

# CHEMISTRY

## CHM 5224 Basic Principles for Organic Chemistry 3 Credits

**Grading Scheme:** Letter Grade

A review for those students intending to enroll in the Advanced Organic Sequence CHM 6225, CHM 6226.

**Prerequisite:** one year of undergraduate organic chemistry.

## CHM 5235 Organic Spectroscopy 3 Credits

**Grading Scheme:** Letter Grade

Advanced study of characterization and structure proof of organic compounds by special methods, including IR, UV, NMR, and mass spectrometry.

**Prerequisite:** CHM 2211.

## CHM 5275 The Organic Chemistry of Polymers 2 Credits

**Grading Scheme:** Letter Grade

Classification of polymerization types and mechanisms from a mechanistic organic point of view. The structure of synthetic and natural polymers and polyelectrolytes. Reaction of polymers. Practical synthetic methods of polymer preparation.

**Prerequisite:** CHM 2200, 2210, or equivalent.

## CHM 5305 Chemistry of Biological Molecules 3 Credits

**Grading Scheme:** Letter Grade

Mechanistic organic biochemistry. Emphasis on model systems, enzyme active sites, and physical and organic chemistry of biomacromolecules.

**Prerequisite:** CHM 2211 and 4412.

## CHM 5416L Advanced Physical Chemistry Laboratory 2 Credits

**Grading Scheme:** Letter Grade

Techniques used in experimental research; techniques of design and fabrication of scientific apparatus. Advanced experiments involving optical, electronic, and high vacuum equipment.

**Prerequisite:** CHM 4411L.

## CHM 5511 Physical Chemistry of Polymers 2 Credits

**Grading Scheme:** Letter Grade

Structure, configuration, conformation, and thermodynamics of polymer solutions, gels, and solids. Thermal, mechanical, optical, and rheological properties of plastics and rubbers.

**Prerequisite:** CHM 4411 or equivalent.

## CHM 6036 Chemical Biology 3 Credits

**Grading Scheme:** Letter Grade

In depth examination of current research directions in the field of chemical biology. Topics covered include aptamers, chemical synthesis of proteins, in vitro incorporation of unnatural amino acids into proteins, directed evolution of enzymes, natural product discovery and their biosynthesis mechanisms, chemically synthesized small-molecule libraries, chemical genetics, chemical screening, and target identification.

**Prerequisite:** Admission to the graduate program and CHM 5305 (Bioorganic Chemistry), or permission of the professor.

## CHM 6037 Chemical Biology and Biochemistry Seminar 1 Credit, Max 12 Credits

**Grading Scheme:** S/U

Weekly seminar series from graduate students and outside speakers in chemical biology/biochemistry areas. Attendance and participation of graduate students required.

**Prerequisite:** Admission into the graduate program

## CHM 6153 Electrochemical Processes 3 Credits

**Grading Scheme:** Letter Grade

Principles of electrochemical methods, ionic solutions, and electrochemical kinetics.

## CHM 6154 Chemical Separations 3 Credits

**Grading Scheme:** Letter Grade

Theory and practice of modern separation methods with emphasis on gas and liquid chromatographic techniques.

## CHM 6155 Spectrochemical Methods 3 Credits

**Grading Scheme:** Letter Grade

Principles of atomic and molecular spectrometric methods; discussion of instrumentation, methodology, applications.

## CHM 6158C Electronics and Instrumentation 1-4 Credits

**Grading Scheme:** Letter Grade

Principles of operation of instruments, optimization of instrumental conditions, and interpretation of instrumental data for qualitative and quantitative analysis.

## CHM 6159 Mass Spectrometric Methods 3 Credits

**Grading Scheme:** Letter Grade

Modern spectrometry including fundamentals, instrumentation, and analytical applications.

## CHM 6165 Chemometrics 3 Credits

**Grading Scheme:** Letter Grade

Analytical method, information theory, and chemometrics, including statistical data analysis, heuristic and non-heuristic data analysis (pattern recognition and artificial intelligence), and experimental design and optimization.

**Prerequisite:** graduate standing.

## CHM 6180 Special Topics in Analytical Chemistry 1-3 Credits, Max 9 Credits

**Grading Scheme:** Letter Grade

Lectures or conferences covering selected topics of current interest in analytical chemistry.

**Prerequisite:** two courses of graduate level analytical chemistry.

## CHM 6190 Analytical Chemistry Seminar 1 Credit, Max 20 Credits

**Grading Scheme:** Letter Grade

Attendance required of graduate majors in the analytical area. graduate course in analytical chemistry. Presentation of one seminar.

## CHM 6225 Advanced Principles of Organic Chemistry 4 Credits

**Grading Scheme:** Letter Grade

Principles of organic chemistry and their application to reaction mechanisms.

**Prerequisite:** CHM 2211.

## CHM 6226 Advanced Synthetic Organic Chemistry 3 Credits

**Grading Scheme:** Letter Grade

Discussion and application of synthetic methodology.

**Prerequisite:** CHM 6225.

## CHM 6227 Topics in Synthetic Organic Chemistry 2 Credits

**Grading Scheme:** Letter Grade

Synthesis of complex organic molecules, with emphasis on recent developments in approaches and methods.

**Prerequisite:** CHM 6226.

## CHM 6251 Organometallic Compounds 3 Credits

**Grading Scheme:** Letter Grade

Properties of organometallic compounds, the nature of the carbon-metal bond, compounds of metals in groups 1, 2, 3, and 4, and transition metals.

## CHM 6271 The Chemistry of High Polymers 2 Credits

**Grading Scheme:** Letter Grade

Fundamental polymer chemistry, with emphasis on the mechanisms of polymerization reactions and the relationship of physical properties to chemical constitution.

**CHM 6301 Enzyme Mechanisms 3 Credits****Grading Scheme:** Letter Grade

Principles of enzyme structure; isolation and purification; physical chemistry of enzyme/substrate interactions; general overview of classes; transition state theory and catalysis; types of chemical catalysis; survey of cofactors; example mechanisms; catalytic antibodies; ribozyme structure and catalysis.

**CHM 6302 Chemistry and Biology of Nucleic Acids 3 Credits****Grading Scheme:** Letter Grade

Principles of nucleic acid structure and function; protein/nucleic acid interactions with particular emphasis on transcriptional regulators and DNA and RNA polymerases; chemistry of phosphate hydrolysis and its application to enzyme mechanisms; evolution of novel RNA molecules capable of specific binding and catalysis.

**CHM 6303 Methods in Computational Biochemistry and Structural Biology 3 Credits****Grading Scheme:** Letter Grade

Modeling and protein structures enzyme reaction mechanisms using empirical as well as quantum-mechanical methods.

**CHM 6306 Special Topics in Biological Chemistry Mechanisms 3 Credits, Max 9 Credits****Grading Scheme:** Letter Grade

Molecular evolution, bioinformatics and protein structure prediction, principles of molecular recognition, rational protein design, biotechnology, reengineered organisms, advanced biophysical techniques, and computational biology.

**CHM 6381 Special Topics in Organic Chemistry 1-3 Credits, Max 9 Credits****Grading Scheme:** Letter Grade

Chemistry of selected types of organic compounds, such as alkaloids, carbohydrates, natural products, steroids.

**Prerequisite:** CHM 6225, CHM 6226.**CHM 6390 Organic Chemistry Seminar Presentation 1 Credit, Max 20 Credits****Grading Scheme:** Letter Grade

Attendance required of graduate majors in the organic area. Presentation of one seminar.

**CHM 6391 Organic Chemistry Seminar Discussion 1 Credit****Grading Scheme:** S/U

Attendance at weekly seminars reporting current advances in organic chemistry.

**Prerequisite:** graduate standing.**CHM 6430 Chemical Thermodynamics 3 Credits****Grading Scheme:** Letter Grade

Energetics, properties of ideal and nonideal systems primarily from the standpoint of classical thermodynamics.

**CHM 6461 Statistical Thermodynamics 3 Credits****Grading Scheme:** Letter Grade

Fundamental principles with applications to systems of chemical interest.

**Prerequisite:** CHM 6430 or its equivalent, permission of instructor.**CHM 6470 Chemical Bonding and Spectra I 3 Credits****Grading Scheme:** Letter Grade

Basic methods and applications of quantum chemistry; atomic structure; chemical bonding in diatomic and polyatomic molecules. Brief introduction to molecular spectroscopy.

**CHM 6471 Chemical Bonding and Spectra II 3 Credits****Grading Scheme:** Letter Grade

Theory of symmetry and its chemical applications; semi-empirical molecular orbital treatment of simple inorganic and organic molecules; further applications to inorganic and organic chemistry.

**Prerequisite:** CHM 6470.**CHM 6480 Elements of Quantum Chemistry 3 Credits****Grading Scheme:** Letter Grade

Brief treatment of the Schrodinger equation, followed by a survey of applications to chemical problems.

**Prerequisite:** CHM 6471.**CHM 6490 Theory of Molecular Spectroscopy 3 Credits****Grading Scheme:** Letter Grade

Molecular energy levels, spectroscopic selection rules; rotational, vibrational, electronic, and magnetic resonance spectra of diatomic and polyatomic molecules.

**CHM 6580 Special Topics in Physical Chemistry 1-3 Credits, Max 12 Credits****Grading Scheme:** Letter Grade

Lecture or conferences covering selected topics of current interest in physical chemistry.

**CHM 6586 Computational Chemistry 3 Credits****Grading Scheme:** Letter Grade

Software for computational chemistry; model building and molecular mechanics; molecular orbitals and electronic structure; optical, infrared, and magnetic resonance spectra; solvation effects and molecular dynamics; building large systems.

**Prerequisite:** undergraduate physical chemistry.**CHM 6590 Physical Chemistry Seminar 1 Credit, Max 20 Credits****Grading Scheme:** S/U

Attendance required of graduate majors in physical chemistry. graduate course in physical chemistry. Presentation of one seminar.

**CHM 6620 Advanced Inorganic Chemistry I 3 Credits****Grading Scheme:** Letter Grade

Crystalline state; covalent bonding; acids, bases, and solvents, nonmetallic compounds of Groups II through VII with emphasis on structure and reactivity.

**CHM 6621 Advanced Inorganic Chemistry II 3 Credits****Grading Scheme:** Letter Grade

Electronic structure of metals and transition metal complexes; solution chemistry and reaction mechanisms at metal centers; redox reactions; introduction to organometallic and bioinorganic chemistry.

**Prerequisite:** CHM 6620.**CHM 6626 Applications of Physical Methods in Inorganic Chemistry 3 Credits****Grading Scheme:** Letter Grade

Principles and applications of spectroscopic methods to the solution of inorganic problems. Those techniques used most extensively in current inorganic research are treated.

**Prerequisite:** graduate standing or consent of instructor.**CHM 6628 Chemistry of Solid Materials 3 Credits****Grading Scheme:** Letter Grade

Structure and properties of solids; semiconductors and superconductors.

**CHM 6670 Inorganic Biochemistry 3 Credits****Grading Scheme:** Letter Grade

Role of elements in biology. Modern spectroscopic and physical methods for study of Group I and II metals, metalloenzymes, metal ion transport and storage, functions of nonmetals in biochemical systems, and biomedical/biotechnical applications of metals.

**Prerequisite:** graduate standing or consent of instructor.**CHM 6680 Special Topics in Inorganic Chemistry 1-3 Credits, Max 12 Credits****Grading Scheme:** Letter Grade

Lectures or conferences on selected topics of current research interest in inorganic chemistry.

**CHM 6690 Inorganic Chemistry Seminar 1 Credit, Max 20 Credits****Grading Scheme:** Letter Grade

Attendance required of graduate majors in inorganic chemistry. graduate course in inorganic chemistry. Presentation of one seminar.

**CHM 6720 Chemical Dynamics 3 Credits****Grading Scheme:** Letter Grade

Basic concepts of rate laws, collision theory, and transition state theory; an introduction to reaction dynamics, structural dynamics, and quantitative structure-reactivity correlations.

**CHM 6905 Individual Problems, Advanced 1-5 Credits, Max 10 Credits****Grading Scheme:** S/U

Double registration permitted. Assigned reading program or development of assigned experimental problem.

**Prerequisite:** consent of faculty member supervising the work.**CHM 6910 Supervised Research 1-5 Credits, Max 5 Credits****Grading Scheme:** S/U

Supervised Research

**CHM 6934 Advanced Topics in Chemistry 1 Credit, Max 8 Credits****Grading Scheme:** S/U

Discussion and evaluation of chemical research advances reported in current chemical literature. S/U

**Prerequisite:** consent of instructor.**CHM 6935 Chemistry Colloquium 1 Credit, Max 7 Credits****Grading Scheme:** S/U

Topics presented by visiting scientists and local staff members.

**CHM 6943 Internship in College Teaching 2-4 Credits, Max 6 Credits****Grading Scheme:** Letter Grade

Required for Master of Science in Teaching students but available for students needing additional practice and direction in college-level teaching.

**Prerequisite:** graduate standing.**CHM 6971 Research for Master's Thesis 1-15 Credits****Grading Scheme:** S/U

Research for Master's Thesis

**CHM 7485 Special Topics in Theory of Atomic and Molecular Structure 1-3 Credits, Max 9 Credits****Grading Scheme:** Letter Grade

Mathematical techniques used in atomic, molecular, and solid-state theory. The one-electron approximation and the general quantum-mechanical manybody problems. Selected advanced topics.

**Prerequisite:** PHZ 6426 or equivalent.**CHM 7979 Advanced Research 1-12 Credits****Grading Scheme:** S/U

Research for doctoral students before admission to candidacy. Designed for students with a master's degree in the field of study or for students who have been accepted for a doctoral program. Not appropriate for students who have been admitted to candidacy.

**CHM 7980 Research for Doctoral Dissertation 1-15 Credits****Grading Scheme:** S/U

Research for Doctoral Dissertation

**CHS 5110 Radiochemistry 2 Credits****Grading Scheme:** Letter Grade

Radioactivity detection, radiochemical separations and analyses, radiochemistry laboratory techniques, the practice of radiological safety, and tracer applications of radioisotopes in chemistry and other fields.

**PHA 6435 Biosynthetic Logic of Medicinal Natural Products 3 Credits****Grading Scheme:** Letter Grade

Covers topics of biosynthesis of the major families of medical natural products, structural and biochemical understanding of their biosynthetic logic, gene cluster identification, genome mining, and production of bioactive "unnatural products" for drug discovery and development.

**Prerequisite:** Students are expected to have the background of Biochemistry, Enzymology, and Bioorganic Chemistry. Or permission of instructors.