List of Approved Advanced Electives for the Chemistry Degree*:

Pay careful attention to prerequisites when choosing Advanced Electives.

Chemistry Courses:

CH 410. Application of Quantum Chemistry. 4 Credits. This course provides and overview of contemporary computational chemistry techniques used to model both single molecule and extended solids. Computations will be conducted on the new University of Oregon super computer, Talapas.

CH 410. Design Principles of Dynamic Biological Systems. 4 Credits. In this course, we will discuss major technological advances over the past 30 years that accelerated scientific discovery at the interface between cell biology and biochemistry. Emphasis will be placed on defining the relationships between protein structure, function, and emergent properties in complex biological systems. Pre req CH 461; MATH 253.

CH 410. Materials Chemistry. 4 Credits.

CH 410. Science/Policy Interface. 4 Credits. This interdisciplinary (PHYS/CH) course has been developed around the use of science and scientific principles to produce better public policy outcomes on real world issues such as climate change, resource management, energy policy, environmental pollution, medical ethics, etc. Strong focus on improving skills for effectively communicating science to the policy world.

CH 410. Single-Molecule Methods. 4 Credits. In this course, students will learn about a variety of approaches used to interrogate single molecules, including techniques based on fluorescence, force, and current, and methods that utilize single molecules as raw materials for devices. We will discuss the theory behind these techniques as well as practical considerations for applying them hands-on. In addition, we will discuss specific studies that utilized single-molecule methods to probe systems ranging from model systems designed to investigate fundamental physical processes, to complex and dynamic biological machines. By studying both the fundamentals and applications of single-molecule methods, students will gain the ability to determine when such methods may be of use in their own research.

CH 420. Physical Organic Chemistry I. 4 Credits. Modern physical organic chemistry including chemical bonding, acid-base chemistry, thermochemistry, noncovalent interactions, and introduction to computational chemistry. Sequence with CH 421/521. Prereq: CH 336 or CH 341.

CH 421. Physical Organic Chemistry II. 4 Credits. Modern physical organic chemistry including tools to study reaction mechanisms, kinetic analysis, isotope effects, and qualitative molecular orbital theory. Sequence with CH 420/520. Prereq: CH 420.

CH 431. Inorganic Chemistry. 4 Credits. Introduction to group theory for molecular symmetry; syntheses, structures, reactions, and reaction mechanisms of coordination complexes and organometallic complexes.

CH 432. Inorganic Chemistry. 4 Credits. Bioinorganic chemistry: metals in biological systems; coordination chemistry, reactions, spectroscopy, metalloclusters, and synthetic modeling. Prereq: CH 431.

CH 433. Inorganic Chemistry. 4 Credits. Solid-state inorganic chemistry: solid-state structure and its determination; the electrical, magnetic, and mechanical properties of materials and their physical description. Prereq: CH 431.

CH 441. Quantum Chemistry. 4 Credits. The principles of time-independent quantum mechanics and their application to model atomic and molecular systems. Prereq: CH 413.

CH 442. Quantum Chemistry and Spectroscopy. 4 Credits. Molecular structure theory, perturbation theory, time-dependent quantum mechanics, theory of spectra, selection rules. Prereq: CH 441.

CH 443. Quantum Chemistry and Spectroscopy. 4 Credits. Experimental spectra of atomic and molecular systems and surfaces. Prereq: CH 442.

CH 444. Chemical Thermodynamics. 4 Credits. The laws of thermodynamics and their applications, including those to nonideal chemical systems. Prereq: CH 413.

CH 445. Statistical Mechanics. 4 Credits. Molecular basis of thermodynamics. Applications to the calculation of the properties of noninteracting and weakly interacting systems. Prereq: CH 413.

CH 446. Chemical Kinetics: [Topic]. 4 Credits. Repeatable. Description and interpretation of the time evolution of chemical systems. Prereq: CH 413.

CH 447. Computational Chemistry. 4 Credits. Introduction to modern computational methods used to understand the properties of molecules. Prereq: CH 411, 412; or PHYS 353.

CH 451. Advanced Organic-Inorganic Chemistry. 4 Credits. Principles of organic-inorganic reaction dynamics; kinetics and mechanisms, linear free-energy relationships, isotope effects, substitution reactions, dynamic behavior of reactive intermediates, electron transfer chemistry. Prereq: CH 336 or CH 341.

CH 452. Advanced Organic Chemistry—Stereochemistry and Reactions. 4 Credits. Principles and applications of stereochemistry; reagents and reactions, with mechanisms, used in contemporary organic synthesis; examples taken from the current literature.

CH 454. Advanced Electrochemistry 4 Credits. Advanced topics in electrochemistry including fundamental concepts (thermodynamics, kinetics, transport) and applications (analytical techniques, electrolysis, batteries).Prereq: CH 411.

CH 461. Biochemistry. 4 Credits. Structure and function of macromolecules. Exposure to calculus and physical chemistry recommended. Prereq: CH 336 or CH 343.

CH 462. Biochemistry. 4 Credits. Metabolism and metabolic control processes. Energy and sensory transduction mechanisms. Prereq: CH 461.

CH 463. Biochemistry. 4 Credits. Mechanisms and regulation of nucleic acid and protein biosynthesis. Other current topics in biochemical genetics. Prereq: CH 461/561; or CH 360 with a grade of B- or better.

CH 464. RNA Biochemistry. 4 Credits. Introduction to the diverse field of RNA biochemistry. Prereq: CH 463 or BI 320.

CH 465. Physical Biochemistry. 4 Credits. Physical chemical properties of biological macromolecules; forces and interactions to establish and maintain macromolecular conformations; physical bases of spectroscopic, hydrodynamic, and rapid-reaction investigative techniques. Offered alternate years. Prereq: CH 461.

CH 466. Structural Biochemistry. 4 Credits. Protein and nucleic acid structures and energetics. Structure determination by x-ray crystallography and nuclear magnetic resonance. Computational methods for structural analysis. Offered alternate years. Prereq: CH 461.

CH 467. Biochemistry Laboratory. 4 Credits. Methods of modern molecular biology and protein purification. Prereq: CH 461

Geology courses:

GEOL 471. Thermodynamic Geochemistry. 4 Credits. Introduction to geologic application of classical chemical thermodynamics. Gibbs free energy and its temperature, pressure, and composition derivatives; fugacity, activity, and chemical potential. Solutions, ideal and nonideal. Prereq: GEOL 311 or 332, CH 223, MATH 253.

GEOL 472. Aqueous-Mineral-Gas Equilibria. 4 Credits. Aqueous chemistry applied to natural waters (geothermal, diagenetic, continental brines). Equilibrium calculations applied to aqueous-mineral-gas systems. Prereq: CH 223; MATH 252.

GEOL 473. Isotope Geochemistry. 4 Credits. Introduction to nuclear physics and isotope systematics; techniques of isotope analysis; applications of stable and radioactive isotopes in geochronology and as tracers of geological processes.

Physics courses:

PHYS 411. Mechanics, Electricity, and Magnetism. 4 Credits. Fundamental principles of Newtonian mechanics, conservation laws, small oscillations, planetary motion, systems of particles. Electromagnetic phenomena. Series. Prereq: MATH 282.

PHYS 412. Mechanics, Electricity, and Magnetism. 4 Credits. Fundamental principles of Newtonian mechanics, conservation laws, small oscillations, planetary motion, systems of particles. Electromagnetic phenomena. Series. Prereq: MATH 281.

PHYS 413. Mechanics, Electricity, and Magnetism. 4 Credits. Fundamental principles of Newtonian mechanics, conservation laws, small oscillations, planetary motion, systems of particles. Electromagnetic phenomena. Series. Prereq: PHYS 412.

PHYS 414. Quantum Physics. 4 Credits. Planck's and de Broglie's postulates, the uncertainty principle, Bohr's model of the atom, the Schroedinger equation in one dimension, the harmonic oscillator, the hydrogen atom, molecules and solids, nuclei and elementary particles. Sequence. Prereq: PHYS 413.

PHYS 415. Quantum Physics. 4 Credits. Planck's and de Broglie's postulates, the uncertainty principle, Bohr's model of the atom, the Schroedinger equation in one dimension, the harmonic oscillator, the hydrogen atom, molecules and solids, nuclei and elementary particles. Sequence. Prereq: PHYS 414

Note: Check with the appropriate department to determine when any specific course will be offered.

** Other courses may be submitted for consideration and approval by the department*