CHEMISTRY (CHEM)

CHEM 6170. Inorganic Chemistry I. 3 Credit Hours.
A series of key topics in inorganic chemistry will be reviewed: acids/bases, redox processes, bonding and structure, transition metal chemistry, coordination complexes.

CHEM 6171. Inorganic Chemistry II. 3 Credit Hours.
Contemporary topics in inorganic chemistry including bioinorganic chemistry, reaction mechanisms and kinetics, optical and magnetic properties of molecular species, and inorganic materials.

CHEM 6172. Physical Methods in Inorganic Chemistry. 3 Credit Hours.
An introduction to the use of physical methods in inorganic chemistry including vibrational spectroscopy, multinuclear NMR, EST, Mossbauer, magnetometery, NQR, PES, diffraction, and EXAFS.

CHEM 6181. Chemical Crystallography. 3 Credit Hours.
The collection and interpretation of diffraction data. Single crystal structure analysis, powder diffraction for phase identification and quantitative analysis, and Rietveld refinement.

CHEM 6182. Chemistry of the Solid State. 3 Credit Hours.
An introduction to the chemistry of the solid state. Synthetic methods, measurement of properties, structure of solids, theory of electrical, optical, and magnetic properties.

CHEM 6183. Organometallic Chemistry. 3 Credit Hours.
The chemistry of main group and transition metal organometallics. Including synthetic methods, homogeneous catalysis and catalytic cycles, and synthetically useful organometallic reagents.

CHEM 6271. Analytical Chemistry I. 3 Credit Hours.
Discussion of chemical equilibrium, separations, and bioanalytical methods.

CHEM 6272. Analytical Chemistry II. 3 Credit Hours.
Topics include experimental design, electronics, and spectroscopy.

CHEM 6273. Analytical techniques for chemistry and biology. 3 Credit Hours.
An introduction to analytical techniques used to answer biological questions with a focus on the roles of small molecules from the human and environmental microbiome.

CHEM 6274. Metabolomics. 3 Credit Hours.
Experimental and data science workflows in modern metabolomics studies.

CHEM 6281. Mass Spectrometry. 3 Credit Hours.
Topics include sample handling, ionization methods, MS/MS, and quantitative analysis.

CHEM 6282. Chemical Sensors. 3 Credit Hours.
Origins of selectivity, principles of transduction mechanisms, construction and applications of modern chemical sensors.

CHEM 6283. Electroanalytical Chemistry. 3 Credit Hours.
Coulometry, electrolytic separations, polargraphy chronopotentimetry, coulometric titrations, voltammetry, and hydrodynamic electrochemical methods of analysis.

CHEM 6284. Environmental Analytical Chemistry. 3 Credit Hours.
Application of techniques from analytical chemistry in monitoring the environment.

CHEM 6285. Analytical Spectroscopy. 3 Credit Hours.
Modern analytical spectroscopy and use of analytical techniques in chemistry and chemical engineering.

CHEM 6287. Scanned Probe Techniques. 3 Credit Hours.
An in-depth analysis of the theory, practice and application of scanning probe microscopy techniques.

CHEM 6288. Analytical Separations. 3 Credit Hours.
In-depth understanding of separation processes and the mechanisms underlying the design and development of modern separation techniques.

CHEM 6370. Organic Reaction Mechanisms. 3 Credit Hours.
Reaction mechanisms in organic chemistry, including the concepts of physical organic chemistry, reactive intermediates, and complex functional group transformations.

CHEM 6371. Identification of Organic Compounds. 3 Credit Hours.
Description of molecular structure and identification of organic compounds using spectroscopic techniques.

CHEM 6372. Physical Organic Chemistry. 3 Credit Hours.
Physical methods in organic chemistry; determination of reaction pathways.

CHEM 6373. Organic Synthesis. 3 Credit Hours.
Methods and strategy for the preparation of complex organic compounds.

CHEM 6381. Advanced Organic Synthesis. 3 Credit Hours.
Advanced topics in the synthesis of complex organic molecules.

CHEM 6382. Computational Methods in Organic Chemistry and Biochemistry. 3 Credit Hours.
The development of approximate methods in molecular orbital theory and molecular mechanics and their application to problems in organic and biochemistry.

CHEM 6414. Introduction to Data Science using Python. 3 Credit Hours.
Basic principles of data science and the application of Python to data science.

CHEM 6471. Chemical Thermodynamics and Kinetics. 3 Credit Hours.
Laws of classical thermodynamics and their chemical applications. Introduction to statistical mechanics and chemical kinetics.

CHEM 6472. Quantum Chemistry and Molecular Spectroscopy. 3 Credit Hours.
Introduction to quantum mechanics and its application to molecular systems, atomic and molecular spectroscopy.

CHEM 6481. Statistical Mechanics. 3 Credit Hours.
Statistical thermodynamics, lattice statistics, molecular distribution and correlation functions, the theories of liquids and solutions, phase transitions, cluster theory, and measurement.

CHEM 6482. Chemical Kinetics and Reaction Dynamics. 3 Credit Hours.
Modern theoretical and experimental methods for studying macroscopic and microscopic bimolecular and unimolecular processes are discussed, as are methods for describing complex kinetic systems.

CHEM 6483. Chemistry of Electronic Organic Materials. 3 Credit Hours.
This course provides a broad description of the basic chemical and physical concepts that determine the properties of electrically active materials.

CHEM 6484. Chemistry of Optical Organic Materials. 3 Credit Hours.
Course description includes synthesis, electronic structure, physico-chemical characterization, and device applications of optically active organic materials.

CHEM 6485. Computational Chemistry. 3 Credit Hours.
Introductory course in computational chemistry, discussing electronic structure theory, semiemphirical methods, molecular mechanics, transistion-state searching, and computation of thermodynamic quantities.

CHEM 6491. Quantum Mechanics. 3 Credit Hours.
Important concepts and applications of quantum mechanics at the intermediate level, including operators, perturbation and variational methods applied to atoms and molecules.

CHEM 6492. Molecular Spectroscopy. 3 Credit Hours.
Study of energy of electronic transitions in molecules, selection rules, excitation processes, and laser spectroscopy.

CHEM 6501. Biochemistry I. 3 Credit Hours.
The chemistry and biochemistry of proteins, lipids, carbohydrates, nucleic acids, and other biomolecules.

CHEM 6502. Biochemistry II. 3 Credit Hours.
The chemistry and biochemistry of proteins, lipids, carbohydrates, nucleic acids, and other biomolecules.

CHEM 6532. Chemistry of the Origins of Life. 3 Credit Hours.
Current scientific theories pertaining to the origin of life and early evolution, emphasizing how current knowledge of biology, chemistry and physics limits the possibilities.

CHEM 6571. Enzymology and Metabolism. 3 Credit Hours.
Structure and chemistry of enzymes, enzyme mechanism, enzyme kinetics, enzyme inhibitors, and medicinal chemistry.

CHEM 6572. Macromolecular Structure. 3 Credit Hours.
Principles of protein, nucleic acid, and membrane structure. Major emphasis on protein folding, detailed description of three-dimensional structure of proteins and nucleic acids.

CHEM 6573. Molecular Biochemistry. 3 Credit Hours.
Current topics in molecular biology including eukaryotic transcriptions, RNA processing, repair and recombination, immunity, viruses, DNA fingerprinting, and genome sequencing.

CHEM 6581. Protein Crystallography. 3 Credit Hours.
Application of crystallographic principles to the structure determination of macromolecules by molecular replacement, multiple isomorphous replacements. High-speed data collection methods and cryocrystallography.

CHEM 6582. Biophysical Chemistry. 3 Credit Hours.
Applications of the principles and techniques of physical chemistry in biochemistry, with emphasis in the equilibrium and dynamic behavior of macromolecules in solution.

CHEM 6583. Drug Design and Discovery. 3 Credit Hours.
Application of principles of chemistry and biology to the creation of knowledge leading to the introduction of new therapeutic agents.

CHEM 6584. Contemporary Biochemistry. 3 Credit Hours.
Topics vary from year to year, but will include subjects from the biochemical literature, such as in Journal of Biological Chemistry.

CHEM 6750. Preparation and Reaction of Polymers. 3 Credit Hours.
A detailed treatment of the reactions involved in the synthesis of both human-made and natural polymers, including preparation and degradative reactions of polymer systems. Crosslisted with CHE and PTFE 6750.

CHEM 6751. Physical Chemistry of Polymer Solutions. 3 Credit Hours.
Study of polymer solutions, polymer miscibility, absorptions, sorptions, plasticization, molecular weights, molecular weight distributions, and interfacial phenomena using thermodynamics and statistical mechanics. Crosslisted with CHE, MSE, and PTFE 6751.

CHEM 6752. Polymer Characterization. 4 Credit Hours.
This course introduces the student to surface, near-surface, and structural methods of polymer characterization. Specialized techniques critical to physical structure are emphasized. Crosslisted with CHE, MSE, and PTFE 6752.

CHEM 6755. Theoretical Chemistry of Polymers. 3 Credit Hours.
Thermodynamics and microscopic dynamics of polymers. Fundamental concepts, including scaling concepts, governing anisotropy of polarizability, phase transitions, morphology, time-dependent correlations, etc. are discussed. Crosslisted with MSE and PTFE 6755.

CHEM 6756. Discovery of Signaling Molecules. 3 Credit Hours.
The diversity of chemical signals between organisms and their structural specificities will be presented along with chemical and biological methods for isolating signaling molecules. Crosslisted with BIOL 6756 and CEE 6756.

CHEM 6757. Advanced Polymer Chemistry. 3 Credit Hours.
Advanced topics in synthetic polymerization methodology, polymer structure, and polymer properties in solution and the solid state.

CHEM 6760. Biocatalysis and Metabolic Engineering. 3 Credit Hours.
This course provides in-depth coverage of various topics in biocatalysis and metabolic engineering. Goals of this course are the development of an understanding of proteins as catalysts, their functioning in metabolic networks, their application in various industries, and recognition of their potential for addressing future challenges in science and engineering. Crosslisted with CHBE 6760.

CHEM 6762. Protein Engineering. 3 Credit Hours.
This course covers the theory and practice of protein engineering methods, including specific examples of engineered proteins and their applications from the literature.

CHEM 6765. Drug Design, Development and Delivery. 3 Credit Hours.
Introduction to the pharmaceutical development process, including design of new drugs, synthesis and manufacturing issues, and methods of delivery into the body. Includes student presentations. Crosslisted with BMED 6765 and CHBE 6765.

CHEM 6770. Instrument Design for Astrobiology Missions. 3 Credit Hours.
Students survey the literature, develop an instrument concept, and present it to a review panel in a mock NASA proposal style.

CHEM 6785. Nanoscale Science and Technology. 3 Credit Hours.
Chemistry and physics of materials, structures, and surfaces with characteristic feature sizes below 100 nm, and their applications in catalysis, electronics, photonics, energy, and biomedicine.

CHEM 6XXX. Chemistry Elective. 1-21 Credit Hours.

CHEM 7000. Master's Thesis. 1-21 Credit Hours.

CHEM 7001. Introduction to Research. 3 Credit Hours.
Introduction to laboratory techniques, experimental design, library and database searching, presentations.

CHEM 8000. Seminar in Chemistry. 1 Credit Hour.

CHEM 8001. Faculty Seminar. 1-3 Credit Hours.

CHEM 8002. Information Resources for Chemists and Biochemists. 2 Credit Hours.

CHEM 8003. Student Seminar. 1-3 Credit Hours.

CHEM 8801. Special Topics. 1 Credit Hour.
Special Topics.

CHEM 8802. Special Topics. 2 Credit Hours.

CHEM 8803. Special Topics. 3 Credit Hours.

CHEM 8812. Special Topics. 2 Credit Hours.

CHEM 8813. Special Topics in Inorganic Chemistry. 3 Credit Hours.
Topics from the inorganic chemistry research literature.

CHEM 8823. Special Topics in Analytical Chemistry. 3 Credit Hours.
Topics from the analytical chemistry research literature.

CHEM 8831. Special Topics. 1 Credit Hour.

CHEM 8833. Special Topics in Organic Chemistry. 3 Credit Hours.
Topics from the organic chemistry research literature.

CHEM 8843. Special Topics in Physical Chemistry. 3 Credit Hours.
Topics from the physical chemistry research literature.

CHEM 8853. Special Topics in Biochemistry. 3 Credit Hours.
Topics from the biochemistry research literature.

CHEM 8863. Special Topics. 3 Credit Hours.
Topics from the polymer chemistry research literature.

CHEM 8873. Special Topics in Polymer Chemistry. 3 Credit Hours.
Topics from the polymer chemistry research literature.

CHEM 88X2. Xfer-Spec Top-Org Chem. 2 Credit Hours.

CHEM 8901. Special Problems. 1-21 Credit Hours.

CHEM 8902. Special Problems. 1-21 Credit Hours.

CHEM 8903. Special Problems. 1-21 Credit Hours.

CHEM 8997. Teaching Assistantship. 1-9 Credit Hours.
For graduate students holding graduate teaching assistantships.

CHEM 8998. Research Assistantship. 1-9 Credit Hours.
For graduate students holding graduate research assistantships.

CHEM 9000. Doctoral Thesis. 1-21 Credit Hours.