Course Descriptions - Chemistry

Professors Allison, Brandt, Erwin, Jelski, Lewis, McLean, Miller, Morris, Mottel, Mueller and Tilstra

CHEM 111 General Chemistry I 3R-4L-4C F,W,S 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 3 or 4 or who qualify on the basis of a chemistry placement examination given during the freshman orientation period.

CHEM 113 General Chemistry II 3R-3L-4C W,S 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
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 153 Introduction to Organic Chemistry 4R-0L-4C Pre: CHEM 112 or CHEM 113
This course probes nomenclature, structure and reactions of aliphatic and aromatic compounds, and introduces the structure and reactions of natural polymers and the preparation structural characterization of synthetic polymers. Activities associated with industrial chemistry and an introduction to biochemistry are included. Hands-on activities are included. Chemistry and chemical engineering majors may count CHEM 153 as a free elective only.

CHEM 225 Analytical Chemistry I 3R-4L-4C F Pre: CHEM 111
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 241 Descriptive Inorganic Chemistry I 3R-3L-2C W Pre: CHEM 115
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
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 270 Geology and the Engineer: An Introduction 4R-0L-4C S Pre: CHEM 111
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 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 major, junior standing or permission 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-4C F Pre: CHEM 225
An integrated sequence of topics in modern analytical chemistry that includes both classical and instrumental methods. Instrumental methods stress design, operating principles, theory and applications. CHEM 326 addressed primarily spectroscopy and spectrometry (emission, X-ray, ultraviolet, infrared, visible, NMR, fluorescence and atomic absorption; mass ) whereas CHEM 327 stresses chromatography (gas, liquid, gel-permeation.), electroanalytical (polarography, amperometry, coulometry, potentiometry), thermal methods and automation in analytical chemistry.

CHEM 330 Biochemistry 4R-0L-4C W Pre: CHEM 253
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: CHEM 303 and CHEM 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 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, MA 221, PH 112, PH 113
Covers elementary quantum mechanics with emphasis on applications in molecular structure.

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

**CHEM 428 Environmental Analysis Methods** (2R-8L-4C) Pre: CHEM 225 or permission
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-1C 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 456 Polymer Chemistry I 4R-0L-4C Pre: CHEM 252
Physical behavior of polymers. Physical properties, molecular weight determination, relationship between morphology and mechanical properties.

CHEM 457 Polymer Chemistry II 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 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.