CHE

CHE 501: Instrumental Methods in Chemistry
Practical and theoretical aspects of instrumentation in chemistry. The primary emphasis is on contemporary methods of molecular structure determination such as X-ray crystallography, NMR, IR, and MS. Other topics may also be presented.
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 514: Transition Metal Chemistry
A survey course with an emphasis on the transition metals. Reaction mechanisms, synthesis, and structure are covered. Specific areas of concern include coordination chemistry, organometallic chemistry, bioinorganic chemistry, and selected topics from solid-state and non-transition metal chemistry.
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 518: Materials Chemistry
Our high technology world is driven forward by advances in materials chemistry. This class will discuss the origin of this technology, covering the synthesis, structures, and properties of advanced materials. These materials will be studied from a multidisciplinary perspective, since the knowledge required for their development spans more than one traditional academic discipline. This class will focus on broad topics with great current societal importance (energy, computing, nanoscience, etc.), and will discuss the materials at the heart of our present technology as well as novel classes of materials being developed for future technology applications. Specific topics may include batteries, fuel cells, catalysts, metallic conductors, semiconductors, superconductors, permanent magnets, magnetic films.
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 522: Molecular Spectroscopy
A detailed description of the theory and practice of molecular spectroscopy. Topics include the interaction of molecules with electromagnetic radiation and the time evolution of molecular energy states.
Prerequisite: CHE 521
Spring, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 523: Chemical Thermodynamics
A rigorous development of the fundamentals of thermodynamics and its application to a number of systems of interest to chemists, such as electrochemical cells, gases, and homogeneous and heterogeneous equilibrium. An introduction to statistical mechanics will also be included.

Fall, 1-3 credits, Letter graded (A, A-, B+, etc.)

CHE 524: Magnetic Resonance
This course provides an introduction to the fundamental quantum mechanics of the magnetism of spin-1/2 (and higher) particles. It includes a study of the Bloch equations (the responses of the magnetism to continuous-wave and pulsed irradiation) and a discussion of the experimental hardware and techniques commonly employed. Topics covered include the basics of the spin Hamiltonian (chemical shifts, J, dipolar, and quadrupolar couplings), dynamics and relaxation 1-D spectroscopy (spin and chemical exchange, lineshapes, spin echoes, etc.), 2-D spectroscopy (homonuclear and heteronuclear correlation), techniques for studies of solids and liquid crystals (magic angle spinning, cross polarization, quadrupolar echo), and the principles of magnetic resonance imaging. Applications to the biological and material sciences, as well as chemical problems, will be discussed.

Spring, alternate years, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 525: Theoretical Chemistry
This course stresses the physical theory underlying chemical phenomena. Special emphasis is given to advanced topics in electronic structure theory, molecular dynamics, condensed matter and surfaces, many-body and quantum ensemble theory, and the interaction of light and molecules.

3 credits, Letter graded (A, A-, B+, etc.)

CHE 528: Statistical Mechanics
Statistical theory of equilibrium systems and rate processes. Ensemble theory, spatial and time correlation functions. Model systems and methods of estimating their properties. Designed to enable the student to use the current literature dealing with application of statistical mechanics to problems in chemistry.

Spring, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 530: Physical Chemistry of Macromolecules
An investigation of the gross and fine structures of macromolecules and molecular aggregates in solution as revealed by hydrodynamic behavior (e.g., ultracentrifugation, viscosity), light scattering, spectroscopic properties (e.g., ultraviolet hypochromism, circular dichroism, Raman, fluorescence, magnetic resonance spectra), and the thermodynamics and kinetics of interaction with small molecules and ions. Theory of conformation changes and phase transitions.

3 credits, Letter graded (A, A-, B+, etc.)

CHE 534: Computing in Chemistry
The basic elements of scripting, design of computer programs, and numerical analysis are discussed within the framework of solving a variety of exciting problems chosen from all areas of chemistry. Topics include automation of repetitive tasks, fitting of data, numerical integration of rate equations, signal and image analysis, and quantum chemistry. No previous knowledge of computer programming is assumed.

Fall, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 535: Introduction to Computational Structural Biology and Drug Design
This course will provide an introduction to Computational Structural Biology with application to Drug Design. Methods and applications that use computation to model biological systems involved in human disease will be emphasized. The course aims to foster collaborative learning and will consist of presentations by the instructor, guest lecturers, and by course participants with the goal of summarizing key methods, topics, and papers relevant to Computational Structural Biology.

Fall, 0-3 credits, Letter graded (A, A-, B+, etc.)

CHE 536: Molecular Modeling of Biological Molecules
This course is designed for students who wish to gain hands-on experience modeling biological molecules at the atomic level. In conjunction with the individual interests, Molecular Mechanics, Molecular Dynamics, Monte Carlo, Docking (virtual screening), or Quantum Mechanics software packages can be used to study relevant biological system(s). Projects will include setup, execution, and analysis. Course participants will give literature presentations relevant to the simulations being performed and a final project report will be required. Familiarity with UNIX (Linux) is desirable.

Prerequisite: CHE 535 or permission of instructor

Spring, 0-3 credits, Letter graded (A, A-, B+, etc.)

CHE 541: Biomolecular Structure and Analysis
The structures of biological macromolecules and the relationship of their structure to biological function are described. Methodology employed to study macromolecules is also discussed. Topics include chemical and physical properties of cell and tissue constituents, including carbohydrates, lipids, nucleic acids, proteins and peptides. Prerequisite: Strong foundation in physical and organic chemistry.

Fall, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 542: Chemical Biology
The reactivity and physiological function of biological macromolecules and their cofactors are described at the chemical biochemical level. The emphasis of this course reflects recent advances in chemical biology. Possible topics include catalysts, reaction mechanisms, correlation between three-dimensional structure and reactivity, receptor-ligand interactions in extracellular and intracellular signaling, protein folding in vitro and in vivo.

Spring, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 543: Chemical Approaches to Biology
The use of molecular concepts and methodology to solve problems in biology and medicine. The course covers methods to elucidate and control biological systems. Possible topics include chemical genomics, metabolomics, and chemotherapeutics.

Prerequisite CHE 542

Fall, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 558: Physical Biology
This is a course on the principles of physical chemistry. We describe the nature of the forces and energies and entropies that drive molecular systems toward their states of equilibrium. We consider a broad range of applications throughout chemistry, biology, materials engineering and nanoscience. This course aims to give students an understanding of how the actions and behaviors of materials arise from their atomic and molecular structures. Co-listed with PHY 558

Spring, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 559: Biological Dynamics and Networks
This course will provide a solid foundation in key theoretical concepts for the study of dynamics in biological systems and networks at different scales ranging from the molecular level to metabolic and gene regulatory networks. Topics of this course include but are not limited to: Physical kinetics;
CHE 581: Departmental Research Seminar
Meetings in which first-year graduate students learn about the research activities of the departmental faculty.
Fall, S/U grading

CHE 582: Literature Seminar
Students select and discuss topics from the current literature.
Spring, Letter graded (A, A-, B+, etc.)

CHE 586: Professional Skills for Scientists
Development and refinement of the professional skills used by scientists: An exploration of more sophisticated presentation skills used in oral and poster presentations; incorporation of collaborative problem solving that mimics real world situations, including simple proposal writing; exposure to professional societies and meetings; an exploration of career options and employment resources; tips for resume preparation and interviews. Recommended for upper division undergraduates and masters students. Winter, 2 credits, ABCF Grading
2 credits, Letter graded (A, A-, B+, etc.)

CHE 588: Graduate Workshop
Additional problem solving and team learning on topics from a concurrent formal graduate course. Topics vary.
Fall and Spring, 0-1 credits, S/U grading
May be repeated for credit.

CHE 589: Directed Study
Subject matter varies according to needs of student.
Fall and Spring, 0-12 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 590: M.S. Term Paper
Seminar leading to a term paper on a selected topic in chemistry, chemical applications, or chemical pedagogy.
Fall, Spring, 3 credits, Letter graded (A, A-, B+, etc.)

CHE 591: Chemistry in Society
Includes current trends in chemical research and the influence of chemistry in areas such as the environment and technology. Topics of local interest and the conflicting demands placed on technology will be integrated into the course. Offered in Fall.
3 credits, Letter graded (A, A-, B+, etc.)

CHE 593: Chemical Demonstrations
The design and implementation of demonstrations to illustrate modern concepts of chemistry.
3 credits, Letter graded (A, A-, B+, etc.)

CHE 596: Teaching and Learning Chemistry
The objective of CHE 596 is to better prepare students for the kinds of interactions they are likely to have in their careers when communicating their chemistry. Specifically, this course will help students to: (i) develop competency with research-based approaches to facilitating discourse that is generative for improving scientific understandings of chemistry phenomena; (ii) recognize the importance of representations in chemistry and to incorporate a more explicit modeling perspective and approach for developing scientific literacy; (iii) develop teaching strategies to effectively communicate abstract and complex chemical concepts to advise expert and non-expert audiences; (iv) develop curricular interventions aimed at improving individual and community practice of challenging conceptual ideas; (v) incorporate historical and philosophical perspectives on the development of fundamental chemical principles into the teaching of those topics in diverse settings; (vi) become aware of recent developments in the learning progressions literature to inform understanding of appropriate curriculum planning and implementation; and (vii) develop an identity towards reflective practice and empowerment of fellow chemistry educators into positions of leadership.
3 credits, Letter graded (A, A-, B+, etc.)

CHE 597: M.S. Research Thesis Development
This course provides a structured environment for students to develop their research project into a written thesis. Students will receive instruction and guidance in performing literature research related to their project and in developing this background material along with their own research into a properly written document.
3 credits, S/U grading
May be repeated for credit.

CHE 598: Professional Masters Internship
Participation in private corporations, public agencies, or non-profit institutions for research and other experiential training activities related to the completion of a Master term paper. Students will be required to have a faculty coordinator as well as a contact in the outside organization, to participate with them in regular consultations on the project, and to successfully complete CHE 590. Prerequisites: Permission of Master's Program Director. 0-12 credits, S/U grading May be repeated for credit Offered
Fall, Spring, and Summer, 0-12 credits, S/U grading
May be repeated for credit.

CHE 599: Research
Fall, Spring, 1-12 credits, S/U grading
May be repeated for credit.

CHE 602: Special Topics in Physical Organic Chemistry
The subject matter varies depending on interests of students and staff. It may cover such areas as photochemistry, theoretical organic chemistry, and the chemistry of unstable intermediates; the emphasis is on fundamental considerations and recent developments.
1-12 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 603: Special Topics in Bioorganic Chemistry
The subject matter varies depending on interests of students and faculty. Possible topics include asymmetric synthesis and natural product synthesis.
Fall, 1-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 606: Special Topics in Synthetic Chemistry
May be repeated for credit.
CHE 607: Modern Drug Design & Discovery
A seminar course covering modern aspects and approaches to drug design. This course combines presentations by faculty and by industry representatives to provide a cross-disciplinary view of the development of pharmaceuticals.
Fall, 1-3 credits, Letter graded (A, A-, B+, etc.)

CHE 610: Practicum in Teaching
Practice instruction in chemistry at the undergraduate level, carried out under faculty orientation and supervision. A minimum of two semesters of CHE 610 or 611 is required of all candidates for graduate research degrees in chemistry, unless explicitly waived by the chairperson.
Fall and Spring, 1-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 611: Practicum in Teaching
Practice instruction in chemistry at the undergraduate level, carried out under faculty orientation and supervision. A minimum of two semesters of CHE 610 or 611 is required of all candidates for graduate research degrees in chemistry, unless explicitly waived by the chairperson.
Fall and Spring, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 619: Critical Readings of Current Topics in Chemistry
Recent research papers from the literature will be analyzed in depth. These papers may originate from the inorganic, organic, physical, and/or biochemical literature. The exact topic of the course is announced in advance. Fall and Spring
0-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 625: Molecular Structure and Crystallography
Experimental methods in the determination of molecular structure. The emphasis is on the determination of structure in the solid state, particularly by X-ray crystallography. Students complete a single-crystal molecular structure determination using modern diffractometer techniques.
3 credits, Letter graded (A, A-, B+, etc.)

CHE 641: Organometallic Chemistry
A systematic presentation of the chemistry of organometallic compounds, particularly those of the transition metals. Topics include structure, bonding, reaction mechanisms, synthesis, and applications in catalysis and organic synthesis.
3 credits, Letter graded (A, A-, B+, etc.)

CHE 682: Special Topics in Inorganic Chemistry
Subject matter varies, depending on interests of students and staff, but covers recent developments in inorganic chemistry.
0-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 683: Special Topics in Physical Chemistry
Subject matter varies, depending on interests of students and staff, but covers recent developments and advanced topics in physical chemistry.
3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 690: Internship in Dissertation-Related Research
Supervised curricular training in dissertation-related research. Prerequisite: For full-time: Summer session or advancement to candidacy; Permission of Graduate Program Director.
Fall and Spring, 1-3 credits, S/U grading
May be repeated for credit.

CHE 693: Special Topics in Physical Chemistry
Subject matter varies, depending on interests of students and staff, but covers recent developments in inorganic chemistry.
0-3 credits, Letter graded (A, A-, B+, etc.)
May be repeated for credit.

CHE 695: Inorganic Chemistry Seminar
Fall and Spring, 0-12 credits, S/U grading
May be repeated for credit.

CHE 696: Organic Chemistry Seminar
Fall and Spring, 0-12 credits, S/U grading
May be repeated for credit.

CHE 697: Seminar in Physical and Quantitative Biology
Fall and spring, 0-1 credits, S/U grading.
0-1 credits, S/U grading
May be repeated 1 times FOR credit.

CHE 698: Colloquium
Fall and Spring, 0-12 credits, S/U grading
May be repeated for credit.

CHE 700: Dissertation Research off Campus - Domestic
Prerequisite: Must be advanced to candidacy (G5). Major portion of research will take place off-campus, but in the United States and/or U.S. provinces. Please note, Brookhaven National Labs and the Cold Spring Harbor Lab are considered on-campus. All international students must enroll in one of the graduate student insurance plans and should be advised by an International Advisor.
Fall, Spring, 1-9 credits, S/U grading
May be repeated for credit.

CHE 701: Dissertation Research off Campus - International
Prerequisite: Must be advanced to candidacy (G5). Major portion of research will take place outside of the United States and/or U.S. provinces. Domestic students have the option of the health plan and may also enroll in MEDEX. International students who are in their home country are not covered by mandatory health plan and must contact the Insurance Office for the insurance charge to be removed. International students who are not in their home country are charged for the mandatory health insurance. If they are to be covered by another insurance plan they must file a waiver be second week of classes. The charge will only be removed if other plan is deemed comparable.
All international students must received clearance from an International Advisor.
Fall, Spring, 1-9 credits, S/U grading
May be repeated for credit.

CHE 800: SUMMER RESEARCH
May be repeated for credit.