CHEMISTRY

Objectives

The Chemistry program prepares students for professional work, graduate work or teaching in chemistry, biochemistry, materials science, and environmental science. In view of the diversity of goals students bring to the study of chemistry or biochemistry, the department offers both the bachelor of arts and the bachelor of science degrees. The B.A. degree is recommended primarily for students who plan to enter fields related to chemistry or biochemistry for which additional graduate work is not required. Students should realize that additional coursework may be needed to prepare them adequately to achieve their goals. The B.S. degree is recommended for students who intend to pursue graduate study in chemistry or biochemistry. A chemistry or biochemistry major can also be used for preparation for medical school, dental school, veterinary medicine school or any of the other professional health sciences. Students in preparation for the B.A. in Chemistry for the High School Teaching License follow a curriculum designed in conjunction with the College of Education and Social Sciences.

With the growing popularity of forensic science, students are entering the field of forensic investigation. Specifically, interest in the role of the scientific laboratory in forensic investigation has attracted students who want to achieve competence in forensic science. The concentration in laboratory forensic science requires students to become well-grounded in the fields of chemistry or biochemistry. The Chemistry Department's forensic chemistry concentration is directed toward preparing students for careers in the science laboratory, not at the crime scene.

In order to be considered for entry into any majors (B.A. and B.S.) in Biochemistry and Chemistry, transfer students must have earned a 2.75 cumulative GPA or better, and students currently attending Lewis University must have an overall GPA of 2.75 or better. Facility in mathematics and laboratory sciences is essential.

All students, whether majors in programs sponsored by the Chemistry Department or majors outside the department, may take a Chemistry course only twice at Lewis University. If a student has not achieved a minimum of a "C-" after the second attempt, the student may not repeat the course at Lewis University.

Programs

Bachelor

- Bachelor of Science or Arts in Chemistry to Master of Arts in Secondary Education / Fast Track Program (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/chemistry/bachelor-science-arts-chemistry-master-secondary-education-fast-track/)
- Chemistry / Bachelor of Arts (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/chemistry/chemistry-bachelor-arts/)
- Chemistry / Bachelor of Science (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/chemistry/chemistry-bachelor-science/)
- Chemistry / Bachelor of Science to Master of Science in Chemistry/ Fast Track Program (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/chemistry/chemistry-bachelor-science-master-4-1-program/)
- Chemistry Major for the High School Teaching License (9 -12) / Bachelor of Arts (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/chemistry/chemistry-major-high-school-teaching-license-9-12-bachelor-arts/)

Minor

- Chemistry / Minor (https://catalog.lewisu.edu/undergraduate/aviation-science-technology/chemistry/chemistry-minor/)

Courses

CHEM 10100 - Basic Inorganic Chemistry (3)
Principles of inorganic chemistry are covered including atomic structure, chemical bonds, states of matter, chemical reactions and nature of compounds, solutions, reaction rates, chemical equilibrium, electrolytes, nuclear processes and applications of the laws of physics where applicable.
Corequisite: CHEM 10200

CHEM 10200 - Basic Inorganic Chemistry Lab (1)
This lab illustrates the principles studied in CHEM 10100. Required of students registered for CHEM 10100.
Corequisite: CHEM 10100

CHEM 10300 - Basic Inorganic Chemistry II (3)
This class is a continuation of CHEM 10100.
Corequisite: CHEM 10400

CHEM 10400 - Basic Inorganic Chemistry II Lab (1)
This lab illustrates the principles studied in CHEM 10300. Required of students registered in CHEM 10300.
Corequisite: CHEM 10300

CHEM 10500 - Introductory Organic and Biochemistry (3)
This course is a survey of principles of organic and biochemistry, particularly as they relate to the health sciences. Areas studied include aliphatic and aromatic hydrocarbons, alcohols and ethers, aldehydes and ketones, carboxylic acids and derivatives, carbohydrates, lipids, proteins, nucleic acids and enzymes. The courses is required of Nursing majors.

CHEM 10602 - ST: Chemistry for Wall Street (3)

CHEM 10700 - Chemistry of Hazardous Materials (3)
This course introduces students to some common chemical hazards, as well as to the EPA, OSHA, NFPA and other federal and state agencies regulating these hazards.

CHEM 10800 - Chemistry and the Environment (3)
This course for non-majors focuses on the basic concepts of Chemistry as applied to the environment.
Illinois Articulation Initiative (IAI): P1902.

CHEM 10900 - Chemistry and Society (3)
For non-majors this course introduces elementary topics in Chemistry with applications in society.
Attributes: Science General Education

CHEM 11000 - General Chemistry 1 (4)
The general course is based on physical principles, with an emphasis on kinetic theory and elementary thermodynamics as applied to gas behavior, heats of reaction and bond energy. Concepts covered include elementary quantum mechanics as applied to spectral phenomena, periodicity and bonding theory.
Corequisite: CHEM 11100
Attributes: Science/Lab Gen Ed
Illinois Articulation Initiative (IAI): P1902.

CHEM 11100 - General Chemistry 1 Lab (1)
This course provides a study of quantitative applications of topics covered in CHEM 11000.
Corequisite: CHEM 11000
Attributes: Experiential Learning Gen Ed, Science/Lab Component Gen Ed
Illinois Articulation Initiative (IAI): P1902L.

CHEM 11200 - Chemistry of Mind Altering Drugs (3)
The Chemistry of Mind-Altering Drugs course explores how drugs influence the human mind and describes the chemistry of psychoactive drugs, including substances of abuse. Separate chapters are dedicated to alcohol and tobacco, while other chapters include narcotics, sedative-hypnotic drugs, psychotherapeutic drugs, stimulants such as cocaine, caffeine and amphetamines/methamphetamines, marijuana, hallucinogens and over-the-counter drugs. Pharmacology and physiology of drug use are explored, as well as motivations for drug use, drugs and the law, substance abuse treatment and drug prevention and education.
Attributes: Science General Education

CHEM 11500 - General Chemistry 2 (4)
Students explore solution theory, electrochemistry and redox theory, chemical equilibrium, acid-base theories, elementary chemical kinetics, radiochemistry and transition metal complexes.
Prerequisite: CHEM 11000
Corequisite: CHEM 11600

CHEM 11600 - General Chemistry 2 Lab (1)
This laboratory stresses quantitative aspects of topics treated in CHEM 11500.
Corequisite: CHEM 11500

CHEM 11700 - Accelerated General Chemistry (4)
The general course is based on physical principles, with an emphasis on kinetic theory and elementary thermodynamics as applied to gas behavior, heats of reaction and bond energy. Concepts covered include elementary quantum mechanics as applied to spectral phenomena, periodicity and bonding theory. Students also explore solution theory, electrochemistry and redox theory, chemical equilibrium, acid-base theories, and elementary chemical kinetics.

CHEM 11800 - Fundamentals of General Chemistry (3)
This course provides the student with an overview of the two semester sequence. Concepts covered include elementary quantum chemistry, periodicity, bonding theory, solution chemistry, electrochemistry, redox theory, chemical equilibrium, acid-base theories, thermodynamics, and kinetics.

CHEM 12000 - Fundamentals of Organic Chemistry (3)
This overview of organic chemistry that covers all of the primary families and their functional groups, some members in each family, and some basic reactions that are of interest in each family.
Prerequisite: CHEM 11500 (may be taken concurrently)
Corequisite: CHEM 12300

CHEM 12200 - Introduction to Forensic Chemistry (3)
This course is designed to introduce students to the chemical aspects of criminal investigation and analytical practices used in gathering evidence found at a crime scene. Studies will include the chemistry of and instrumentation used in drug identification, arson, ballistics, paint, fiber, glass, and other evidence that can be identified from chemical residue.
Corequisite: CHEM 12300
Illinois Articulation Initiative (IAI): P1902.

CHEM 12300 - Introduction to Forensic Chemistry Lab (1)
This course provides a laboratory experience and quantitative applications of the concepts and topics learned in the lecture course CHEM 12200.
Corequisite: CHEM 12200
Illinois Articulation Initiative (IAI): P1903L.

CHEM 12400 - Foundations of Physical Science (3)
This course is designed to equip students with essential skills and professional practices necessary for success in the physical sciences in college and beyond. Students will strengthen their mathematical foundation, develop critical thinking skills essential for scientific inquiry, and cultivate an appreciation for the culture and community of the physical sciences. Through hands-on activities, real-world applications, and critical analysis of popular science communication, students will gain a deeper understanding of core physical science principles and learn to apply them in diverse contexts.

CHEM 22100 - Organic Chemistry I Lab (1)
This lab applies the principles stressed in CHEM 22000.
Corequisite: CHEM 23000

CHEM 22600 - Organic Chemistry 2 Lab (1)
This lab applies the subjects and principles stressed in CHEM 22500.
Corequisite: CHEM 23500

CHEM 22700 - Accelerated Organic Chemistry (4)
This course explores the structure, bonding, and physical properties of organic materials and introduces the nomenclature of organic chemistry. It focuses specifically on the structure, properties, bonding, stereochemistry, reactions, and reaction mechanisms of carbon-based molecules. It covers functional group transformations useful for chemical synthesis, bonding, and structure of organic molecules, and the identification of organic compounds using these propertiesApplications of organic chemistry principles to multi-step organic synthesis for the preparation of novel materials, polymers, and relevant macromolecules will be discussed.
Prerequisite: CHEM 11700 (may be taken concurrently)

CHEM 22800 - Accelerated General Chemistry and Organic Laboratory (3)
The laboratory course deals with the application of concepts stressed in the Accelerated General Chemistry (CHEM 11700) and Accelerated Organic Chemistry (CHEM 22700) courses.
Prerequisite: CHEM 22700 (may be taken concurrently)

CHEM 23000 - Organic Chemistry I (3)
This course explores the structure, bonding, and physical properties of organic materials and introduces the nomenclature of organic chemistry. This course focuses specifically on the structure, properties, bonding, stereochemistry, reactions, and reaction mechanisms of carbon based molecules.
Prerequisite: CHEM 11500 and CHEM 11600

CHEM 23200 - Fundamental Spectroscopy (2)
This course provides the presentation of physical theories and the practice of the most common spectroscopic techniques used for identification and quantitation of chemical systems. Topics include atomic and molecular spectroscopies; UV-VIS, IR, AA, NMR, and Fluorescence.
Prerequisite: CHEM 11500 and CHEM 11600
Corequisite: CHEM 23000

CHEM 23500 - Organic Chemistry 2 (3)
This course builds upon the material covered in CHEM 23000 It covers functional group transformations useful for chemical synthesis, bonding and structure of organic molecules, and the identification of organic compounds using these properties Applications of organic chemistry principles to multi-step organic synthesis for the preparation of novel materials, polymers, and relevant macromolecules will be discussed.
Prerequisite: CHEM 23000

CHEM 23600 - Organic Chemistry Lab for Chemistry/Biochemistry Majors (2)
The course provides an introduction to the synthesis of organic compounds as well as methods of purification, and identification of organic compounds. Laboratory topics include recrystallization, melting points; distillations; extractions; chromatography; spectroscopic techniques; radical chain reactions, elimination and addition reactions; electrophilic substitution; and oxidation and reduction reactions.
Prerequisite: CHEM 23200
Corequisite: CHEM 23500

CHEM 24200 - Introduction to Solid State Chemistry (2)
Students explore the entire periodic table of elements to better understand physical and chemical principles of metal ions and inorganic chemistry. This course builds on the concepts learned in general chemistry while introducing students to advanced topics in solid state chemistry, materials science, nanoscience, and metal complexation.
Prerequisite: CHEM 23000 and CHEM 23200

CHEM 25000 - Research (1-4)
An opportunity for students to work with faculty members on problems of basic research.

CHEM 29600 - Research Methods Seminar (1)
This course is intended to give an overview of the research process and focus strongly on scientific communication Topics covered include research ethics, scientific method and the experimental process, literature searches and literature reviews, scientific writing (journals, proposals, abstracts), and presentation skills This course partially fulfills the advanced writing requirement for theChemistry, Forensic Chemistry Concentration, or Biochemistry (Bachelor of Science) major.

CHEM 30000 - Physical Chemistry I (3)
This course provides a comprehensive introduction to theories on gases, physical transformations, chemical equilibrium, phase diagrams, mixtures, electrochemistry, and the laws of thermodynamics (See PHYS 33100).
Prerequisite: CHEM 23500 (may be taken concurrently) and PHYS 21800 (may be taken concurrently) and MATH 25000 (may be taken concurrently)

CHEM 30100 - Physical Chemistry I Lab (1)
This lab applies theories and principles emphasized in CHEM 30000.
Corequisite: CHEM 30000

CHEM 30200 - Biophysical Chemistry I (3)
Biophysical Chemistry will explore the applications of physical chemistry to probe the structure, function, and reactivity of biological systems More specifically this course applies the theories of gases, physical transformation, chemical equilibrium, phase diagrams, mixtures, electrochemistry, thermodynamics, and the laws of statistical thermodynamics to biological and supramolecular systems The approach seeks to derive phenomena in biological systems in terms of either the molecules that make up the system or the supra-molecular structure of the system.
Prerequisite: CHEM 23500 (may be taken concurrently) and PHYS 21800 (may be taken concurrently) and MATH 25000 (may be taken concurrently)

CHEM 30300 - Biophysical Chemistry Lab I (1)
This lab applies the theories, principles, and techniques emphasized in CHEM 30200, namely theories of gases, physical transformation, chemical equilibrium, phase diagrams, mixtures, electrochemistry, thermodynamics, and the laws of statistical thermodynamics to biological and macromolecular systems.
Corequisite: CHEM 30200

CHEM 30500 - Physical Chemistry 2 (3)
A continuation of CHEM 30000, this course covers Quantum theory, atomic structure, spectroscopy, statistical mechanics and kinetics.
Prerequisite: CHEM 30000
Corequisite: CHEM 30600

CHEM 30600 - Physical Chemistry 2 Lab (1)
This lab applies theories and principles emphasized in CHEM 30500.
Corequisite: CHEM 30500

CHEM 30700 - Biophysical Chemistry 2 (3)
A continuation of CHEM 30200, this course covers kinetics, quantum theory, atomic structure, spectroscopy, photochemistry, photobiology and macromolecules.
Prerequisite: CHEM 30200
Corequisite: CHEM 30800

CHEM 30800 - Biophysical Chemistry 2 Lab (1)
This lab applies the theories and principles emphasized in CHEM 30700, namely kinetics, quantum theory, atomic structure, spectroscopy, photochemistry, photobiology and macromolecules
Corequisite: CHEM 30700

CHEM 32000 - Analytical Chemistry (3)
Students learn about the equilibrium theory as applied to analytical procedures in acid-base systems, oxidation-reduction processes, solubility, and complexation phenomena.
Prerequisite: CHEM 23200 (may be taken concurrently) and (CHEM 23500 (may be taken concurrently) or CHEM 22500 (may be taken concurrently))

CHEM 32100 - Analytical Chemistry Lab (1)
This lab provides a study of the theory and practice of quantitative separations and analyses including training in volumetric and gravimetric techniques in the four areas specified in CHEM 32000.
Corequisite: CHEM 32000

CHEM 32500 - Instrumental Analysis (2)
Instrumental methods of analysis are studied in the context of the physical theories underlying their application to chemical systems. Other topics covered include: infrared, UV-visible, x-ray and atomic absorption spectroscopy; electrometric methods of analysis; and N.M.R., gas chromatography and mass spectrometry.
Prerequisite: CHEM 32000 (may be taken concurrently)
Corequisite: CHEM 32600

CHEM 32600 - Instrumental Analysis Lab (2)
Students practice the physical methods of analysis in several of the areas specified in CHEM 32500.
Prerequisite: CHEM 32000 (may be taken concurrently)
Corequisite: CHEM 32500

CHEM 33200 - Advanced Instrumental Analysis (2)
Advanced spectroscopic theory and instrumental methods are studied and applied in the context of chemical systems. Topic covered in CHEM 23200 are expanded and other topics covered include chromatography, mass spectrometry, electrochemistry, and x-ray absorption and diffraction.
Prerequisite: CHEM 23200 (may be taken concurrently) and CHEM 23500 (may be taken concurrently) and PHYS 21800 (may be taken concurrently)

CHEM 34000 - Environmental Chemistry I (3)
Students explore the sources, fundamental principles, reactions, transport, effects and fate of chemicals in water and waste water. Sources of energy and energy alternatives are studied, together with problems of hazardous waste and possible remediation approaches.

CHEM 34100 - Environmental Chemistry I Lab (1)
Students apply the principles stressed in CHEM 34000.
Corequisite: CHEM 34000

CHEM 34200 - Environmental Chemistry II (3)
A continuation of CHEM 34000, the course studies the sources, reactions, transport, effects and fate of chemicals in the atmosphere, as well as solid waste and soil environments. Advanced laboratory techniques are examined in order to understand how various chemicals involved in pollution of water, air and soil environments are analyzed.
Prerequisite: CHEM 34000
Corequisite: CHEM 34300

CHEM 34300 - Environmental Chemistry II Lab (1)
Students apply the principles stressed in CHEM 34200.
Corequisite: CHEM 34200

CHEM 39700 - Chemistry/Biochemistry Seminar (1)
This seminar gives students the opportunity to explore contemporary topics in Chemistry/Biochemistry though literature research and class presentations and by attending seminars and colloquia This seminar will also develop the research project proposal that will be conducted in the Capstone Project course.
Prerequisite: CHEM 29600 or PHYS 29600
Program Restrictions: Must be enrolled in one of the following Programs: Biochemistry or Chemistry .
Class Restrictions: Must be enrolled in one of the following Classes: Junior, Sophomore or Senior.

CHEM 39800 - Special Topics (1-4)
Subject matter of a specialized nature is covered in detail Lab reports and/or research papers may be required.

CHEM 40000 - Advanced Inorganic Chemistry (3)
Students study quantum chemistry, including the vector model of the atom; spectroscopic terms and states; transition metal complexes stereochemistry, spectral properties, magnetochemistry and reactions studied in the light of relevant bonding theories. The class also covers compounds of main group elements, with an emphasis on physical methods of investigation.
Prerequisite: CHEM 30000 (may be taken concurrently)

CHEM 40100 - Advanced Organic Chemistry (3)
A study of physical organic chemistry, this course emphasizes reaction mechanisms, reaction kinetics, stereochemistry and physical principles.
Prerequisite: CHEM 23500 (may be taken concurrently) and CHEM 30500 (may be taken concurrently)

CHEM 40200 - Topics in Organic Chemistry (3)
This course discusses of the current topics in organic chemistry Lab reports and/or research papers may be required.

CHEM 40300 - Nuclear Chemistry (3)
Students explore the properties of atomic nuclei, including radioactivity and nuclear decay, nuclear reactions, penetration of a potential barrier by the alpha particle, Fermi's theory of beta decay, modern ideas of the structure of the nucleus, theories of low and intermediate energy-induced nuclear reactions, the deuteron problem and nucleon-nucleon scattering (See PHYS 41000).
Prerequisite: CHEM 30500 (may be taken concurrently)

CHEM 40400 - Radiochemistry (3)
This course focuses on the nature, production and applications of radioactivity. Topics include radioactive decay processes, types of radioactive decay, atomic nuclei, interactions with matter and radiochemical instrumentation.
Prerequisite: CHEM 30500 (may be taken concurrently)

CHEM 40500 - Biochemistry I (3)
The focus of this course is on major classes of molecules found in the living cells: water, proteins, carbohydrates, lipids and nucleic acids. The course explores concepts of organic and physical chemistry as they apply to biological molecules. The organic functional groups that define the structures and determine the chemical and physical properties of the biomolecules and their building blocks are described. The concept of structure determining the function" of biomolecules is explored. Emphasis is on the concepts of thermodynamics: entropy
Prerequisite: CHEM 23500 (may be taken concurrently) or CHEM 22500 (may be taken concurrently)
Corequisite: CHEM 40600

CHEM 40600 - Biochemistry I Lab (1)
This is a laboratory course to accompany Biochemistry 1 lecture (CHEM 40500). This course introduces students to the methods used to design and run controlled experiments with proper standards. Experiments focus on techniques used in the purification and characterization of the different biological molecules mainly proteins, carbohydrates and lipids such as chromatography and spectroscopy. Experiments also focus on different aspects of enzyme methodology and enzyme kinetics.
Corequisite: CHEM 40500

CHEM 40700 - Biochemistry 2 (3)
This course focuses mainly on bioenergetics and metabolism. Bioenergetics is the quantitative study of energy conversions in biological systems following the laws of thermodynamics. The focus is on the chemical reactions of the central metabolic pathways which are common to all forms of life. These pathways involve multienzymatic reactions that result in the degradation and synthesis of the different biological molecules at steady state conditions. The role of ATP and its production through glycolysis, citric acid cycle, Beta oxidation, urea cycle, oxidative deamination, transamination, electron transport and oxidative phosphorylation is explored in detail. The analysis of the control and integration of these pathways are also described. Emphasis is on energy coupling of reactions in biological systems and the thermodynamic properties of the reactions such as entropy (delta S), enthalpy (delta H) and free energy (delta G) and how they determine reaction spontaneity. The students will also be instructed in critical reading and analysis skills of original scientific, biochemical articles.
Prerequisite: CHEM 40500

CHEM 40800 - Biochemistry 2 Lab (1)
This is a laboratory course to accompany Biochemistry 2 lecture (CHEM 40700). New techniques are introduced. Students are expected to work independently in designing and preparing all reagents needed for the experiments. Experiments include the application of techniques such as chromatography, UV spectroscopy, immunoassays, electrophoresis, DNA fingerprinting, and NMR spectroscopy to analyze and characterize biological molecules. During the second half of the semester, students are expected to design and perform experiments for a research project.
Corequisite: CHEM 40700

CHEM 41500 - Advanced Forensic Chemistry I (4)
This course includes detailed investigation of current topics in forensic chemistry and forensic science. Topics include arson and explosives investigation, drug analysis, the analysis of paint and gunshot residue, and questioned documents analysis. Students will also learn the basics of crime scene procedures, chain-of-custody, quality assurance, courtroom testimony, laboratory accreditation, and analyst certification. This course will include three hours of lecture per week along with a three hour weekly laboratory
Prerequisite: CHEM 23500 (may be taken concurrently)

CHEM 41600 - Advanced Forensic Chemistry II (4)
The second semester course will build on topics learned in Advanced Forensic Chemistry 1. students will explore the principles of forensic identification analysis and comparison of biological evidentiary samples such as blood, semen, saliva, and other biological samples and tissues. The course will include electrophoresis, DNA extraction procedures, polymerase chain reaction (PCR), DNA typing, sex and race determination, methods of DNA analysis and detection, and other topics. This class will include three hours of lecture per week along with a three hour weekly laboratory.
Prerequisite: CHEM 41500

CHEM 41700 - Trace Analysis (3)
This course will provide a comprehensive and up-to-date overview of the field of trace analysis. Students will learn about sample acquisition and the analysis of trace organic pollutants using gas chromatography (GC) and gas chromatography mass spectrometry (GC-MS) techniques. These techniques will then be applied in the identification of unknown trace compounds. Statistical methods will be covered in the evaluation of experimental errors. This course will also cover governmental regulatory limits along with the methods for monitoring and enforcing these limits.
Prerequisite: CHEM 23500 (may be taken concurrently) and CHEM 32000 (may be taken concurrently) and CHEM 33200 (may be taken concurrently)

CHEM 41800 - Advanced Toxicology (3)
Students will explore the principles of toxicology, environmental problems, testing procedures, and governmental regulations. The toxicology and subsequent treatment of exposures to major drug categories, industrial chemicals, household consumer products, and drugs of abuse will be covered. The course will also cover the characterization and handling of physical evidence collected at the scene of a fire or explosion.
Prerequisite: CHEM 23500 (may be taken concurrently) and CHEM 32000 (may be taken concurrently) and CHEM 33200 (may be taken concurrently)

CHEM 42000 - Advanced Chemical Laboratory Topics (2)
This course may include any number of different advancedtechniques for the synthesis, purification, and characterization of inorganic, organic, organometallic, or biochemical compounds. Students may also study the synthesis and characterization of air-sensitive and water-sensitive organometallic compounds and transition metal complexes. Complexes will be analyzed using a variety of instrumental methods.

CHEM 42100 - Polymer Chemistry (3)
This course explores mechanisms of polymerization reactions, the molecular weight distributions of products, the principles, limitations and advantages of the most important methods of molecular weight determination, the relationship of physical properties to structure and composition, the correlations of applications with chemical composition, and the applications of polymer chemistry to coatings.
Prerequisite: CHEM 22700 (may be taken concurrently)

CHEM 42200 - Colloidal and Surface Chemistry (3)
This course explores the fundamentals of colloid interactions between surfaces, particles, and surfactants as well as the principles of self-assembly. Application of the principles of surface and colloidal chemistry to technologies involving particulate dispersions, emulsions, aerosols, wetting, flocculation, separation, and stabilization will also be discussed.
Prerequisite: CHEM 22700 (may be taken concurrently)

CHEM 43000 - Polarized Light Microscopy (2)
The course covers principles, theory and practice of polarized light microscopy (PLM) useful for particle and materials characterization and identification. The identification of particles using the polarized light microscope has a variety of applications within the fields of biology and chemistry.
Corequisite: CHEM 43100

CHEM 43100 - Polarized Light Microscopy Practicum (1)
This course provides the practical experience to independently operate the polarized light microscope (PLM).
Corequisite: CHEM 43000

CHEM 43200 - Raman Microspectroscopy (2)
Raman Microspectroscopy is a powerful laboratory tool for analysis of unknowns using their spectrum, and has a variety of applications within the field of chemistry.
Corequisite: CHEM 43300

CHEM 43300 - Raman Microspectroscopy Practicum (1)
This course provides the practical experience to independently apply skills learned in Raman Microspectroscopy to unknown samples.
Corequisite: CHEM 43200

CHEM 43400 - Microscopic Particle Handling (2)
The modern laboratory has, as one of its principal investigative instruments, the microscope. Some materials require special handling and preparation prior to examination. This course covers particle isolation, manipulation and mounting in preparation for microscopic examination. These techniques permit the use of a variety of microscopes with applications within the fields of biology and chemistry.
Corequisite: CHEM 43500

CHEM 43500 - Microscopic Particle Handling Practicum (1)
This course provides the practical experience to independently prepare samples for their examination using a variety of microscopes.
Corequisite: CHEM 43400

CHEM 43600 - Scanning Electron Microscopy (2)
The modern laboratory has, as one of its principal investigative instruments, the scanning electron microscope. This course covers foundation, theory and use of scanning electron microscopes. The scanning electron microscope has a variety of applications within the fields of biology and chemistry.
Corequisite: CHEM 43700

CHEM 43700 - Scanning Electron Microscopy Practicum (1)
This course provides the practical experience to independently operate the scanning electron microscope (SEM).
Corequisite: CHEM 43600

CHEM 43800 - Infrared Microscopy (2)
The modern laboratory has, as one of its principal investigative instruments, the infrared microscope. The infrared microscope has a variety of applications within the fields of biology and chemistry.
Corequisite: CHEM 43900

CHEM 43900 - Infrared Microscope Practicum (1)
This course provides the practical experience to independently operate the Infrared Microscope (FTIR).
Corequisite: CHEM 43800

CHEM 44000 - Infrared Spectral Interpretation (1)
The modern laboratory has, as one of its principal investigative tools, the analysis of unknowns using their spectrum. Spectral analysis has a variety of applications within the field of chemistry. The course explores techniques to determine unknown molecular structures from infrared spectra.
Corequisite: CHEM 44100

CHEM 44100 - Infrared Spectral Interpretation Practicum (1)
This course provides the practical experience to independently interpret spectral data from unknown samples.
Corequisite: CHEM 44000

CHEM 44200 - White Powder Unknowns (2)
The course utilizes microscopy and other methods to identify over 60 white powder samples.
Corequisite: CHEM 44300

CHEM 44300 - White Powder Unknowns Practicum (1)
The course provides the practical experience to independently identify unknown samples of over 60 white powders.
Corequisite: CHEM 44200

CHEM 44400 - Digital Photomicrography (2)
This course covers problem-solving techniques in capturing and documenting macroscropic and microscopic observations using scientifically acceptable methods.
Corequisite: CHEM 44500

CHEM 44500 - Digital Photomicrography Practicum (1)
This course covers problem-solving techniques in capturing and documenting macroscopic and microscopic observations using scientifically acceptable methods.
Corequisite: CHEM 44400

CHEM 44600 - Introduction to Forensic Trace Evidence (2)
The course covers problem-solving techniques in identifying crime scene trace evidence.
Corequisite: CHEM 44700

CHEM 44700 - Introduction to Forensic Trace Evidence Practicum (1)
The course provides the practical experience to independently identify crime scene trace evidence.
Corequisite: CHEM 44600

CHEM 44800 - X-Ray Microanalysis by Energy-Dispersive X-Ray Spectrometry (2)
EDS is an analytical technique to determine the elemental or chemical characterization of unknown samples. This course covers those techniques with applications within the fields of biology and chemistry.
Corequisite: CHEM 44900

CHEM 44900 - X-Ray Microanalysis by Energy-Dispersive X-Ray Spectrometry Practicum (1)
This course provides the practical experience to independently analyze samples for their elemental composition and chemical characterization. This course covers those techniques with applications within the fields of biology and chemistry.
Corequisite: CHEM 44800

CHEM 45000 - Research (1-4)
An opportunity for students to work with faculty members on problems at an advanced level. Lab reports and/or research papers may be required.

CHEM 45100 - Advanced Imaging Techniques for the Scanning Electron Microscope (1)
The modern laboratory has, as one of its principal investigative instruments, the scanning electron microscope. The scanning electron microscope has a variety of applications within the fields of biology and chemistry.
Corequisite: CHEM 45200

CHEM 45200 - Advanced Imaging Techniques for the Scanning Electron Microscope Practicum (1)
This course provides the practical experience to independently operate the scanning electron microscope (SEM) to achieve high quality images.
Corequisite: CHEM 45100

CHEM 45300 - Forensic Fiber Identification (2)
The Forensic Fiber Identification course offers techniques for the identification of natural and man-made fibers.
Corequisite: CHEM 45600

CHEM 45400 - Gunshot Residue Identification (2)
The course utilizes microscopy (SEM/EDS) to identify forensic samples of gunshot residue.
Corequisite: CHEM 45500

CHEM 45500 - Gunshot Residue Identification Practicum (1)
This course provides the practical experience to independently identify forensic samples of gunshot residues.
Corequisite: CHEM 45400

CHEM 45600 - Forensic Fiber Identification Practicum (1)
This course provides the practical experience to independently identify forensic samples of natural and man-made fibers.
Corequisite: CHEM 45300

CHEM 45700 - Hair Comparison (2)
This course offers techniques for the identification of animal and human hairs and introduction to the principles and practice of forensic hair comparison using microscopy and DNA analysis.
Corequisite: CHEM 45800

CHEM 45800 - Hair Comparison Practicum (1)
This course provides the practical experience to independently identify animal and human hair for forensic analyses.
Corequisite: CHEM 45700

CHEM 45900 - Analysis of Low Explosives (2)
The course covers the problem-solving techniques in identifying bomb scene evidence.
Corequisite: CHEM 46000

CHEM 46000 - Analysis of Low Explosives Practicum (1)
This course provides the practical experience to independently identify bomb scene evidence.
Corequisite: CHEM 45900

CHEM 46100 - Pharmaceutical Contaminants (2)
The course utilizes microscopy couples with sample isolation, preparation and analytical analysis of small particle contaminates.
Corequisite: CHEM 46200

CHEM 46200 - Pharmaceutical Contaminants Practicum (1)
This course provides the practical experience to independently interpret samples of contaminants from pharmaceutical products.
Corequisite: CHEM 46100

CHEM 46300 - Pigment Identification (2)
The course utilizes microscopy to identify paint materials for conservation professionals.
Corequisite: CHEM 46400

CHEM 46400 - Pigment Identification Practicum (1)
This course provides the practical experience to independently interpret samples of paints from artwork or architecture.
Corequisite: CHEM 46300

CHEM 46500 - Capstone Project (1)
In this course, students carry out a major project or set of topically-linked smaller projects from proposal through data collection and data analysis to dissemination. Capstone projects may be experimental, computational, or pedagogical depending on the students interests and emphasis within the major Students present their Capstone Project results in a written journal-style article, an oral presentation, and a poster This course partially fulfills the advanced writing requirement for the Chemistry/ Biochemistry (Bachelor of Science) major.
Prerequisite: CHEM 39700

CHEM 47000 - Internship (1-6)
This course is designed to provide students with a supervised experience. A written report is required. Students wishing to enroll in this course should see the instructor. Approximately 70 clock hours are required for every semester hour credit.

CHEM 49700 - Seminar (1)
An opportunity for students to investigate a current topic in the chemical literature. The findings will be organized in a term paper and presented to the department.
Attributes: Workshop/Seminar

CHEM 49800 - Special Topics (1-4)
Subject matter of a specialized nature is covered in detail Lab reports and/or research papers may be required.

CHEM 49801 - ST: Introduction to Solid State Chemistry (2)

CHEM 49802 - ST: Organic Chemistry - Extra Innings (0)

CHEM 49803 - ST: Introduction to Medicinal Biochemistry (2)

CHEM 49804 - Limnology (1-4)

CHEM 49805 - ST: Immunology (3)

CHEM 49806 - ST: Kinetics and Reaction Mechanisms (3)
Subject matter of a specialized nature is covered in detail. Lab reports and/or research papers may be required

CHEM 49807 - ST: Composite Material Fabrication and Repair (3)
A study of the various types of composites used on aircraft, part of this course includes vacuum bag manufacturing and repair of a honeycomb panel by each student in the laboratory.

CHEM 49808 - ST: The Science of Superheroes (1)
Subject matter of a specialized nature is covered in detail. Lab reports and/or research papers may be required.

CHEM 49809 - ST: Advanced Laboratory Techniques (3)
This will focus on advanced instrumental techniques such as XRD, DLS, SEM, LPC, and kinetic spectroscopy.

CHEM 49900 - Independent Study (1-4)
Students undertake advanced study in Chemistry under the supervision of a departmental faculty member.
Class Restrictions: Must be enrolled in one of the following Classes: Junior or Senior.