Contact

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Course Descriptions - Chemistry

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CHEM 111 General Chemistry I 3R-4L-4C F Pre: None
The chemistry of matter. A laboratory-driven course which covers states of matter, equilibrium, solutions, and ionic equilibria. Assumes a working knowledge of algebra.

CHEM 112 General Chemistry Honors 4R-3L-5C F Pre: Advanced placement
An accelerated course covering topics in CHEM 111 and CHEM 113. An additional 3 credits will be awarded students with a grade of B or better. Enrollment is limited to those students who complete the chemistry Advanced Placement Examination with a score of 4 or who qualify on the basis of a chemistry placement examination given prior to the freshman orientation period.

CHEM 113 General Chemistry II 3R-3L-4C W Pre: CHEM 111
The chemistry of energy. A laboratory and reading-driven course which covers simple thermodynamic considerations, electrochemistry, chemical kinetics, and nuclear chemistry.

CHEM 115 General Chemistry III 3R-3L-4C W, S Pre: CHEM 113 or CHEM 112 or CHEM 202
A treatment of atomic structure and theories as they apply to the periodic properties of the elements. Chemical bonding and molecular geometry are also studied. The laboratory provides descriptive chemistry and logic in designing separation schemes for qualitative analysis.

CHEM 201 Engineering Chemistry I 3R-3L-4C F,W,S Pre: MA 111
Topics include stoichiometry, nomenclature, reactions in aqueous solution including balancing oxidation-reduction reactions, atomic structure and periodic properties. Chemical bonding including Lewis dot structures, molecular geometry, and molecular orbital theory are considered in relation to the properties of solids, liquids, solutions and gases. Chemical kinetics along with the Arrhenius equation and nuclear reactions is covered. Not available for students who have credit for CHEM113.

CHEM 202 Engineering Chemistry II 3R-3L-4C W,S Pre: CHEM 201
Heterogeneous and homogeneous equilibria for gas-phase, solution phase, and acid/base reactions are covered. Electrochemistry, thermochemistry, and thermodynamics are also covered. Not available for students who have credit for CHEM 113.

CHEM 225 Analytical Chemistry I 3R-4L-4C F, S Pre: CHEM 115 or CHEM 202
This laboratory-driven course is an introduction to classical and modern quantitative analysis with emphasis on calculations, separations, and precise and accurate measurements. Theoretical and practical perspectives of chemical analysis are considered. Chemical instrumentation includes recording pH/mV meters, constant rate burets, colorimeters, spectrophotometers, high performance liquid chromatographs and gas-liquid chromatographs.

CHEM 230 Introduction to Organic Chemistry and Biochemistry 4R-0L-4C F Pre: CHEM 202 or CHEM 115
An introduction to the concepts of organic chemistry as they apply to biochemistry, including stereochemistry, nomenclature, and aqueous organic

chemical reactions. Covers essential organic chemistry, including nomenclature, functional groups, and basic reactions. Introduces the fundamental molecules of biochemistry, including amino acids, nucleotides, carbohydrates, and lipids. Students may not receive credit for both CHEM 230 and CHEM 251.

CHEM 241 Descriptive Inorganic Chemistry lR-3L-2C W Pre: CHEM 115 or CHEM 202

A survey of the properties and chemical reactions of the elements and their compounds. Basic principles of inorganic chemistry which are useful for predicting and explaining these properties and reactions are explored.

CHEM 251 Organic Chemistry I 3R-4L-4C F Pre: CHEM 115 or CHEM 202

An introduction to the classification of organic compounds, their structural features, including stereochemistry, and the methods used to determine structure, including IR and NMR spectroscopy; concepts related to reaction mechanisms and synthetic methods are introduced.

CHEM 252 Organic Chemistry II 3R-4L-4C W Pre: CHEM 251

Continuation of Organic Chemistry I with greater emphasis on reaction mechanisms and synthesis.

CHEM 253 Organic Chemistry III 3R-4L-4C S Pre: CHEM 252

Study of carbanions, classical and non-classical carbocations, polyfunctional compounds, heterocyclics, orbital symmetry and more advanced reaction mechanisms, molecular rearrangements and syntheses.

CHEM 264 Introduction to Environmental Science 4R-0L-4C W Pre: CHEM 111 or CHEM 201 or consent of instructor

This course will introduce students to the broad field of environmental science by examining the biological, chemical, and physical processes that regulate the earth□s ecosystems and the effect that anthropogenic activity has in disrupting these components on the local and global scale. A final aspect of the course will discuss sustainable human utilization of natural resources. Cross-listed with AB264.

CHEM 270 Geology and the Engineer: An Introduction 4R-0L-4C S Pre: CHEM 111 or CHEM 201

Physical, historical, chemical, structural and environmental aspects of earth science addressed from an engineer□s perspective. The study of minerals and rocks, investigation of geologic hazards and interpretation of topographic maps, geologic maps and aerial photographs will be applied on local field excursions.

CHEM 275 Special Topics in Chemistry (1-4)R-0L-(1-4)C Pre: Permission of instructor

Studies in topics of current chemical interest not addressed in other named courses.

CHEM 276 Directed Laboratory Study in Chemistry 0R-3L-1C F Pre: Consent of instructor

Laboratory studies designed to supplement the background of entering students with an exceptional high school background in chemistry. This course is recommended for students entering with an AP 5 score.

CHEM 290 Chemical Research 0R-(4-8)L-(1-2)C

Research under the direction of a member of the faculty selected by mutual agreement. Freshman and/or sophomore students may earn up to 2 credits and are required to submit a written report to the chemistry faculty.

CHEM 301 Chemical Literature 2R-0L-2C F

Introduces students to the use of primary, secondary and tertiary literature sources, and the use of online searching techniques.

CHEM 304 Glassblowing 1R-3L-1C S Pre: Chemistry majors only or consent of instructor

A laboratory course in the manufacture, use and repair of scientific glassware. Six types of seals are constructed; a student-designed project is required.

CHEM 326 Analytical Chemistry II 3R-4L-4-C F Pre: CHEM 225

Addresses spectroscopic methods of chemical analysis including instrument design, operating principles, theory and application. Topics include atomic and molecular absorption and luminescence methods in the infrared, visible, ultraviolet and X-ray regions.

CHEM 327 Analytical Chemistry III 3R-4L-4-C W Pre: CHEM 225

Addresses separations and electroanalytical methods of chemical analysis including instrumentation, theory and application. Separation techniques include gas and liquid chromatography and electrophoresis. Electroanalytical methods include potentiometry and voltammetry.

CHEM 330 Biochemistry 4R-0L-4C W Pre: CHEM 252 or CHEM 230

Includes the structure and function of biological molecules, the storage and transmission of genetic information, and the reactions, strategy and regulation of metabolic pathways.

CHEM 360 Introduction to Physical Chemistry for Engineers 3.5R-2L-4C W, S Pre: CHE 303 and CHE 304

Introduction to statistical thermodynamics, electrochemistry, chemical kinetics, surface chemistry and colloid science. The laboratory will meet for 4 hours alternate weeks and will investigate topics associated with chemical kinetics and surface phenomena.

CHEM 361 Physical Chemistry I 4R-2L-4C F Pre: CHEM 115 or CHEM 202, and MA 221

Covers the laws of thermodynamics, free energy, gases, phase equilibria and solutions. Emphasizes the applications of differential and integral calculus and includes an introduction to statistical thermodynamics and surface chemistry. The laboratory will meet for 4 hours on alternate weeks and will investigate topics associated with thermodynamics and phase equilibrium.

CHEM 362 Physical Chemistry II 3R-2L-4C W Pre: CHEM 361

Covers chemical equilibria, statistical mechanics, kinetics and electrochemistry. The laboratory will meet for 4 hours on alternate weeks.

CHEM 363 Quantum Chemistry & Molecular Spectroscopy 4R-0L-4C S Pre: CHEM 115 or CHEM 201, MA 221, PH 112

Covers elementary quantum mechanics with emphasis on applications in molecular structure.

CHEM 401 Chemistry Seminar I 1R-0L-0C F

Students will attend the chemistry department□s seminar series. The class may also spend time on career issues, such as resume writing, interviewing and job-searching methods.

CHEM 402 Chemistry Seminar II 1R-0L-0C W

Students will attend the chemistry department□s seminar series. The class may also spend time on career issues, such as resume writing, interviewing and job-searching methods.

CHEM 403 Chemistry Seminar III 1R-0L-1C S

Students will prepare and deliver a professional seminar to chemistry faculty and students. Students will also prepare resumes and practice job interviews.

CHEM 410 Introduction to MEMS: Fabrication and Applications 3R-3L-4C S Pre: JR or SR standing

Properties of silicon wafers; wafer-level processes, surface and bulk micromachining, thin-film deposition, dry and wet etching, photolithography,

process integration, simple actuators. Introduction to microfluidic systems. MEMS applications: capacitive accelerometer, cantilever and pressure sensor.

CHEM 411 Advanced MEMS: Modeling and Packaging 3R-3L-4C F Pre: PH410 or equivalent course

Design process, modeling; analytical and numerical. Actuators; dynamics and thermal issues. Use of software for layout and simulation. Characterization and reliability of MEMS devices. Electrical interfacing and packaging of MEMS. Microsensors, microfluidic systems, applications in engineering, biology, chemistry, and physics.

CHEM 428 Environmental Analysis Methods (2R-8L-4C) Pre: CHEM 225 or permission of instructor

Environmental Protection Agency (EPA) procedures, American Standard Testing of Methods (ASTM), or other standard methods will be surveyed and used to analyze authentic samples. Students will use modern analytical and computerized instruments and will make decisions about procedures and optimal experimental conditions and they will assess the reliability and validity of their data. Classroom presentations will be directly related to the laboratory experience.

CHEM429 / CHEM529 Environmental Analysis and Remediation Strategies (4R-0L-4C) Pre: junior or higher standing

Environmental Protection Agency (EPA) procedures, American Standard Testing of Methods (ASTM), and current methods proposed in the literature will be surveyed. Method development and decision making matrices will be emphasized. Sampling protocols, remediation strategies, such as phytoremediation and bioremediation, chemometrics, and analysis techniques, such as supercritical extraction, capillary electrophoresis, biochemical microchip sensors, chromatographic methods, etc., will be discussed. [Concurrent laboratory experience may involve CHEM.476.]

CHEM 430 Advanced Biochemistry 4R-0L-4C S Pre: CHEM 330

Relationship between chemical structure and biological function. Metabolism, with emphasis on chemical motifs.

CHEM 433 Biochemistry Laboratory 0R-4L-lC S Coreq: CHEM 430

Fundamental techniques employed in isolation, characterization and study of biomolecules, and enzyme kinetics. Techniques used may include homogenization, solvent extraction, centrifugation, salt fractionation, chromatography, and electrophoresis.

CHEM 441 Inorganic Chemistry I 4R-0L-4C F Pre: CHEM 252 and CHEM 362

The chemistry of non-metals. This course consists of a systematic study of the properties and reactions of the elements and their compounds based upon modern theories of the chemical bond, as well as from the viewpoint of atomic structure and the periodic law.

CHEM 442 Inorganic Chemistry II 3R-4L-4C W Pre: CHEM 441

The chemistry of metals. Modern theories such as valence bond, molecular orbital, electrostatic and ligand field are used to explain the properties of complex ions. Synthesis and characterization of complexes are done in the lab.

CHEM 445 Organometallic Chemistry 4R-0L-4C S Pre: CHEM 252

A survey of the chemistry of main group organometallic compounds and organo-transition metal complexes. Reaction mechanisms and uses in organic synthesis and catalysis are studied.

CHEM 451 Organic Structure Determination 2R-8L-4C S Pre: CHEM 253 or permission of instructor

Chemical and spectroscopic identification of organic compounds. Study of nuclear magnetic resonance and mass spectrometry, infrared spectroscopy and other techniques applied to structure elucidation and stereochemistry.

CHEM 452 Synthetic Organic Chemistry 4R-0L-4C F or W Pre: CHEM 253

A survey of contemporary methodology in organic synthesis. Retrosynthetic analysis, functional group transformations, condensation chemistry, and organometallic reagents will be stressed. Includes computer assisted synthesis.

CHEM 454 Theoretical Organic Chemistry 4R-0L-4C W Pre: CHEM 253 and CHEM 361 or permission of instructor

Study of physical and chemical methods used to investigate organic reaction mechanisms; the chemistry of carbenes; organic photochemistry.

CHEM 455 Natural Products 4R-0L-4C Pre: CHEM 253 or permission of instructor

A study of naturally occurring materials such as carbohydrates, lipids, amino acids, terpenes and steroids. The course also entails a discussion of synthesis, biosynthesis, structure elucidation, selected degradation and other reactions as well as some medicinal characteristics of selected natural products.

CHEM 457 Synthetic Polymer Chemistry 4R-0L-4C Pre: CHEM 252

Polymer synthesis, reactions, and applications. Organic chemistry of polymer synthesis and modification. Design of polymer systems that meet certain performance criteria or have desirable physical properties.

CHEM 461 Advanced Physical Chemistry 4R-0L-4C Pre: CHEM 363

Addresses a variety of topics in quantum mechanics, statistical thermodynamics or kinetics.

CHEM 462 Physical Polymer Chemistry 4R-0L-4C Pre: CHEM 252

Physical behavior of polymers. Physical properties, molecular weight determination, relationship between morphology and mechanical properties.

CHEM 465 Environmental Organic Chemistry 4R-0L-4C Pre: CHEM 251 or CE 564 or consent of instructor

This course will examine the processes that control the fate of organic contaminants in the environment. Course topics include applying chemical thermodynamics to understand environmental fate, aqueous solubilities, partitioning behavior into various environmental compartments, sorption behavior, and the mechanisms and kinetics of some important abiotic transformations.

CHEM 470 Special Topics in Chemistry (1-4)R-0L-(1-4)C F, W, S Pre: permission of instructor

Studies in advanced topics of current chemical interest not addressed in other named courses.

CHEM 476 Directed Laboratory Study in Chemistry 0R-4L-1C F, W, S Pre: To be taken concurrently with the appropriate elective not accompanied by an identified laboratory component.

Laboratory studies designed to supplement an area concentration in organic, inorganic, analytical, physical, or some other field of chemistry.

CHEM 477 Directed Study in Chemistry (1-4)R-0L-(1-4)C F, W, S Pre: Permission of instructor

Allows individual study in a topic not usually offered. A student may take 1 to 4 credits. A maximum of 4 credits is permitted.

CHEM 490 Chemical Research 0R-(4-12)L-(1-3)C

Research under the direction of a member of the faculty selected by mutual agreement. Students may earn a maximum of 18 credits between CHEM 290 and CHEM 490. Students may register for 1 to 3 credits per quarter.