

## CHEMISTRY COURSE OFFERINGS

### FALL, 2019

**CHEM 0001-01 & 0001-02 Chemical Fundamentals with Lab.** Atomic and molecular structure, chemical nomenclature, intermolecular forces and states of matter, the relation of structure and bonding to physical and chemical properties of matter, patterns of chemical reactions, stoichiometry, thermochemistry, and properties of solutions. Three lectures, one laboratory, one recitation. Only one of Chemistry 1, 11, or 16, may be counted for credit. *Kryatov*

**CHEM 0002-01 & 0002-02 Chemical Principles with Lab.** Chemical kinetics and thermodynamics, physical and chemical equilibria, aqueous equilibria (acid-base, precipitation, and complex formation), electrochemistry, introduction to organic chemistry (families of organic compounds, basic stereochemistry and nomenclature). Additional topics may include environmental, nuclear, coordination chemistry; chemistry of selected elements; and introduction to biological chemistry. Three lectures, one laboratory, one recitation. *Campbell, Davis*

**Prerequisite:** Chemistry 1, 11, 16, or consent. Only one of Chemistry 2 or 12 may be counted for credit.

**CHEM 0011 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. Only one of Chemistry 1, 11, or 16 and one of Chemistry 2 or 12 may be counted for credit. *Pamuk-Turner*

**Prerequisites:** Score of at least 3 on the AP chemistry exam or consent; Mathematics 32 (may be taken concurrently).

**CHEM 0031 Physical Chemistry I.** Fundamental principles of chemical thermodynamics and kinetics and their application to the energetics and rates of chemical reactions in the gaseous and solution states. *Utz*

**Prerequisites:** Chemistry 2 or 12, Mathematics 34 or equivalent, and Physics 2, 4, or 12, or consent. (Physics may be taken concurrently.) Fall.

**CHEM 0033 Beginning Physical Chemistry Laboratory.** Thermodynamic, kinetic, and electrochemical experiments. One laboratory. *Campbell*

**Prerequisites:** Chemistry 31 or concurrent registration.

**CHEM 0043 Bioanalytical Chemistry.** Characterization, separation, detection, identification, and quantification of analytes in complex biological samples. Alternative to CHEM 0042 (Quantitative Analysis), but designed for students majoring in biochemistry or with interests in biotechnology, chemical biology, and biomedical engineering. Modern instrumentation, experimental methodology, and data analysis in a hands-on laboratory environment supported by a formal lecture to introduce fundamental concepts and reinforce experimental design and methods in data interpretation and error analysis. Three lectures, one laboratory. *Mace*

**Prerequisites:** Chemistry 171 or Biology 152.

**CHEM 0051 Organic Chemistry I.** Structure, bonding, conformational analysis, functional groups, and stereochemistry. Organic reactions, synthesis, and mechanisms including acid/base reactions, nucleophilic substitution and elimination, reactions of alcohols, ethers, aldehydes, ketones, carboxylic acids and their derivatives, and amines. Tools for structure determination including nuclear magnetic resonance and infrared spectroscopy. Two 75-minute lectures, one recitation. (Note: The laboratory course, CHEM 53, is normally taken concurrently with CHEM 51.) **Kritzer**

**Prerequisites:** CHEM 2 or 12.

**CHEM 0053 Organic Chemistry Laboratory I.** Experiments based on topics in Chemistry 51. One laboratory, one lecture. **Stolow**

**Co-requisite or prerequisite:** Chemistry 50 or 51.

**CHEM 0061 Inorganic Chemistry.** Chemistry illustrative of the kinds of bonding in inorganic compounds, including discussions of ionic, covalent, electron-deficient, and coordination compounds. Three lectures. Only one of Chemistry 61 or 161 may be taken for credit. **Haas**

**Prerequisites:** Chemistry 31 and 52.

**CHEM 0063 Inorganic and Synthetic Chemistry Laboratory.** Experiments include those based on topics in Chemistry 61. Techniques in synthesis, spectroscopy, and reactivity studies. Applications of inorganic compounds in synthesis, catalysis, materials sciences, and biology. One laboratory, one lecture. **Haas**

**Prerequisites:** Chemistry 61 or 161.

**CHEM 0081 Research I. (Previously CHEM 91)** Training in the methods of chemical research. Frequent conferences and library assignments. Open to qualified advanced students. Requires at least fifteen hours per week of laboratory and/or other research work in chemistry during the fall or spring semesters, or 35-40 hours per week during the summer sessions. Pass-fail grading.

**CHEM 0082 Research II. (Previously CHEM 92)** Continued training in the methods of research. Requires at least fifteen hours per week of laboratory and/or other research work in chemistry during the fall or spring semesters, or 35-40 hours per week during the summer sessions. Students write a report of research accomplished.

**Recommendations:** CHEM 81 and permission of instructor.

**CHEM 0083-0088 Research III-VIII.** Continued training in the methods of research. Requires at least fifteen hours per week of laboratory and/or other research work in chemistry during the fall or spring semesters, or 35-40 hours per week during the summer sessions. Students write a report of research accomplished.

**Recommendations:** permission of instructor. Courses must be taken in numerical order, starting with CHEM 81.

**CHEM 0133 Quantum Mechanics.** Covers Schrödinger equation and basic quantized systems, statistical interpretation and uncertainty, perturbation theory, scattering, symmetries and invariance, approximation methods, energy calculations. **Shultz**

**Prerequisite:** Chemistry 32; Mathematics 51 recommended.

**CHEM 0135 Biophysical Chemistry.** Thermodynamics of biochemical systems, biochemical and biological dynamics, biochemical spectroscopy and structure determination, statistical thermodynamics and transport properties, electrochemistry in the biological context, and membrane biophysics. Three lectures. *Lin*

**Prerequisites:** Chemistry 52 and 31.

**CHEM 0141 Instrumental Analysis.** Theory, operation, and application of principal instruments used in chemical analysis and research. Selected special topics such as molecular, atomic, and mass spectroscopies; electrochemistry; and chromatography are included. Designed to acquaint the student with modern laboratory techniques used in all areas of chemistry. Students will select an analytical project of their choosing (with instructor approval) incorporating analytical metrics of precision, accuracy, selectivity, and sensitivity as well as develop experiments and questions that relate theory to experimental data. *Robbat*

**Recommendations:** Chemistry 31, 42, and 51, or consent.

**CHEM 0150 Intermediate Organic Chemistry.** Survey of the principles of organic chemistry. Topics include reaction mechanisms, synthesis, and spectroscopic methods of structure determination. Three lectures. *Scheck*

**Prerequisite:** Chemistry 52.

**CHEM 0152 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*

**Prerequisite:** Chemistry 52.

**CHEM 0155 Organic Spectroscopy.** Applications of NMR, IR, UV, and mass spectrometry to the identification of organic compounds. Three class meetings. *Stolow*

**Prerequisite:** Chemistry 52.

**CHEM 0161 Advanced Inorganic Chemistry.** Atomic and molecular structure. Symmetry operations and symmetry point groups. Chemical bonding in inorganic and coordination compounds. Types of inorganic reactions and their mechanisms. Reactivity of major classes of inorganic compounds. Descriptive chemistry of selected main-group elements. More rigorous than Chemistry 61. May receive credit for only one of Chemistry 61 or 161. *Haas*

**Prerequisites:** Chemistry 32 and 52.

**CHEM 0172 Advanced Biochemistry.** Understanding human health and disease at the molecular level. Synthesis and breakdown of carbohydrates, lipids, amino acids, nucleic acids, and proteins. Molecular understanding of human metabolism and cellular signaling. Special topics in modern biomedical science. *Pamuk-Turner*

**Prerequisite:** Chemistry 171.

**CHEM 0195 Senior Thesis I.** Intensive research investigation, to be combined with Chemistry 0199 leading to a written thesis. At least 20 hours per week of research work is required. Application is made during the sixth or at the start of the seventh semester.

**Prerequisites:** At least one summer or semester of research prior to the senior year, senior standing as a major in chemistry, biochemistry, ACS certified chemistry, or chemical physics, and department approval.

**CHEM 0291 Professional Skills in Chemical Research.** Topics will include: joining a research group, scientific writing, public speaking, study topic and original proposal success, literature management, thesis preparation, research group specific safety, shipping of chemicals, public communication, careers in science, involvement the local scientific community, and outreach. **Sykes**

**Prerequisites:** Permission of instructor