CHEMISTRY (CHEM-GA)

CHEM-GA 1111 Inorganic Chemistry (4 Credits)
Typically offered not typically offered
Study of the inorganic elements, concentrating on the transition metals, in which the structure of their compounds, spectra, and reactivity is discussed in light of recent advances in both theory and experiment. The importance of the inorganic elements in such fields as biochemistry and catalysis is discussed.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1112 Organometallic Chemistry (4 Credits)
Typically offered not typically offered
Study of the structure, bonding, and reactions of organometallic complexes, with particular emphasis on the mechanism of reactions and the characterization of compounds by spectroscopic means. Application of organometallic reagents in organic synthesis and industrial catalysis is discussed.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1113 Chemistry of the Transition Metals (4 Credits)
Typically offered Fall
Bonding and electronic structure of transition metal complexes; basic transformations of organometallic chemistry; catalytic reaction, including cross-coupling, olefin metathesis, asymmetric hydrogenation, olefin polymerization.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1200 Chemical Applications of Group Theory (4 Credits)
Study applications of a branch of abstract algebra to problems of symmetry in chemistry, electronic structure theory, spectroscopy, and crystallography. Symmetries of molecules and crystals, construction of symmetry adapted linear combinations of atomic orbitals, prediction of normal modes and allowed spectroscopic transitions of molecules.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1300 Colloid Science (4 Credits)
Introduction to the major concepts in Colloid Science, including synthesis and stabilization of colloidal suspensions, particle characterization and self-assembly principles. Study of scientific principles underlying the behavior of colloidal suspension. Overview of most important types of particle interactions and how these interactions can be used to guide colloidal self-assembly. Study classic synthetic strategies to fabricate stable and monodisperse particles as well as advanced methodologies to shape and functionalize colloidal matter. Familiarization with standard particle characterization methods.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1311 Adv Organic Chem: React of Organic Compound (4 Credits)
Typically offered Spring
Survey of the major classes of organic reactions, reagents, mechanisms, stereochemistry, and protecting groups. Discusses the origins of chemoselectivity, regioselectivity, and stereoselectivity and the planning of organic synthesis.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1312 Strategies in Synthetic Organic Chemistry (2 Credits)
Typically offered Spring
Analysis of modern strategies and methodologies for the synthesis of organic compounds.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1313 Physical Organic Chemistry (4 Credits)
Typically offered Fall
Structure and bonding in organic molecules, including MO calculations, perturbation methods, and aromaticity; stereochemistry and conformational analysis; pericyclic reactions; thermochemistry and kinetics; transition state theory and activation parameters; acids and bases; and methods for the determination of mechanisms.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1314 Organic React Mechanisms (2 Credits)
Typically offered not typically offered
Discussion of the mechanisms of organic reactions, primarily in solution. Topics include nucleophilic and electrophilic substitution reactions, molecular rearrangements, electrophilic and nucleophilic addition reactions, elimination, carbanions, free radicals, and photochemistry.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1315 Supramolecular Chemistry (4 Credits)
Typically offered Spring
Molecular recognition in the context of organic and biological molecules. Emphasis will be on the understanding of weak forces that dictate self-assembly, and intra- and intermolecular interactions. Physical organic and biophysical methods are introduced as necessary.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1326 Organic Analysis (4 Credits)
Typically offered Fall
Application of spectroscopic methods to the determination of the structure of organic molecules. Structure determination is approached through problem solving using IR, UV, MS, NMR, and spectroscopy. Particular emphasis is given to 1H and 13C NMR.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1400 Spectroscopic Analysis in Organic and Inorganic Chemistry (4 Credits)
Introduction to modern spectroscopic techniques for structural determination of organic and inorganic molecules. Topics include NMR spectroscopic methods, EPR spectroscopy, mass spectrometric methods, vibrational spectroscopy techniques, electronic (UV-visible) spectroscopic techniques, and cyclic voltammetry
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1500 Machine Learning in Molecular Science (4 Credits)
Introduction to machine learning and its applications to problems in chemistry. Study of practical understanding of machine learning, concepts, methods, intuitions, algorithms, strengths, limitations, applicability and application of these concepts.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1814 Biophysical Chemistry (4 Credits)
Typically offered Fall and Spring
Structure and properties of macromolecules of biological importance: thermodynamics of polymer solutions; determination of molecular weight and conformation of biopolymers; and polyelectrolyte theory.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1815 Macromolecular Chemistry (4 Credits)
Typically offered Fall
Structural chemistry of macromolecules, including vector analysis, symmetry, crystallography, DNA, RNA, and virus structure.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1818 Adv Biophysical Chem (4 Credits)
Typically offered Fall
Three advanced topics in biophysical chemistry are discussed: electron transfer theory and its application to electron transfer in biology; statistical mechanics of biopolymers; and protein-DNA interactions with emphasis on DNA repair enzymes.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1882 Biochemistry II (4 Credits)
Typically offered not typically offered
Topics include organic and physical chemistry of proteins, lipids, carbohydrates, and nucleic acids; enzyme kinetics and mechanisms; membranes and transport; bioenergetics and intermediary metabolism; molecular genetics and regulation.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1883 Molecular Biochemistry (4 Credits)
Typically offered Fall
Mechanisms and interactions of biomolecules found in nature, including noncovalent interactions; DNA, RNA and protein synthesis and structure; protein modifications and turnover; biomolecular catalysis, allostery and cooperativity; lipids and carbohydrates of the cell; biosynthesis of natural products; modern techniques in biochemistry.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 1885 Experimental Biochem (4 Credits)
Typically offered not typically offered
Experiments and instruction in analytical techniques, including chromatography, spectrophotometry, and electrophoresis; isolation and characterization of biomolecules; kinetic analysis of enzymatic activity; and analysis of protein-protein and protein-DNA interactions that direct basic biochemical pathways.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2232 Total Synthesis (2 Credits)
Typically offered Spring
Modern synthetic methods in organic chemistry centering on significant synthesis. Each synthesis is examined with respect to synthetic strategy, mechanisms of individual steps, and the scope of specialized reagents.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2261 Spec Topics in Organic Chemistry: (4 Credits)
Typically offered occasionally
Topics of current interest in organic chemistry are covered in depth. by four faculty members. Topics such as nanoscience, mass spectrometry, nuclear magnetic resonance, and infrared spectroscopy are addressed through a problem-solving approach; topics from current literature and research areas complement the core courses.
Grading: GSAS Graded
Repeatable for additional credit: Yes

CHEM-GA 2262 Special Topics: (4 Credits)
Typically offered occasionally
This course will provide an introduction to spectroscopy. The course will discuss molecular motion and symmetry in the context of spectroscopic analysis as well as a general description of two-level systems, transition probabilities, line shapes and coherences. In addition the instrumentation, measurement and analysis tools will be described.
Grading: GSAS Graded
Repeatable for additional credit: Yes

CHEM-GA 2281 Organic Photochemistry (4 Credits)
Typically offered not typically offered
Description of the generation, structure, and chemical transformation of electronic excited states of organic molecules.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2400 The Science of Materials (4 Credits)
Typically offered Fall
A comprehensive foundation course that addresses basic concepts of materials science. Topics include bonding forces, crystal structures, defects, x-ray diffraction, solid-state phase diagrams, crystallization mechanisms, diffusion in solids, and mechanical, electrical, optical, and magnetic properties. Classes of materials include metals, ceramics, polymers, liquid crystals, organic crystals.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2420 Polymer Chemistry (4 Credits)
Typically offered Spring
This course is intended to introduce the student to the major concepts in polymer chemistry such as polymerizations and reactions of polymers and to prepare the student for research in polymer science.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2600 Statistical Mechanics (4 Credits)
Typically offered Fall and Spring
Introduction to the fundamentals of statistical mechanics. Topics include classical mechanics in the Lagrangian and Hamiltonian formulations and its relation to classical statistical mechanics, phase space and partition functions, and the development of thermodynamics. Methods of molecular dynamics and Monte Carlo simulations are also discussed.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2601 Molecular Modeling (4 Credits)
Typically offered Spring
A full-scale introduction to biomolecular modeling and simulation with the goal of assisting students to develop a practical understanding of computational methods (strengths, limitations, applicability) and competence in applying these methods to biomolecules.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2626 Mathematical Methods in Chemistry (4 Credits)
Typically offered Fall
Provides students with the fundamental mathematical tools needed for further study in theoretical chemistry. Topics include vector spaces, linear algebra, ordinary and partial differential equations, special functions, complex analysis, and integral transforms.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2627 Computational Chemistry (4 Credits)
Typically offered not typically offered
An introduction to molecular modeling and simulation with the goal of assisting students to develop a practical understanding of computational methods.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2651 Advanced Statistical Mechanics (4 Credits)
Typically offered Spring
Continuation of the Statistical Mechanics course. Topics include advanced concepts in ensemble theory, distribution function theory of liquids, quantum statistical mechanics in the eigenvalue and path-integral formulations, time-dependent statistical mechanics, linear response theory and spectroscopy, and critical phenomena.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2665 Quantum Mechanics (4 Credits)
Typically offered Fall
Quantum mechanics of elementary systems; includes perturbation theory, particle in a box, the one-electron atom, harmonic oscillators, and the elements of atomic and molecular structure.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2666 Quantum Chemistry and Advanced Statistical Mechanics (4 Credits)
Typically offered Spring
Representation theory, time-dependent and time-independent perturbation theory, rotational and vibrational levels in molecules, many-electron systems, interaction of electric and magnetic fields with atoms and molecules, quantum treatment of many-electron systems, and techniques of quantum chemistry.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2671 Special Topics Physical Chemistry: (4 Credits)
Typically offered occasionally
Special Topics is an umbrella course and is used to introduce many new courses or run infrequently held courses
Grading: GSAS Graded
Repeatable for additional credit: Yes

CHEM-GA 2672 Special Topics: (4 Credits)
Typically offered occasionally
Special Topics is an umbrella course and is used to introduce many new courses or run infrequently held courses
Grading: GSAS Graded
Repeatable for additional credit: Yes

CHEM-GA 2673 Professional Development (0 Credits)
Typically offered Fall
This class centers prepares students to be successful at NYU, in their field and in their future employment. In detail, students enrolled in this class are a) being introduced to the workings of NYU, 2) learn about the ethics of carrying out research, 3) learn how to publish scientific results, 4) are being introduced to effective teaching techniques, 5) learn how to apply for funding and fellowships, 6) are being familiarized with the safety procedures in chemical lab settings, and 7) are being introduced to career paths past their degree.
Grading: GSAS Pass/Fail
Repeatable for additional credit: No

CHEM-GA 2680 Nmr Spectroscopy: Theory and Practice (4 Credits)
Typically offered Fall and Spring
This course discusses modern NMR techniques in theory and practice. Both liquid- and solid-state NMR techniques will be introduced and demonstrated. Connections to Magnetic Resonance Imaging will be discussed. Applications to structure determination of biomolecules and materials will be discussed. Hands-on experience and computer simulations using MATLAB and Mathematica will be offered during class.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2690 Applied Infrared Spectroscopy (2 Credits)
Typically offered Spring
Overview of infrared spectroscopy as applied to the study of inorganic and organic materials, including nanoparticles and polymers. Reviews selection rules and optics. Focuses on modern methods including reflectance spectroscopy as applied to the study of surfaces and solutes in highly absorbing media.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2884 Bio-Organic Chemistry (4 Credits)
Typically offered Spring
Covers a broad range of topics at the interface between organic chemistry and biology, based on the most recent advances in bioorganic chemistry, chemical biology functional genomics, and molecular evolution.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 2931 Research (1-12 Credits)
Typically offered Fall
Engage in a process of systematic inquiry that entails collection of data; documentation of critical information; and analysis and interpretation of that data/information, in accordance with suitable methodologies set by specific fields of chemistry and conducted as part of a research group under the supervision of a principal investigator.
Grading: GSAS Graded
Repeatable for additional credit: Yes

CHEM-GA 2932 Research (1-12 Credits)
Typically offered Spring
Engage in a process of systematic inquiry that entails collection of data; documentation of critical information; and analysis and interpretation of that data/information, in accordance with suitable methodologies set by specific fields of chemistry and conducted as part of a research group under the supervision of a principal investigator.
Grading: GSAS Graded
Repeatable for additional credit: Yes

CHEM-GA 3010 Graduate Seminar (2 Credits)
Typically offered Fall
Students enrolled in this course (1) learn how to give a presentation understandable to an audience of their peers, many of whom work in a different area of specialization; (2) learn how to evaluate presentations given by their peers both within and outside their area of specialization; (3) gain exposure to a broad range of scientific topics and presentation styles; and (4) have the opportunity to attend presentations by external speakers to broaden exposure to various topics and professional presentation styles.
Grading: GSAS Graded
Repeatable for additional credit: No

CHEM-GA 3200 Original Research Proposal (1 Credit)
This course is a required one-credit one-semester course for third-year graduate students pursuing a Ph.D. degree in the Department of Chemistry. The course covers topics related to research proposals in all fields of chemistry, including the conception and writing of innovative proposals as well as the associated review process. Each student will be tasked with creating an original research proposal that will be aided, and then reviewed, by peer teams that emulate NSF review panels or NIH study sections. As such, the course will provide guidance for the written and oral component for the 3rd year Original Research Proposal (ORP) exam early in the spring semester, as well as for proposals intended to secure resources in future careers.
Grading: GSAS Pass/Fail
Repeatable for additional credit: Yes

CHEM-GA 9627 Computational Chemistry (4 Credits)
Typically offered not typically offered
Fulfillment: Chemistry elective.
Grading: GSAS Graded
Repeatable for additional credit: No
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CHEM-GA 9666 Quantum Chemistry and Advanced Statistical Mechanics (4 Credits)
Representation theory, time-dependent and time-independent perturbation theory, rotational and vibrational levels in molecules, many-electron systems, interaction of electric and magnetic fields with atoms and molecules, quantum treatment of many-electron systems, and techniques of quantum chemistry.
Grading: GSAS Graded
Repeatable for additional credit: No