# CHEMISTRY (CHE)

**CHE 4207 Preparative Inorganic Chemistry (2)**
Pre-requisite(s): CHE 3238 and 4302
A wide range of experimental techniques currently used in preparative inorganic chemistry research. Such techniques include dry bag, inert atmosphere, ion-exchange, and vacuum line manipulations; electrolytic, non-aqueous solvent, and tube furnace preparations. Emphasis will be given to both the preparation and characterization of compounds prepared in the laboratory.

**CHE 4217 Instrumental Analysis Laboratory (2)**
Pre-requisite(s): CHE 4225 or 4227, and either credit or concurrent registration in CHE 4316
Laboratory work in instrumental analysis with an emphasis on spectroscopy, separations, and electrochemical methods.

**CHE 4227 Physical Chemistry Laboratory I (2)**
Pre-requisite(s): CHE 2416 and credit or concurrent enrollment in CHE 4321
Techniques of physical property measurement, data analysis, and interpretation, with emphasis on thermodynamics, electrochemistry, surface chemistry, solutions, and kinetics. Instruction in effective report writing.

**CHE 4228 Physical Chemistry Laboratory II (2)**
Pre-requisite(s): CHE 4225 or 4227, and credit or concurrent enrollment in CHE 4322
Advanced work in measurement and data analysis techniques, with emphasis on lasers, molecular spectroscopy, and photochemistry. Instruction in effective report writing.

**CHE 4237 Advanced Organic Laboratory (2)**
Pre-requisite(s): CHE 3238 and 3332
Advanced organic synthesis, purification and analysis techniques, including the use of instrumental methods, such as inert atmosphere techniques and modern analytical and preparative chromatography.

**CHE 4307 Modern Inorganic Chemistry II (3)**
Pre-requisite(s): CHE 4302
Advanced topics in inorganic chemistry; molecular symmetry with applications to electronic structure and spectroscopy; reaction kinetics and mechanisms; inorganic synthesis and catalysis; bioinorganic chemistry.

**CHE 4316 Instrumental Analysis (3)**
Pre-requisite(s): CHE 4321 or 4327
Introduction to instrumental methods of analysis including spectroscopy, separations, and electrochemical methods.

**CHE 4321 Physical Chemistry I (3)**
Pre-requisite(s): CHE 2416, MTH 2321, and PHY 1430; and CHE 3332 or consent of instructor
Gases, liquids and solids, phase changes, electrochemistry, and the principles of kinetics and thermodynamics. (Not applicable to a major in biochemistry.)

**CHE 4322 Physical Chemistry II (3)**
Pre-requisite(s): CHE 2416, MTH 2321, and PHY 1430; and CHE 3332 or consent of instructor
Postulates of quantum mechanics. Application of quantum theory to simple models: particle in a box, rigid rotor, and harmonic oscillator. Electronic, rotational, and vibrational motion in molecules. Molecular energy levels and spectra. Electronic structure of atoms and molecules. Basic concepts of statistical thermodynamics.

**CHE 4334 Organic Spectroscopy (3)**
Pre-requisite(s): Either CHE 3238 and 3332 with grades of B or above; or CHE 3332 with a grade of B or above and credit or concurrent enrollment in CHE 4237
The most common spectroscopic methods including infrared, ultraviolet-visible, nuclear magnetic resonance and mass spectroscopies, with emphasis on the practical use of NMR and MS in structure determination problems.

**CHE 4341 General Biochemistry (3)**
Pre-requisite(s): CHE 3332 with a grade of C or better
Structure and dynamics of compounds of biological interest. (Students may not receive credit for both BIO 4307 and CHE 4341.)

**CHE 4342 Topics in Human Biochemistry (3)**
Pre-requisite(s): A grade of C or better in CHE 3332; and either a grade of C or better in CHE 4341 or a grade of B or better in BIO 4307
Topics in selected areas of human biochemistry such as hormone action, neurotransmission, vision, digestion, transport.

**CHE 5050 Chemistry Colloquium (0)**
A weekly, graduate-level seminar featuring speakers from science departments at Baylor, industry, medical schools, and other universities.

**CHE 5101 Responsible Conduct of Research (1)**
Covers ethical and regulatory issues regarding modern scientific research.

**CHE 5150 Graduate Seminar (1)**
Pre-requisite(s): Enrollment in the graduate program
A seminar program in which students will be required to present a paper for evaluation before the graduate faculty and other graduate students. Must be taken two times for the master's degree and three times for the Ph.D. degree.

**CHE 5260 Scientific Communication (2)**
Pre-requisite(s): Graduate standing
This experiential-learning course, designed for first-year graduate students, provides instruction and practice in the development of an original research proposal. Strategies for effective oral and written communication of scientific information are emphasized, along with the importance of mastering primary literature in the chosen field of interest.

**CHE 5301 Chemistry of the Elements (3)**
Comparative chemistry of the Main Group and Transition elements; relationships between structure and reactivity; energetics and kinetics of inorganic reactions.

**CHE 5302 Symmetry and Group Theory in Chemistry (3)**
Application of symmetry and group theory to chemical bonding and spectroscopic selection rules; use of character tables; electronic and vibration spectroscopy.

**CHE 5303 Physical Methods in Inorganic Chemistry (3)**

**CHE 5304 Special Topics in Inorganic Chemistry (3)**
This course concerns characterization of redox active inorganic complexes by a number of physical methods. Topics covered include electronic structure and geometry (Group theory, MO diagrams), orbital energies of ground and excited states (UV-vis absorbance/emission), and ways of accessing and interpreting changes in oxidation states (electrochemistry, Marcus theory). Symmetry and group theory are fundamental to many of these applications, and will be introduced.

**CHE 5305 Organometallic Chemistry and Homogenous Catalysis (3)**
Chemical reactions of organometallic compounds and their role in homogeneous catalysis with emphasis on the transition metals. Reactivity patterns and reaction mechanisms in organometallic chemistry. Factors influencing stabilities and reactivities of metal-carbon bonds.

**CHE 5306 Bioinorganic Chemistry (3)**
An overview of the biological chemistry of metal ions. Emphasis will be on the structural motifs of metalloproteins and their associated reactivities in relation to physiological function.

**CHE 5309 Special Topics in Inorganic Chemistry (3)**
Topics in Inorganic chemistry that are not covered in other graduate chemistry courses. May be repeated for credit if topic is different.

**CHE 5310 Advanced Chemical Instrumentation (3)**
Principles of chemical instrumentation, including principles of electronic signal handling, sources of noise and signal-to-noise theory, noise reduction techniques such as modulation and phase-sensitive detection, introductory information theory, introductory geometrical optics, and vacuum systems.

**CHE 5312 Advanced X-omics Mass Spectrometry (3)**
Understanding of chemical interactions within complex mixtures, such as biological fluids and environmental samples, requires simultaneous characterization of all sample components at the molecular level. State-of-the art high performance mass spectrometers, coupled to various separation techniques, provide the necessary sensitivity, resolving power, and multidimensionality for comprehensive characterization of complex mixtures. This course covers current topics in x-omics research (including genomics, metabolomics, petroleomics, and proteomics) with a focus on bioanalytical aspects of utilizing ion generation methods, ion-molecule reactions, ion fragmentation techniques, particle analyzers/detectors, and multidimensional data generation/analyses. Moreover, fundamental aspects and practical significance of accurate mass measurements and conformational analyses in biomedical research and drug development strategies are presented.

**CHE 5314 Separation Science (3)**
Theoretical foundations and practical applications of analytical separations with emphasis on gas, liquid, supercritical fluid, and ion chromatographies.

**CHE 5315 Electroanalytical Chemistry (3)**
Modern electroanalytical techniques and their application to analytical, kinetic, mechanistic, and synthetic problems.

**CHE 5316 Analytical Spectroscopy (3)**
Theoretical and practical aspects of analytical optical spectroscopy with emphasis on instrumentation.

**CHE 5319 Special Topics in Analytical Chemistry (3)**
Topics in Analytical chemistry that are not covered in other graduate chemistry courses. May be repeated for credit if topic is different.

**CHE 5320 Thermodynamics and Statistical Thermodynamics (3)**
Principles of classical and statistical thermodynamics.

**CHE 5322 Chemical Kinetics and Mechanisms (3)**
Theory of rate processes and the use of kinetic data in the interpretation of reaction mechanisms.

**CHE 5323 Structural Studies by X-ray Crystallography (3)**
Preliminary studies of X-ray structure determination and solving the phase problem by various techniques to be learned before employing methods of structural refinement. Results and conclusions derived from refined structures will be applied to chemical research problems. Practical experience of crystal structure analysis will be the main emphasis.

**CHE 5325 Quantum Chemistry (3)**
Comparison of classical and quantum mechanics and application of quantum mechanics to electronic structure of the atoms and to the study of molecules and chemical bonds.

**CHE 5326 Lasers and Molecular Spectroscopy (3)**
Properties of lasers and the fundamental principles of laser operation. Modern application of lasers to the study of spectroscopy and energy flow in atoms and molecules.

**CHE 5329 Special Topics in Physical Chemistry (3)**
Topics in physical chemistry that are not covered in other graduate chemistry courses. May be repeated for credit if topic is different.

**CHE 5331 Stereochemistry (3)**
Pre-requisite(s): CHE 3332 and credit or concurrent enrollment in CHE 4322
The stereochemistry of compounds of carbon and other elements, steric effects on physical and chemical properties of compounds, and recent developments in the field.

**CHE 5334 Heterocyclic Chemistry (3)**
Pre-requisite(s): CHE 3238, 3332 with grades of B or above; or consent of instructor
The chemistry of heterocyclic compounds including substances containing nitrogen, oxygen, and sulfur. Synthesis, typical reactions and reaction mechanisms will be emphasized.

**CHE 5335 Physical Organic Chemistry (3)**
Organic reaction mechanisms, including kinetics, steric and electronic effects, and molecular orbital considerations.

**CHE 5336 Advanced Synthesis and Natural Products (3)**
A study of modern synthetic organic chemistry with particular emphasis on the synthesis of complex natural products and reaction mechanisms.

**CHE 5339 Special Topics in Organic Chemistry (3)**
Topics in organic chemistry that are not covered in other graduate chemistry courses. May be repeated for credit if topic is different.

**CHE 5345 Selected Topics in Bioanalytical Chemistry (3)**
This current topics course covers current breakthroughs in the development and application of bioanalytical tools. Applications of bioanalytical tools in fundamental biochemical science, as well as in biomedical applications, are included.

**CHE 5346 Chemical Biology (3)**
Revolutionary transformations in chemistry and biology have led to a merging at the boundary of these disciplines where contributions from both fields impact our molecular and quantitative understanding of biology. This course covers current research in chemical biology with a focus on enzyme mechanisms, molecular probes, biological pathways, chemical tools, and analytical methods to study biology, while also harnessing biological activity for chemical syntheses and commercial applications.

**CHE 5347 Physical Biochemistry (3)**
Theory and applications of physical chemistry to systems of biological interest including such topics as reaction kinetics, protein folding and denaturation, ligand interactions, x-ray diffraction of proteins and nuclear magnetic resonance spectroscopy.

**CHE 5348 Enzymology (3)**
Kinetics, mechanisms, regulation, and other topics related to enzyme-catalyzed reactions.

**CHE 5349 Special Topics in Biochemistry (3)**
Topics in biochemistry that are not covered in other graduate chemistry courses. May be repeated for credit if topic is different.

**CHE 5380 Principles of Biochemistry (3)**
Pre-requisite(s): At least one year of course work in each of the following: chemistry, physics, organic chemistry, biology
In addition to concurrent enrollment in the Medical Sciences M.S. degree program. Online biochemistry course for students in the Medical Sciences Master's degree program. Foundational principles of molecular structure and function are followed by in-depth study of biomolecules, enzymatic processes, and metabolic pathways.

**CHE 5V60 Advanced Special Topics in Chemistry (1-3)**
Topics in chemistry that are not covered in other graduate chemistry courses. May be repeated for credit if topic is different.

**CHE 5V98 Graduate Research (1-10)**
Pre-requisite(s): Graduate standing
Required of all graduate students. For research credit prior to admission to candidacy for an advanced degree. Credit will be given for the amount of work done. May be repeated for credit through 45 hours.

**CHE 5V99 Thesis (1-9)**
Credit for the amount of work done. In no case will fewer than six semester hours be accepted for a thesis. Required of all master's students.

**CHE 6V99 Dissertation (1-9)**
Required of all doctoral candidates. In no case will fewer than twelve semester hours be accepted for a dissertation.