CHEMISTRY (CHEM)

CHEM 0930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)
For experimental courses of variable subjects. Requires permission of the department. Offered occasionally.

CHEM 1000 - Chemistry and the Environment
Credit(s): 3 Credits
This course presents an introduction to the basic principles of chemistry and the role they play in important environmental issues. Topics include energy use and sustainability, elemental cycles, atmospheric chemistry and pollution, the hydrosphere and water pollution, and the biosphere and persistent organic compounds. Lecture: 3 hours/week. Offered annually.
Attributes: Natural Science Req (A&S)

CHEM 1005 - Chemistry and the Environment
Credit(s): 3 Credits
This course presents an introduction to the basic principles of chemistry and the role they play in environmental issues. Topics include energy use, elemental cycles, atmospheric chemistry and pollution, the hydrosphere and water pollution, and the biosphere and persistent organic compounds. Lecture: 3 hours/week. Offered annually for SPS students.
Attributes: Prof. Studies Students Only

CHEM 1050 - Basic Chemistry
Credit(s): 3 Credits
Designed for students who intend to take CHEM-1110 but do not have the background or mathematical skills required to enter directly into CHEM-1110. Topics include nomenclature, the scientific method as applied in chemistry, basic atomic theory, gas laws, equilibrium and chemical calculations and important classes of chemical reactions. Fall semester.
Attributes: Natural Science Req (A&S)

CHEM 1060 - Intensive Basic Chemistry
Credit(s): 0 Credits
This course is a condensed version of CHEM-1050. This course if offered for the second half of the fall semester only. Registration is by invitation only. Students who start the fall term in CHEM-1110, and make C-, D, or F at mid-term, are invited to drop CHEM-163 and enroll in CHEM-1060. These students will learn some basic skills that will improve their foundation in chemistry and allow them to move on to CHEM-1110 the next semester.
Attributes: Natural Science Req (A&S)

CHEM 1075 - Engineering Chemistry Laboratory
Credit(s): 1 Credit
For Parks College students, others need special permission. Laboratory experiments to illustrate and supplement material in CHEM-1070. Fall semester.
Corequisite(s): CHEM 1070
Restrictions:
Enrollment limited to students in the Parks College of Eng, Av Tch college.

Attributes: Natural Science Req (A&S)

CHEM 1080 - Principles of Chemistry 1 Lecture
Credit(s): 3 Credits
This course is the first in a two sequence introductory chemistry course designed for nursing and allied health students. This course covers general chemistry and some introductory organic chemistry. Students will learn fundamental concepts in chemistry and demonstrate mastery of the course material through quizzes, exams, Sapling tutorials, and homework assignments. (Offered every Fall.)
Attributes: Natural Science Req (A&S)

CHEM 1085 - Principles of Chemistry 1 Lab
Credit(s): 1 Credit
Principles of Chemistry I Lab is a one credit hour lab course built to provide hands-on techniques and experimentation that aligns itself with the theory being taught in the Chem 1080 lecture course. Topics for this course include general chemistry and beginning of organic chemistry. (Offered every Fall.)
Prerequisite(s): CHEM 1080* with a grade of C- or higher
* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

CHEM 1110 - General Chemistry 1
Credit(s): 0 or 3 Credits
Introduction to chemistry: periodic table, elements, nomenclature, atomic structure, chemical bonding, gas laws, chemical reactions. Lecture 3 hours/week. Offered Fall, Spring, and Summer.
Prerequisite(s): ((CHEM 1050 with a grade of C- or higher, CHEM 1060 with a grade of C- or higher, or Chemistry Placement Waiver with a minimum score of 1050); (SLU Math Index with a minimum score of 950, Math Waiver per Advisor with a minimum score of 1200, MATH 1200, MATH 1320, MATH 1400, MATH 1510, or MATH 1520))
Attributes: Natural Science Req (A&S)

CHEM 1115 - General Chemistry 1 Laboratory
Credit(s): 1 Credit
The laboratory course to complement the first semester of General Chemistry. Laboratory: 3 hours/week. Fall, Spring, and Summer semesters.
Prerequisite(s): ((CHEM 1110* or CHEM 1130*))
* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

CHEM 1120 - General Chemistry 2
Credit(s): 0 or 3 Credits
Continuation of Chemistry 1110 covering redox reactions and electrochemistry, chemical kinetics and thermodynamics, nuclear chemistry, transition metal chemistry, and descriptive chemistry of the elements. Lecture 3 hours/week. Spring and Summer only.
Prerequisite(s): ((CHEM 1110 with a grade of C- or higher or CHEM 1130 with a grade of C- or higher))
Attributes: Natural Science Req (A&S)

CHEM 1125 - General Chemistry 2 Laboratory
Credit(s): 1 Credit
The lab course to complement CHEM 1120 and CHEM 1140. Students must have completed CHEM 1115 (or its equivalent) with C- or better. Offered spring and summer.
Prerequisite(s): (CHEM 1115 with a grade of C- or higher; (CHEM 1140* with a grade of C- or higher or CHEM 1120* with a grade of C- or higher))
* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

CHEM 1130 - General Chemistry 1 for Majors
Credit(s): 0 or 3 Credits
Majors only. Introduction to chemistry: periodic table, elements, nomenclature, atomic structure, chemical bonding, gas laws, chemical reactions. Lecture 3 hours/week. Offered Fall.
Prerequisite(s): ((CHEM 1050 with a grade of C- or higher, CHEM 1060 with a grade of C- or higher, or Chemistry Placement Waiver with a minimum score of 1050); (MATH 1400*, SLU Math Index with a minimum score of 950, or Math Waiver per Advisor with a minimum score of 1400))
* Concurrent enrollment allowed.
Restrictions:
Enrollment is limited to students with a major in Biochemistry or Chemistry.

Enrollment limited to students in the College of Arts Sciences college.

Attributes: Natural Science Req (A&S)

CHEM 1140 - General Chemistry 2 for Majors
Credit(s): 0 or 3 Credits
Continuation of Chemistry 1130 covering redox reactions and electrochemistry, chemical kinetics and thermodynamics, nuclear chemistry, transition metal chemistry, and descriptive chemistry of the elements. For students majoring in Chemistry or Biochemistry. Lecture 3 hours/week. Spring semester only.
Prerequisite(s): (CHEM 1110 with a grade of C- or higher or CHEM 1130 with a grade of C- or higher)
Restrictions:
Enrollment is limited to students with a major in Biochemistry/Molecular Biology, Biochemistry or Chemistry.

Enrollment limited to students in the College of Arts Sciences college.

Attributes: Natural Science Req (A&S)

CHEM 1480 - Principles of Chemistry 2 Lecture
Credit(s): 3 Credits
This course is the second in a two sequence introductory chemistry course designed for Health Science students. This course covers organic and biochemistry. The goals of the course include the following:</br> • Students will learn fundamental concepts in organic and biochemistry and demonstrate mastery of the course material through quizzes, exams, Sapling tutorials, and homework assignments</br> • Students will learn to use electronic support systems to practice calculations and reinforce concepts. (Offered every Spring.)
Attributes: Natural Science Req (A&S)

CHEM 1485 - Principles of Chemistry 2 Lab
Credit(s): 1 Credit
Principles of Chemistry 2 Lab is a 1 credit hour lab course built to provide hands-on techniques and experimentation that aligns itself with the theory being taught in the lecture course for those in the Allied Health field. Topics for this course include organic and biochemistry. (Offered every Spring.)
Prerequisite(s): CHEM 1080 with a grade of C- or higher and CHEM 1085 with a grade of C- or higher; CHEM 1480* with a grade of C- or higher
* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

CHEM 1930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)
For experimental courses of variable subjects. Requires permission of the department. Offered occasionally.
Attributes: Natural Science Req (A&S)

CHEM 1980 - Independent Study
Credit(s): 1-3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

CHEM 2200 - Analytical Chemistry 1
Credit(s): 2 Credits
Introductory gravimetric and volumetric analysis, Calibration and use of quantitative apparatus, theories underlying analytical procedures, calculations involved with analysis. Fall and Spring semester. Lecture: 2 hours/week. Offered Fall and Spring semesters.
Prerequisite(s): (CHEM 1120 with a grade of C- or higher or CHEM 1140 with a grade of C- or higher)
Corequisite(s): CHEM 2205
Attributes: Natural Science Req (A&S)

CHEM 2205 - Analytical Chemistry 1 Laboratory
Credit(s): 2 Credits
Calibration and use of quantitative apparatus including analytical balances, spectrophotometers, potentiostats, and chromatographic instrumentation. Corequisite: CHEM 2200. Laboratory: 6 hours/week. Offered Fall and Spring semesters.
Prerequisite(s): ((CHEM 1120 with a grade of C- or higher or CHEM 1140 with a grade of C- or higher); CHEM 1125 with a grade of C- or higher)
Corequisite(s): CHEM 2200
Attributes: Natural Science Req (A&S)

CHEM 2410 - Organic Chemistry 1
Credit(s): 0 or 3 Credits
Modern organic chemistry of aliphatic and aromatic compounds. Offered for students in the biological sciences and preprofessional health studies. Fall and Summer semesters.Lecture: 3 hours/week. Offered Fall and Summer semesters.
Prerequisite(s): ((CHEM 1120 with a grade of C- or higher or CHEM 1140 with a grade of C- or higher); CHEM 1125 with a grade of C- or higher)
Restrictions:
Students cannot enroll who have a major in Biochemistry or Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 2415 - Organic Chemistry 1 Laboratory
Credit(s): 1 Credit
An introduction to organic laboratory techniques. Laboratory three hours per week. Fall and Summer semesters.
Prerequisite(s): ((CHEM 1120 with a grade of C- or higher or CHEM 1140 with a grade of C- or higher); CHEM 1125 with a grade of C- or higher; (CHEM 2410* or CHEM 2430*))
* Concurrent enrollment allowed.
Restrictions:
Students cannot enroll who have a major in Biochemistry or Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 2420 - Organic Chemistry 2
Credit(s): 0 or 3 Credits
Continuation of CHEM 2410. Lecture: 3 hours/week. Offered Spring and Summer semesters.
Prerequisite(s): CHEM 2410 with a grade of C- or higher
Restrictions:
Students cannot enroll who have a major in Biochemistry or Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 2425 - Organic Chemistry 2 Laboratory
Credit(s): 1 Credit
Laboratory to accompany CHEM 2420 with an emphasis on the synthesis and reactions of organic compounds. Laboratory 3 hours/week. Pre-requisite CHEM 2415 with C- or better. CHEM 2420 must be taken concurrently. Spring and Summer semesters.
Prerequisite(s): ((CHEM 2415 with a grade of C- or higher or CHEM 2435 with a grade of C- or higher); (CHEM 2420* with a grade of C- or higher or CHEM 2440* with a grade of C- or higher))
* Concurrent enrollment allowed.
Restrictions:
Students cannot enroll who have a major in Biochemistry or Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 2430 - Organic Chemistry 1 for Majors
Credit(s): 0 or 3 Credits
Modern organic chemistry of aliphatic and aromatic compounds. Limited to Chemistry and Biochemistry majors. Lecture: 3 hours/week. Offered Fall semester only.
Prerequisite(s): (CHEM 1120 with a grade of C- or higher, CHEM 1140 with a grade of C- or higher, or CHEM 178 with a grade of C- or higher)
Restrictions:
Enrollment is limited to students with a major in Biochemistry or Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 2435 - Organic Chemistry 1 Lab for Majors
Credit(s): 1 Credit
Laboratory to accompany CHEM 2430. Limited to Chemistry and Biochemistry majors. Laboratory: 3 hours/week. Offered Fall semester only.
Prerequisite(s): (CHEM 1120 with a grade of C- or higher or CHEM 1140 with a grade of C- or higher); CHEM 1125 with a grade of C- or higher
Corequisite(s): CHEM 2430
Restrictions:
Enrollment is limited to students with a major in Biochemistry or Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 2440 - Organic Chemistry 2 for Majors
Credit(s): 0 or 3 Credits
Continuation of CHEM 2430. Limited to Chemistry and Biochemistry majors. Lecture: 3 hours/week. Offered Spring semester only.
Prerequisite(s): CHEM 2430 with a grade of C- or higher
Restrictions:
Enrollment is limited to students with a major in Biochemistry or Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 2445 - Organic Chemistry 2 Laboratory for Majors
Credit(s): 1 Credit
Laboratory to accompany CHEM 2440. Chemistry and Biochemistry majors only. Pre-requisite: CHEM 2435 with C- or better. Laboratory 3 hours/week. Spring semester.
Prerequisite(s): CHEM 2435 with a grade of C- or higher; CHEM 2430 with a grade of C- or higher
Restrictions:
Enrollment is limited to students with a major in Biochemistry or Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 2930 - Special Topics
Credit(s): 1-3 Credits (Repeatable for credit)
For experimental courses of variable subjects. Requires permission of the department. Offered occasionally.
Attributes: Natural Science Req (A&S)

CHEM 2980 - Independent Study
Credit(s): 3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

CHEM 3100 - The Chemical Literature
Credit(s): 1 Credit (Repeatable for credit)
Introduction to chemical literature and related informational retrieval techniques; students utilize available resources to prepare one or more oral seminar presentations. Lecture one hour/week. Fall and Spring semesters. Pre-requisites: CHEM 2440 or 2420 and CHEM 2200.
Prerequisite(s): (CHEM 2440 or CHEM 2420); CHEM 2200
Attributes: Natural Science Req (A&S)

CHEM 3330 - Physical Chemistry 1
Credit(s): 3 Credits
Topics include kinetic theory, chemical thermodynamics and equilibria. Fall semester.
Prerequisite(s): CHEM 2200 with a grade of C- or higher; (0 Course from MATH 1520-4999 or Math Waiver per Advisor with a minimum score of 1520)
Attributes: Natural Science Req (A&S)

CHEM 3340 - Physical Chemistry 2
Credit(s): 3 Credits
Topics include chemical kinetics, quantum chemistry and spectroscopy. Spring semester.
Prerequisite(s): CHEM 2200 with a grade of C- or higher; (0 Course from MATH 1520-4999 or Math Waiver per Advisor with a minimum score of 1520)
Attributes: Natural Science Req (A&S)

CHEM 3345 - Physical Chemistry Laboratory
Credit(s): 1-6 Credits
Laboratory, three hours per week. Experiments included from topics in CHEM 3330 and 3340. Spring Semester.
Prerequisite(s): CHEM 3330
Corequisite(s): CHEM 3340
Restrictions:
Enrollment is limited to students with a major in Biochemistry or Chemistry.

Enrollment limited to students in a Bachelor of Science degree.

Attributes: Natural Science Req (A&S)

CHEM 3600 - Principles of Biochemistry
Credit(s): 1-3 Credits
This course provides a survey of biochemistry. Topics include (a) structure and properties of amino acids, carbohydrates, lipids, and nucleic acids (b) behavior of enzymes (c) metabolism: glycolysis, citric acid cycle, oxidative phosphorylation (d) information transfer: replication, transcription, translation. Lecture 3 hours/week. Spring semester only.
Prerequisite(s): (CHEM 2410 or CHEM 2430)
Attributes: Natural Science Req (A&S)

CHEM 3890 - Introduction to Chemical Literature
Credit(s): 1 Credit
Introduction to chemical literature and related informational retrieval techniques; students utilize available resources to prepare one or more oral seminar presentations. Fall semester.
Restrictions:
Enrollment limited to students with a semester level of Junior or Senior.

Attributes: Natural Science Req (A&S)

CHEM 3910 - Internship
Credit(s): 1-6 Credits (Repeatable for credit)

CHEM 3930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)
For upper-level experimental courses of variable subjects. Requires permission of the department. Offered occasionally.
Attributes: Natural Science Req (A&S)

CHEM 3970 - Undergraduate Research
Credit(s): 1-3 Credits (Repeatable for credit)
Chemical research under the direction of a faculty member of the department.
Attributes: Natural Science Req (A&S)

CHEM 3980 - Independent Study
Credit(s): 1-3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

CHEM 4200 - Analytical Chemistry 2
Credit(s): 3 Credits
Topics to be covered include an introduction to computer-based instrumentation, data acquisition methods, statistical evaluation of data. Also included are lectures on instrumental techniques such as optical spectroscopy, electrochemical measurements, and separation methods. Lecture 3 hours/ week. Fall semester. Pre-requisites: CHEM 2200 and 2205; CHEM 2420 or 2440; PHYS 1330 or 1630.
Prerequisite(s): (CHEM 2200 and CHEM 2205); (CHEM 2420 or CHEM 2440); (PHYS 1330 or PHYS 1630)
Attributes: Chemical Biology Elective, Natural Science Req (A&S)

CHEM 4205 - Analytical Chemistry 2 Laboratory
Credit(s): 1 Credit
Experiments to be covered include UV-Vis spectrophotometry, fluorescence spectrometry, gas chromatography, liquid chromatography, potentiometric methods, atomic absorption, an introduction to computer-based instrumentation, and miniaturized instrumentation. Lab: 3 hours/ week. Fall Semester.
Prerequisite(s): CHEM 2200; CHEM 2205 with a grade of C- or higher; (CHEM 2440 or CHEM 2420); CHEM 2445
Corequisite(s): CHEM 4200
Attributes: Natural Science Req (A&S)

CHEM 4300 - Mathematical Techniques in Chemistry
Credit(s): 3 Credits
Includes introduction to differential equations, group theory, matrix algebra and vector analysis as applied to chemistry. Lecture 3 hours/ week. Spring semester. Pre-requisite: MATH 1520.
Prerequisite(s): (0 Course from MATH 1520-4999 or Math Waiver per Advisor with a minimum score of 1520)
Attributes: Natural Science Req (A&S)

CHEM 4400 - Organic Spectroscopy
Credit(s): 3 Credits
This lecture/laboratory course meets for two hours of lecture and three hours of lab per week. The course looks at the principles of spectroscopic techniques used in organic/bioorganic chemistry. The course teaches practical, approaches to the use of various spectroscopic techniques for structure determination of organic molecules. Spring semester. Pre-requisites: CHEM 2420 or 2440; CHEM 2425 or 2445.
Prerequisite(s): (CHEM 2440 or CHEM 2420); (CHEM 2445 or CHEM 2425)
Attributes: Chemical Biology Elective, Natural Science Req (A&S)

CHEM 4470 - Medicinal Chemistry
Credit(s): 3 Credits
This course examines the relationship between chemical structure and biological activity with an emphasis on drug design and modification. Specific drug classes which will be sued as illustrative of this relationship include, cardiovascular drugs, anti-inflammatory agents, steroid hormones, and chemotherapeutic agents (antibiotics), among others. Lecture 3 hours/week. (Offered in Spring)
Prerequisite(s): ((CHEM 2410 and CHEM 2420) or (CHEM 2430 and CHEM 2440))
Attributes: Natural Science Req (A&S)

CHEM 4500 - Inorganic Chemistry
Credit(s): 3 Credits
The development and foundation of the periodic classification of the elements and an introduction to the systematic study of the properties of the elements and their compounds. Lecture 3 hours/week. Fall semester.
Prerequisite(s): (CHEM 2420 or CHEM 2440)
Attributes: Chemical Biology Elective, Natural Science Req (A&S)

CHEM 4505 - Inorganic Chemistry Laboratory
Credit(s): 1 Credit
Inorganic Chemistry Laboratory Arranged laboratory, three hours per week. Experiments include Inorganic preparations, advanced laboratory methods, chemical characterization. Spring Semester.
Prerequisite(s): CHEM 4500
Restrictions:
Enrollment limited to students in the CHEM06 program.

Attributes: Natural Science Req (A&S)

CHEM 4610 - Biochemistry 1
Credit(s): 0 or 3 Credits
An upper-level, one semester, undergraduate course focusing on biomolecules. Topics to be covered include biological buffers, thermodynamics, amino acids, proteins, carbohydrates, lipids, membranes, nucleic acids, recombinant DNA, enzymes, and molecular motors. Lecture 3 hours/week. Fall semester.
Prerequisite(s): (CHEM 2420 or CHEM 2440); CHEM 2200 with a grade of C- or higher
Attributes: Natural Science Req (A&S)

CHEM 4615 - Biochemistry 1 Laboratory
Credit(s): 1 Credit
This laboratory is intended to introduce the students to many of the important techniques employed by biochemists including but not limited to buffers, titrations, spectrophotometry, ion exchange chromatography, thin layer chromatography, quantification of protein concentration, electrophoresis, and enzyme kinetics. Lab 3 hours/week. Fall semester. Pre-requisites: CHEM 2425 or 2445 with C- or better; CHEM 2205 with C- or better; and CHEM 4610 which may be taken concurrently.
Prerequisite(s): CHEM 2205 with a grade of C- or higher; (CHEM 2425 with a grade of C- or higher or CHEM 2445 with a grade of C- or higher); CHEM 4610*
* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

CHEM 4620 - Biochemistry 2
Credit(s): 3 Credits
An upper-level, one semester, undergraduate course focusing on metabolism and information transfer. Topics to be covered include glycolysis, citric acid cycle, electron transport, oxidative phosphorylation, photosynthesis, synthesis and degradation of biomolecules, transcription, replication, and translation. Lecture 3 hours/week. Spring semester. Pre-requisite: CHEM 4610 with C- or better.
Prerequisite(s): CHEM 4610 with a grade of C- or higher
Attributes: Natural Science Req (A&S)

CHEM 4625 - Biochemistry 2 Laboratory
Credit(s): 1 Credit
An upper level undergraduate laboratory surveying advanced components of biochemistry. This laboratory introduces many of the advanced techniques employed by biochemists including but not limited to isolation and characterization of enzymes, NMR, ligand binding, recombinant DNA techniques, X-ray crystallography, PCR, and computer modeling. Lab 3 hours/week. Spring semester. Pre-requisite: CHEM 4615 with C- or better. Co-requisite: CHEM 4620.
Prerequisite(s): CHEM 4615 with a grade of C- or higher
Corequisite(s): CHEM 4620
Attributes: Natural Science Req (A&S)

CHEM 4700 - Environmental Chemistry
Credit(s): 3 Credits
This course is concerned with the impact of human activities on our natural surroundings, and will focus on the chemical processes that occur in bodies of water and in the atmosphere. Pollutant removal and health hazards to humans will also be discussed. Lecture 3 hours/week. Offered occasionally. Pre-requisite: CHEM 2440 or 2420.
Prerequisite(s): (CHEM 2420 or CHEM 2440)
Attributes: Natural Science Req (A&S)

CHEM 4800 - Fundamentals and Design of Nanomaterials
Credit(s): 3 Credits
This course addresses the properties, synthesis and production, and representative recent applications of nanomaterials. The fundamental physicochemical properties of nanostructures that confer their unique properties are discussed. Basic theoretical models for describing physical and chemical prosperities of nanostructures are presented. Synthetic methods for making nanoscale structures and materials are addressed along with techniques for their characterization. Nanotechnology and recent applications of nanostructures are covered.
Prerequisite(s): CHEM 2420; CHEM 2200; CHEM 3330

CHEM 4910 - Internship
Credit(s): 1-6 Credits (Repeatable for credit)

CHEM 4930 - Special Topics
Credit(s): 1-4 Credits (Repeatable for credit)

CHEM 4980 - Advanced Independent Study
Credit(s): 0-3 Credits (Repeatable for credit)
Prior permission of sponsoring professor and chairperson required.
Attributes: Natural Science Req (A&S)

CHEM 5000 - Introduction to Chemical Research
Credit(s): 1 Credit
This course will provide new, incoming graduate students with instruction on how to perform research in our department. Lectures will involve how to pick research mentor, database searching and journal capabilities, how to write an abstract, how to give oral and poster presentation, research ethics, and chemical safety.

CHEM 5150 - Statistical Methods of Physical Scientists
Credit(s): 3 Credits
This course presents many of the important statistical methods used in physical sciences with a focus on applications important to engineering, chemistry, and physics. Errors, uncertainties, and error analysis in physical measurements, probability theory, probability density functions, moments of distributions, statistical parameters, statistical tests, least squares, chemometrics, electronic noise and noise reduction, and control charts are all discussed. Student should have taken Instrumental Analysis or equivalent .

CHEM 5160 - Advanced Synthetic Chemistry
Credit(s): 3 Credits

CHEM 5170 - Advances in Analysis and Modeling of Chemical Systems
Credit(s): 3 Credits

CHEM 5200 - Analytical Chemistry II
Credit(s): 3 Credits
This course will examine instrumentation required analytical determinations. We will take both a broad and a more detailed look at instrumental methods for chemical analysis. We will study a broad range of chemical analysis methods, including chromatographic, electrochemical, optical spectroscopic, and mass spectral methods. Time permitting we will also touch on x-ray, surface and few more esoteric techniques. We will also learn some of the more detailed electronic and engineering aspects of chemical instrumentation.

CHEM 5205 - Analytical Chemistry III Lab
Credit(s): 1 Credit

CHEM 5230 - Mass Spectrometry
Credit(s): 3 Credits
This is a graduate level course focused on the theory and application of mass spectrometry. There will be a special emphasis on biological analyses using mass spectrometry. This course will focus on a general theory and instrumentation of moving ions in the gas phase; quantitation and applications of mass spectrometry. Student should have taken Instrumental Analysis or equivalent. Offered in the fall of even years.

CHEM 5250 - Bioanalytical Meth Analysis
Credit(s): 3 Credits
This course will focus on analytical techniques and methodologies that are used to monitor biologically important compounds in various matrices. Topics will include the use of enzymes in bioassays, immunoassays involving antibody-antigen interactions, mass spectrometry in proteomics, capillary electrophoresis for genomics, and microscale instrumentation for quantitative determinations. Student should have taken Instrumental Analysis or equivalent. Offered every other Fall semester.

CHEM 5260 - Analytical Separations
Credit(s): 3 Credits
This course focuses on chromatographic and electrophoretic separations. Topics include general plate theory, the principles and optimization of gas chromatography, liquid chromatography, supercritical fluid chromatography and capillary electrophoresis, and the principles of the detection systems utilized in these separation techniques. (Offered every Spring semester.) Student should have taken Instrumental Analysis or equivalent.

CHEM 5270 - Electroanalytical Chemistry
Credit(s): 3 Credits
This course is designed to introduce you to the fundamentals of electrochemistry and to discuss electroanalytical techniques. Topics to be covered include: chronoamperometry, cyclic voltammetry, scanning electrochemical microscopy, spectroelectrochemistry, electrochemiluminescence, and electrochemical sensors.

CHEM 5290 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)
Scheduling in a given semester depends on the availability of an instructor and anticipated enrollment. (Offered occasionally.)

CHEM 5299 - Introduction to Analytical Research
Credit(s): 1-3 Credits
Advanced laboratory individually planned to afford opportunities for special training, or as an introduction to research in analytical chemistry. (Offered every semester.)

CHEM 5300 - Mathematical Techniques in Chemistry
Credit(s): 3 Credits
Includes introduction to differential equations, group theory, matrix algebra and vector analysis as applied to Chemistry.
Prerequisite(s): MATH 1520

CHEM 5330 - Advanced Physical Chemistry
Credit(s): 3 Credits

CHEM 5340 - Advanced Thermodynamics
Credit(s): 3 Credits
The subject matter of this course entails advanced chemical thermodynamics. The four laws are recalled from Modern Thermodynamic perspective. The major component of the course is Statistical Thermodynamics where the four laws are restated from microscopic point of view. Statistical interpretation of equilibrium constant is given. Finally, laws related to the workings of far-from-equilibrium systems are summarized using Prigogine's minimum entropy production principle.

CHEM 5350 - Elements of Surface/Colloid Science
Credit(s): 3 Credits
The chemical properties of interfaces will be the main focus of this course. Chemistry of gas-liquid, solid-gas, and solid-liquid interfaces will be discussed with emphasis on thermodynamic descriptions. Industrial applications of interfacial processes will also be discussed. (Offered periodically)

CHEM 5370 - Computational Chemistry
Credit(s): 3 Credits
A description of the theory and practice of computational methods used in modern chemical research. Students gain knowledge of computational methods through classroom instruction and semester-long projects focused on a molecular system of their choice. Molecular calculations are performed using Gaussian 03 on a supercomputer.

CHEM 5390 - Special Topics: Physical Chemistry
Credit(s): 3 Credits (Repeatable for credit)
Scheduling in a given semester depends on the availability of an instructor and anticipated enrollment. (Offered occasionally.)

CHEM 5399 - Introduction to Physical Research
Credit(s): 1-3 Credits
Advanced laboratory individually planned to afford opportunities for special training, or as an introduction to research in physical chemistry. (Offered every semester.)

CHEM 5400 - Organic Spectroscopy
Credit(s): 3 Credits
Scheduling in a given semester depends on the availability of an instructor and anticipated enrollment. (Offered occasionally.)

CHEM 5440 - Bioorganic Chemistry
Credit(s): 3 Credits
This course examines organic chemistry pertinent to molecules and reactions found in biology. The course material is arranged by major classes of biomolecules: peptides/proteins/enzymes/cofactors, carbohydrates, nucleic acids, fatty acids and polyketides, terpenes, catalytic antibodies, etc. (Offered every Spring in even years)
Prerequisite(s): (CHEM 2420 or CHEM 2440)
Attributes: Chemical Biology Elective

CHEM 5450 - Advanced Organic Chemistry
Credit(s): 3 Credits
Physical organic chemistry including molecular orbital theory, structure-activity relationships, stereochemistry, reactive intermediates, determination of organic reaction mechanisms. (Offered every Fall semester.)
Attributes: Chemical Biology Elective

CHEM 5460 - Synthetic Organic Chemistry
Credit(s): 3 Credits
Emphasis on modern synthetic methods, mechanisms and application to the synthesis of complex structures. (Offered every Spring semester.)
Attributes: Chemical Biology Elective

CHEM 5470 - Principles of Medicinal Chemistry
Credit(s): 3 Credits
This course examines the relationship between chemical structure and biological activity with an emphasis on drug design and modification. Specific drug classes which will be sued as illustrative of this relationship include, cardiovascular drugs, anti-inflammatory agents, steroid hormones, and chemotherapeutic agents (antibiotics), among others. Fall semester.

CHEM 5480 - Heterocyclic Chemistry
Credit(s): 3 Credits
A broad survey of the synthetic approaches to, and reactions of the fundamental heterocyclic systems. (Offered occasionally.)
Attributes: Chemical Biology Elective

CHEM 5499 - Introduction to Organic Research
Credit(s): 1-3 Credits
Advanced laboratory individually planned to afford opportunities for special training, or as an introduction to research in organic chemistry. (Offered every semester.)

CHEM 5500 - Inorganic Chemistry
Credit(s): 3 Credits
The development and foundation of the periodic classification of the elements and an introduction to the systematic study of the properties of the elements and their compounds. Fall semester.

CHEM 5550 - Organometallic Chemistry
Credit(s): 3 Credits
Key aspects of organometallic and metal cluster chemistry: rationalization of organometallic complexes using the eighteen-electron rule; metal carbonyl complexes and their analogs; commonly encountered carbon- and heteroatom-based ligands; isolobal theory; mechanisms of organometallic reactions; organometallic chemistry in catalysis with a focus on some key industrial homogenous catalytic processes.
Prerequisite(s): CHEM 2420; CHEM 2440; CHEM 4500

CHEM 5560 - Solid State Chemistry
Credit(s): 3 Credits

CHEM 5570 - Group Theory & Spectroscopy
Credit(s): 3 Credits
Introduction to spectroscopic techniques applied to structural problems in inorganic chemistry. Topics include IR, UV, visible, NMR and ESR spectroscopy; ligand field theory and group theory in interpretation of spectra. (Offered every other Fall semester.)

CHEM 5590 - Special Topics: Inorganic Chemistry
Credit(s): 3 Credits
Scheduling in a given semester depends on the availability of an instructor and anticipated enrollment. (Offered occasionally.)

CHEM 5599 - Introduction to Inorganic Research
Credit(s): 3 Credits
This course gives students a through grounding in basic and advanced aspects of solid state structure and function. It begins with a survey of basic crystalline packing and symmetry leading to description of critical properties, such as electrical and super-conductivity. Solid state analysis will be described, with an emphasis placed on X-ray diffraction (XRD) techniques.

CHEM 5610 - Biochemistry 1
Credit(s): 3 Credits
Chemistry 5610 is an one semester, graduate course covering the fundamental components of biomolecules. The first portion of Chem 5610 will focus on the structure and function of biological macromolecules such as proteins, nucleic acids, carbohydrates, lipids, and membranes. The second portion of Chem 5610 will focus on protein dynamics such as enzyme kinetics, specificity, mechanism, and regulation. Upon completion of this course, I want my students to (1) possess general biochemistry knowledge about a wide variety of topics in order to build further knowledge, (2) use knowledge to solve unique problems requiring problem-solving skills and not mere memorization, and (3) have a better understanding of how biochemistry is related to everyday life, medicine, etc. My challenge as the instructor of this course is to challenge you as students. This course will require both memorization and an understanding of material to solve unique problems. This course brings together aspects of organic, physical, and analytical chemistry as well as biology and genetics.

CHEM 5615 - Biochemistry 2
Credit(s): 3 Credits
A one semester, graduate course focusing on metabolism and information transfer. Topics to be covered include glycolysis, citric acid cycle, electron transport, oxidative phosphorylation, photosynthesis, synthesis and degradation of biomolecules, transcription, replication, and translation.
Prerequisite(s): CHEM 5610 with a grade of C- or higher

CHEM 5620 - Biophysical Chemistry
Credit(s): 3 Credits
Chemistry 5620 is a one semester, graduate course that presents a comprehensive account of the structures and physical/chemical properties of biomolecules. The first part deals with the structure of biological macromolecules and the forces that determine this structure. The second part summarizes some of the techniques used in studying biological structure and function. The third part demonstrates how techniques and principles are used in concert to gain an understanding of the behavior and properties of biological macromolecules. Offered periodically.
Attributes: Chemical Biology Elective

CHEM 5630 - Introduction to Chemical Biology and Biotechnology
Credit(s): 3 Credits
This course will serve as an introduction to topics related to the fields of chemical biology and biotechnology. Offered in fall.
Attributes: Chemical Biology Elective

CHEM 5700 - Environmental Chemistry
Credit(s): 3 Credits
Concerns the impact of human activities on our natural surroundings. Course will focus on the chemical processes which occur in the atmosphere and in bodies of water and the effect of release of chemical pollutants on these systems. Sources of pollutants will be identified, and their removal from aqueous and atmospheric systems will be discussed. Health hazards to humans of selected pollutants will be covered to a limited extent. Student should have taken two semesters of Organic Chemistry.

CHEM 5800 - Fundamentals and Design of Nanomaterials
Credit(s): 3 Credits
This course addresses the development and application of nanomaterial. Synthetic and preparative processes for making nanoscale structures and materials are addressed along with techniques for their characterization. Theoretical models for describing physical and chemical prosperities of nanostructures are presented. Nanotechnology and applications of nanostructures are covered.

CHEM 5850 - Polymer Chemistry
Credit(s): 3 Credits
A survey of polymer chemistry including the mechanisms of polymerization and the characterization and structure-property relationships of polymers. (Offered every other year.)

CHEM 5920 - Research Seminar
Credit(s): 0-1 Credits (Repeatable for credit)
Registration required of full-time graduate students during regular sessions when the course is offered. Applicants for the M.S. (Research) degree may accumulate a maximum of three semester hours toward that degree. (Offered every Fall and Spring semester.)

CHEM 5930 - Special Topics
Credit(s): 1-3 Credits (Repeatable for credit)

CHEM 5970 - Research Topics
Credit(s): 1-3 Credits (Repeatable for credit)
Prior permission of guiding professor required.

CHEM 5980 - Graduate Reading Course
Credit(s): 1-3 Credits (Repeatable for credit)
Prior permission of guiding professor and department chairperson required.

CHEM 5990 - Thesis Research
Credit(s): 0-6 Credits (Repeatable for credit)

CHEM 6900 - Introduction to Proposal Writing and Oral Presentations
Credit(s): 3 Credits
This course will introduce students to the complex process of proposal writing and the art of preparing and presenting effective oral presentations.

CHEM 6930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)

CHEM 6980 - Independent Study
Credit(s): 1 or 3 Credits (Repeatable for credit)

CHEM 6990 - Dissertation Research
Credit(s): 0-6 Credits (Repeatability up to 12 credits)
This course involves an experimental or theoretical research project chosen and completed under the guidance of a graduate faculty member. A thesis must be written and orally defended.