a general audience (in the style of Three-minute thesis (3MT) and/or TedTalk) as well as a research seminar geared towards a scientific audience.
Also listed as FOOD 5810.
Precludes additional credit for CHEM 5801 (no longer offered), FOOD 5801 (no longer offered).

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]
M.Sc. Thesis
Includes: Experiential Learning Activity

CHEM 6800 [0.5 credit]
Seminar in Biochemistry II
A graduate seminar on current topics in the field of Biochemistry. 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 Biochemistry.
Includes: Experiential Learning Activity
Also listed as BIOL 6102.
Lecture three hours a week.
CHEM 6909 [0.0 credit]
Ph.D. Thesis
Includes: Experiential Learning Activity