

CHEMISTRY COURSE OFFERINGS

SPRING, 2018

(09/29/2017)

CHEM 0001-01 - CHEMICAL FUNDAMENTALS W/LAB

Atomic and molecular structure, intermolecular forces and states of matter, the relation of structure and bonding to the physical and chemical properties of matter, patterns of chemical reactions, stoichiometry, and thermochemistry. Additional topics may include qualitative thermodynamics and equilibrium and chemistry of materials. Three lectures, one laboratory, one recitation. Only one of CHEM 1, 11, or 16 may be counted for credit. **Lin**

CHEM 0002-01 & CHEM 0002-02 - CHEMICAL PRINCIPLES W/LAB

Properties of solutions, chemical kinetics and thermodynamics, physical and chemical equilibria, aqueous equilibria (acid-base, precipitation, and complex formation), electrochemistry. Additional topics may include environmental, nuclear, and coordination chemistry, and chemistry of selected elements. Three lectures, one laboratory, one recitation. Only one of CHEM 2 or 12 may be counted for credit. **Kryatov**

Recommendations: *Chemistry 1, 11, 16, or consent*

CHEM 0006-01 – From the Big Bang to Humankind (Cross-listed as BIO 6 and AST 6)

An exploration of the origins of the Universe, the formation of Earth and its structure, the chemistry of life, the development of complex organisms, and the development of modern humans including evidence for the various ideas presented, the scientific method used by scientists, and how the community of scientists evaluate the evidence. This course does not fulfill pre-med requirements for a lab-based chemistry course. **Campbell**

CHEM 0008-01 – ENVIRONMENTAL CHEMISTRY (Cross listed as ENV 8)

An introductory course designed primarily to give non-science majors an appreciation of basic chemical principles underlying the causes of and possible solutions to current environmental problems. The concept of equilibrium in complex systems; thermodynamic limits and kinetic realities. Case studies from current literature. **Kenny**
Recommendations: High-school chemistry.

CHEM 0012-01 - GENERAL CHEMISTRY

Topics covered are the same as in Chemistry 1 and 2, but discussed in greater detail and with a higher degree of mathematical rigor. Designed to provide a strong foundation for advanced courses in chemistry. For well-prepared students intending to be science majors. Some familiarity with elementary calculus concepts assumed. Three lectures, one seminar on frontiers in chemistry, one laboratory, one recitation. 1.5 course credits. Only one of CHEM 1, 11, or 16 and one of CHEM 2 or 12 may be counted for credit. **Pamuk-Turner**

Recommendations: *Score of at least 3 on the AP chemistry exam or permission of instructor; MATH 32 (formerly MATH 11). These courses may be taken concurrently.*

CHEM 0032-01 - PHYSICAL CHEMISTRY II

Four main topics of modern physical chemistry: elementary wave mechanics and chemical bonding, elementary mathematical models for problems in molecular structure, topic in chemical kinetics. **Campbell**

Requires completion of CHEM 0002 or CHEM 0012

CHEM 0034-01 - PHYSICAL CHEMISTRY LAB

Spectroscopic, kinetic, and advanced physical chemistry experiments. One laboratory. One-half course. **Campbell**
Requires completion or same term enrollment of CHEM 0032.

CHEM 0042-01 – QUANTITATIVE ANALYSIS

Introduction to the methods and scientific basis of quantitative analysis including sampling, error & statistical analyses, data treatment & presentation, basic concepts and operation of chromatographic, electroanalytical, and spectroscopic instrumentation. For chemistry and life science majors, as well as students enrolled in environmental studies and engineering. The course will provide students in chemistry or any related discipline with the necessary foundation, understanding, and basic tools for doing good science. Two lectures, two laboratories. 1.5 courses. **Kounaves**
Requires completion of CHEM 0002 or CHEM 0012.

CHEM 0052-01 - ORGANIC CHEMISTRY I I

Continuation of CHEM 51. Structure, properties, and reactions of alkenes, alkynes, conjugated unsaturated systems and aromatic compounds. Radical reactions. Mechanisms, retrosynthetic analysis and synthetic strategy. Additional topics such as the chemistry of carbohydrates, lipids, amino acids, and nucleic acids. Two 75-minute lectures, one recitation. One course. (Note: The laboratory course, CHEM 54, is normally taken concurrently with CHEM 52.) **Thomas**
Prerequisites: CHEM 0051.

CHEM 0054-01 - ORGANIC CHEMISTRY II LABORATORY

Experiments based on topics in Chemistry 52. One laboratory, one lecture. One-half course. **Stolow**
Requires completion of CHEM 0053

CHEM 0094-01 – SPECIAL TOPICS - SCIENCE AND THE HUMAN EXPERIENCE

For non-chemistry majors – does not count towards the chemistry and undergraduate major. **Garlick**

CHEM 0131-01 – STATISTICAL THERMODYNAMICS

Entropy and principles of probability. Maxwell-Boltzmann statistics, heat, work, energy and chemical driving forces. Fermi Dirac statistics, counting of states and conduction. Calculation of chemical potential and equations of state from models and fundamental constants. Determination of equilibrium and transport properties. Applications may include Coulombic interactions and electrochemistry, binding and catalysis. Discussion of water and aqueous solutions. **Shultz**
Recommendations: CHEM 031 and 032, MATH 42 (formerly MATH 13), MATH 51 (formerly MATH 38) recommended.

CHEM 0132-01 – CHEMICAL KINETICS AND DYNAMICS

Study of chemical reaction rates in the gas phase and solution. Topics include kinetic models, experimental methods, molecular reaction dynamics, kinetic theory of gases, potential energy surfaces, and transition state theory. **Utz**
Recommendations: CHEM 32 or permission of instructor.

CHEM 0142-01 – ADVANCED ANALYTICAL METHODS

Student-led case studies of modern analytical instrumentation and its application to chemically-related problems in a broad variety of research areas such as environmental, materials, biomedical, and others. Course requires in-depth oral and written presentations based on recently published literature. **Kounaves**
Recommendations: Chemistry 42 or 141, or consent.

CHEM 0144-01 – SPECTROSCOPIC METHODS OF ANALYSIS

Spectroscopic analytical techniques, including principles and applications of spectroscopic measurements, fundamental interaction of radiation and matter, emission spectroscopy, atomic absorption, UV-visible fluorescence, Fourier transform IR, X-ray techniques, mass spectroscopy, and surface techniques such as AES, ESCA, and SIMS. Three lectures.

Robbat

Recommendations: CHEM 42 or 141, or permission of instructor.

CHEM 0151-01 – PHYSICAL ORGANIC CHEMISTRY

Advanced organic chemistry with emphasis on structure and reaction mechanisms, uses of kinetics and other physical methods, and dynamic interaction between current theoretical concepts and experiment. Three lectures. **Stolow**

Recommendations: CHEM 52

CHEM 0152-01 – ADVANCED ORGANIC SYNTHESIS

Study of noteworthy syntheses of complex molecules with a view to developing a rationale and methodology for synthesis. Examination of the mechanism and scope of new bond-forming methods and functional group transformations. Three lectures. **Bennett**

Recommendations: CHEM 0052

CHEM 0157-01 – MEDICINAL CHEMISTRY

Molecular-level mechanism of action of compounds useful in human medicine. Introduces the biochemistry of a biological system relevant to a particular disease process, then focuses on the detailed interaction of chemotherapeutic agents with the system. Material is drawn principally from the primary literature. Course is not comprehensive. Topics may include antiviral/antitumor agents, compounds affecting immunity and inflammation, antibiotics, nucleic-acid-based therapeutics, and combinatorial drug discovery methods. **Kumar/Pamuk**

Recommendations: BIO 13 and CHEM 52.

CHEM 0165-01 – PHYSICAL METHODS IN INORGANIC CHEMISTRY

Spectroscopic methods in inorganic and coordination chemistry: UV-Vis, infrared, Raman, electron paramagnetic resonance, nuclear quadrupole resonance, Mossbauer spectroscopy. Multinuclear NMR, NMR of paramagnetic compounds. Magnetism applications of different methods to electronic structure determination and to studies on complexation in solution. X-ray crystallography. **Haas**

Recommendations: CHEM 61 or 161, or permission of instructor.

CHEM 0171-01 – BIOCHEMISTRY I (Cross-listed as BIO 0171)

Structure and function of proteins, nucleic acids, carbohydrates, and lipids. Mechanisms and molecular function of binding proteins, enzymes, and membrane transporters. In-depth explorations of metabolic pathways and regulation with connections to physiology and human disease. **Scheck**

Prerequisites: CHEM 51 or two semesters of organic chemistry taken elsewhere; BIO 13 recommended.

CHEM 0192-01 - SEMINAR IN CHEMISTRY

Discussion of specialized problems and current chemical research. Credit 0.5 per course, only may be counted once toward a graduate degree. Undergraduate students taking this course will receive a Pass/Fail grade with 0.0 credit. This course does not count toward an undergraduate major in Chemistry. **Scheck/Lin**

Recommendations: Open to qualified advanced students in chemistry.

CHEM 0194-01/0248-01 – SPECIAL TOPICS IN ANALYTICAL CHEMISTRY: ANALYSIS OF LIVING SYSTEMS

Selected topics of contemporary interest in analytical chemistry. Three lectures. Two courses. *Mace*

CHEM 0194-02/0268-01 – SPECIAL TOPICS IN INORGANIC CHEMISTRY: Frontiers in Inorganic Reactivity and Catalysis

Selected topics of contemporary interest in inorganic chemistry. Three lectures. Two courses. *Rybak-Akimova*

Prerequisite: Consent

CHEM 0292-01 - PROF SKILLS IN CHEMICAL RESEARCH, TRAINING AND LEARNING

This two-semester course provides instruction and training in "soft skills" critical to students' professional success in chemical research and teaching. Topics include: successful TAing, selecting a research group, finding mentors, scientific writing, efficient experimentation strategies, public speaking, approaches for study topic and original proposal success, literature management, thesis preparation, communication of science to the public, careers in science, involvement in the local scientific community and outreach. Responsible conduct of research (RCR) issues such as: conflicts of interest, responsible authorship and peer review, research misconduct, collaborative science, and data acquisition and management are also covered as part of this course. These topics are discussed in the context of chemistry research and the Tufts Chemistry Doctoral Program. Assessment includes Q&A sessions and case study based quizzes. Chem 291 (Fall) and Chem 292 (Spring) comprise a two-semester course sequence required for all Chemistry doctoral students." *Sykes*