CHEMISTRY (CHEM)

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

CHEM 1000 - Chemistry and the Environment
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), UUC:Global Interdependence, UUC:Natural & Applied Science

CHEM 1030 - Fundamentals of Chemistry
2 Credits
Designed to help students develop quantitative problem-solving skills necessary to model and describe chemical systems. Intended to serve as preparation for Chemistry 1110. Topics include nomenclature, units and unit conversions, atomic theory, stoichiometric problem evaluation, setup, and analysis, chemical calculations, and classes of reactions. Fall half semester.
Prerequisite(s): (MATH 1200*, SLUMP with a minimum score of 1400, or SCHEM with a minimum score of 1030)

* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

CHEM 1050 - Basic Chemistry
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.
Prerequisite(s): (MATH 1200* or SLUMP with a minimum score of 1400)

* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S), UUC:Natural & Applied Science

CHEM 1075 - Engineering Chemistry Laboratory
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
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), UUC:Natural & Applied Science

CHEM 1085 - Principles of Chemistry 1 Lab
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 1090 - Introductory Chemistry
4 Credits
The course introduces the principles of chemistry, focusing on the particulate nature of matter and its interactions and reactions that form the basis for the underlying molecular dynamics of living systems. Presents basic concepts of chemical bonding and intermolecular interactions for molecules and molecules' behavior in aqueous solutions with examples from biologically relevant molecules. Introduces kinetics and chemical thermodynamics with examples from biological systems. Offers students an opportunity to obtain a framework for understanding the chemical basis for different methods for separating and purifying biological compounds.
Corequisite(s): CHEM 1095

CHEM 1095 - Introductory Chemistry Laboratory
1 Credit
The course introduces basic laboratory techniques. Covers a range of topics including qualitative and quantitative analysis and the characteristics of chemical and physical processes.
Corequisite(s): CHEM 1090

CHEM 1110 - General Chemistry 1
0 or 3 Credits
Composition of matter, elements and compounds, naming, chemical reactions, gas laws, thermochemistry, periodicity and elemental properties, atomic structure, chemical bonding, molecular shapes, and intermolecular forces.
Prerequisite(s): (CHEM 1050 with a grade of C- or higher, CHEM 1030 with a grade of C- or higher, or SCHEM with a minimum score of 1110); (0 Course from MATH 1200-4999, SLU Math Index with a minimum score of 950, Math Waiver per Advisor with a minimum score of 1200, or SLUMP with a minimum score of 1400)
Attributes: Natural Science Req (A&S), UUC:Natural & Applied Science

CHEM 1115 - General Chemistry 1 Laboratory
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.

CHEM 1120 - General Chemistry 2
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
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 1120* with a grade of C- or higher or CHEM 1140* with a grade of C- or higher)

* Concurrent enrollment allowed.
Attributes: Natural Science Req (A&S)

CHEM 1130 - General Chemistry 1 for Majors
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.
Prerequisite(s): ((CHEM 1050 with a grade of C- or higher, CHEM 1030 with a grade of C- or higher, Chemistry Placement Waiver with a minimum score of 1050, or SCHEM with a minimum score of 1100); (0 Course from MATH 1400-4999, SLU Math Index with a minimum score of 950, Math Waiver per Advisor with a minimum score of 1200, or SLUMP with a minimum score of 1400))
Restrictions:
Enrollment limited to students in the Chemistry department.

Attributes: Natural Science Req (A&S), UUC:Natural & Applied Science

CHEM 1140 - General Chemistry 2 for Majors
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 limited to students in the Chemistry department.

Attributes: Natural Science Req (A&S)

CHEM 1480 - Principles of Chemistry 2 Lecture
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.)
Prerequisite(s): CHEM 1080 with a grade of C- or higher
Attributes: Natural Science Req (A&S)

CHEM 1485 - Principles of Chemistry 2 Lab
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) or CHEM 1083 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
1 or 4 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
1-3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

CHEM 2200 - Analytical Chemistry 1
3 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: 3 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: Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

CHEM 2205 - Analytical Chemistry 1 Laboratory
1 Credit
Calibration and use of quantitative apparatus including analytical balances, spectrophotometers, potentiostats, and chromatographic instrumentation. Corequisite: CHEM 2200. Laboratory: 4 hours/week. Offered Fall and Spring semesters.
Prerequisite(s): (CHEM 1120 or CHEM 1140); CHEM 1125
Corequisite(s): CHEM 2200
Attributes: Forensic Science Elective, Forensic Science Bio/Chem Lab, Natural Science Req (A&S)

CHEM 2410 - Organic Chemistry 1
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 in the Chemistry department may **not** enroll.

Attributes: Natural Science Req (A&S)

CHEM 2415 - Organic Chemistry 1 Laboratory
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* with a grade of C- or higher or CHEM 2430* with a grade of C- or higher))

* Concurrent enrollment allowed.
Restrictions:
Students in the Chemistry department may **not** enroll.

CHEM 2420 - Organic Chemistry 2
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 in the Chemistry department may **not** enroll.

Attributes: Natural Science Req (A&S)

CHEM 2425 - Organic Chemistry 2 Laboratory
1 Credit
Laboratory to accompany CHEM 2420 with an emphasis on the synthesis and reactions of organic compounds. Laboratory 3 hours/week. 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 in the Chemistry department may **not** enroll.

Attributes: Natural Science Req (A&S)

CHEM 2430 - Organic Chemistry 1 for Majors
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 limited to students in the Chemistry department.

Attributes: Natural Science Req (A&S)

CHEM 2435 - Organic Chemistry 1 Lab for Majors
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 limited to students in the Chemistry department.

Attributes: Natural Science Req (A&S)

CHEM 2440 - Organic Chemistry 2 for Majors
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 limited to students in the Chemistry department.

Attributes: Natural Science Req (A&S)

CHEM 2445 - Organic Chemistry 2 Laboratory for Majors
1 Credit
Laboratory to accompany CHEM 2440. Chemistry and Biochemistry majors only. Laboratory 3 hours/week. Spring semester.
Prerequisite(s): CHEM 2435 with a grade of C- or higher; CHEM 2440* with a grade of C- or higher; CHEM 2430 with a grade of C- or higher

* Concurrent enrollment allowed.
Restrictions:
Enrollment limited to students in the Chemistry department.

Attributes: Natural Science Req (A&S)

CHEM 2930 - Special Topics
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
3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

CHEM 3100 - The Chemical Literature
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.
Prerequisite(s): (CHEM 2440 with a grade of C- or higher or CHEM 2420 with a grade of C- or higher); CHEM 2200 with a grade of C- or higher
Attributes: Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

CHEM 3330 - Physical Chemistry 1
3 Credits
Topics include kinetic theory, chemical thermodynamics and equilibria. Fall semester.
Prerequisite(s): CHEM 2200 with a grade of C- or higher; (1 Course from MATH 1520-4999 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1520, or SLUMP with a minimum score of 2530)
Attributes: Forensic Science Bio/Chem Elec

CHEM 3340 - Physical Chemistry 2
3 Credits
Topics include chemical kinetics, quantum chemistry and spectroscopy. Spring semester.
Prerequisite(s): CHEM 2200 with a grade of C- or higher; (1 Course from MATH 1520-4999 with a grade of C- or higher or Math Waiver per Advisor with a minimum score of 1520)
Attributes: Forensic Science Bio/Chem Elec

CHEM 3345 - Physical Chemistry Laboratory
1-6 Credits
Laboratory, three hours per week. Experiments included from topics in CHEM 3330 and 3340. Spring Semester.
Prerequisite(s): CHEM 3330 with a grade of C- or higher
Corequisite(s): CHEM 3340
Restrictions:
Enrollment limited to students in a Bachelor of Science degree.

Enrollment limited to students in the Chemistry department.

Attributes: Forensic Science Bio/Chem Lab, Natural Science Req (A&S)

CHEM 3600 - Principles of Biochemistry
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 with a grade of C- or higher or CHEM 2430 with a grade of C- or higher)
Attributes: Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

CHEM 3910 - Internship
1-6 Credits (Repeatable for credit)
Prerequisite(s): (CORE 1000 or UIS with a minimum score of S); CORE 1500*

* Concurrent enrollment allowed.
Attributes: UUC:Reflection-in-Action

CHEM 3930 - Special Topics
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 - Independent Research in Chemistry
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
1-3 Credits (Repeatable for credit)
Attributes: Natural Science Req (A&S)

CHEM 4200 - Analytical Chemistry 2
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.
Prerequisite(s): (CHEM 2200 with a grade of C- or higher and CHEM 2205 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); (PHYS 1330 with a grade of C- or higher or PHYS 1630 with a grade of C- or higher)
Attributes: Bio-Chemical Biology Elective, Chemical Biology Elective, Forensic Science Bio/Chem Elec

CHEM 4205 - Analytical Chemistry 2 Laboratory
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 with a grade of C- or higher; CHEM 2205 with a grade of C- or higher; (CHEM 2440 with a grade of C- or higher or CHEM 2420 with a grade of C- or higher); CHEM 2445 with a grade of C- or higher
Corequisite(s): CHEM 4200
Attributes: Forensic Science Bio/Chem Lab

CHEM 4300 - Mathematical Techniques in Chemistry
3 Credits
Includes introduction to differential equations, group theory, matrix algebra and vector analysis as applied to chemistry. Lecture 3 hours/ week. Spring semester.
Prerequisite(s): (1 Course from MATH 1520-4999 with a grade of C- or higher or Math Waiver per Advisor with a minimum score of 1520)

CHEM 4400 - Organic Spectroscopy
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.
Prerequisite(s): (CHEM 2440 with a grade of C- or higher or CHEM 2420 with a grade of C- or higher); (CHEM 2445 with a grade of C- or higher or CHEM 2425 with a grade of C- or higher)
Attributes: Bio-Chemical Biology Elective, Chemical Biology Elective, Forensic Science Bio/Chem Elec

CHEM 4470 - Medicinal Chemistry
3 Credits
This course will provide the students with a comprehensive introduction to medicinal chemistry. Topics will include drug discovery, biological targets, drug-target interactions, drug structure optimization, drug metabolism, structure-based drug design, drug synthesis, and select specific drug classes. Lecture 3 hours/week. (Offered in Spring)
Prerequisite(s): ((CHEM 2410 with a grade of C- or higher and CHEM 2420 with a grade of C- or higher) or (CHEM 2430 with a grade of C- or higher and CHEM 2440 with a grade of C- or higher))
Attributes: Forensic Science Bio/Chem Elec

CHEM 4500 - Inorganic Chemistry
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 with a grade of C- or higher or CHEM 2440 with a grade of C- or higher)
Attributes: Bio-Chemical Biology Elective, Chemical Biology Elective, Forensic Science Bio/Chem Elec

CHEM 4505 - Inorganic Chemistry Laboratory
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 is limited to students with a major in Chemistry.

Attributes: Natural Science Req (A&S)

CHEM 4610 - Biochemistry 1
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 with a grade of C- or higher or CHEM 2440 with a grade of C- or higher); CHEM 2200 with a grade of C- or higher
Attributes: Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

CHEM 4615 - Biochemistry 1 Laboratory
1 Credit
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.
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: Forensic Science Bio/Chem Lab

CHEM 4620 - Biochemistry 2
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: Forensic Science Bio/Chem Elec, Natural Science Req (A&S)

CHEM 4625 - Biochemistry 2 Laboratory
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.
Prerequisite(s): CHEM 4615 with a grade of C- or higher
Corequisite(s): CHEM 4620
Attributes: Forensic Science Bio/Chem Lab, Natural Science Req (A&S)

CHEM 4800 - Fundamentals and Design of Nanomaterials
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 with a grade of C- or higher; CHEM 2200 with a grade of C- or higher; CHEM 3330 with a grade of C- or higher

CHEM 4910 - Internship
1-6 Credits (Repeatable for credit)
Prerequisite(s): (CORE 1000 or UIS with a minimum score of S); CORE 1500*

* Concurrent enrollment allowed.
Attributes: UUC:Reflection-in-Action

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

CHEM 4980 - Advanced Independent Study
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
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 5200 - Analytical Chemistry II
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.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5230 - Mass Spectrometry
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 5260 - Analytical Separations
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.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5270 - Electroanalytical Chemistry
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.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5299 - Introduction to Analytical Research
1-3 Credits (Repeatable up to 3 credits)
Advanced laboratory individually planned to afford opportunities for special training, or as an introduction to research in analytical chemistry. (Offered every semester.)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5300 - Mathematical Techniques in Chemistry
3 Credits
Includes introduction to differential equations, group theory, matrix algebra and vector analysis as applied to Chemistry.

CHEM 5370 - Computational Chemistry
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.
Attributes: Bioinformatics & Comp Bio Elec

CHEM 5390 - Special Topics: Physical Chemistry
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
1-3 Credits (Repeatable up to 3 credits)
Advanced laboratory individually planned to afford opportunities for special training, or as an introduction to research in physical chemistry. (Offered every semester.)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5400 - Organic Spectroscopy
3 Credits
Scheduling in a given semester depends on the availability of an instructor and anticipated enrollment. (Offered occasionally.)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5410 - Organic Chemistry 3
3 Credits
A one semester course exploring the fundamental principles of reactivity of organic compounds within the context of the synthesis of complex chemical structures. This course will focus on understanding and proposing mechanisms for synthetically relevant reactions and using them to predict and explain reaction outcomes.

CHEM 5440 - Bioorganic Chemistry
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)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology, Chemical Biol Pharmacology, Chemistry or Chemistry.

Attributes: Bio-Chemical Biology Elective

CHEM 5450 - Advanced Organic Chemistry
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: Bio-Chemical Biology Elective

CHEM 5460 - Synthetic Organic Chemistry
3 Credits
Emphasis on modern synthetic methods, mechanisms and application to the synthesis of complex structures. (Offered every Spring semester.)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

Attributes: Bio-Chemical Biology Elective

CHEM 5470 - Medicinal Chemistry
3 Credits
This course will provide the students with a comprehensive introduction to medicinal chemistry. Topics will include drug discovery, biological targets, drug-target interactions, drug structure optimization, drug metabolism, structure-based drug design, drug synthesis, and select specific drug classes. Lecture 3 hours/week. (Offered in Spring)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

Attributes: Bioinformatics & Comp Bio Elec

CHEM 5499 - Introduction to Organic Research
1-3 Credits (Repeatable up to 3 credits)
Advanced laboratory individually planned to afford opportunities for special training, or as an introduction to research in organic chemistry. (Offered every semester.)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5500 - Inorganic Chemistry
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.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5550 - Organometallic Chemistry
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.

CHEM 5560 - Solid State Chemistry
3 Credits
Chemistry 5560 is a one semester, graduate course covering certain key aspects of solid-state chemistry materials and characterization. The course will begin with the fundamentals of crystal structure and symmetry and then consider solid state thermodynamics and electronic properties. After discussing defects and non-stoichiometry, techniques of X-ray structure determination will be examined in more detail. Offered periodically.

CHEM 5570 - Group Theory & Spectroscopy
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 5599 - Introduction to Inorganic Research
3 Credits (Repeatable up to 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.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5610 - Biochemistry 1
3 Credits
This is a one semester, graduate course covering the fundamental components of biomolecules. The first portion will focus on the structure and function of biological macromolecules such as proteins, nucleic acids, carbohydrates, lipids, and membranes. The second portion 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.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

Attributes: Bioinformatics & Comp Bio Elec, BME Graduate Elective

CHEM 5615 - Biochemistry 2
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
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

Attributes: Bioinformatics & Comp Bio Elec

CHEM 5620 - Biophysical Chemistry
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.
Attributes: Bioinformatics & Comp Bio Elec, Bio-Chemical Biology Elective

CHEM 5630 - Introduction to Chemical Biology and Biotechnology
3 Credits
This course will serve as an introduction to topics related to the fields of chemical biology and biotechnology.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

Attributes: BME Graduate Elective, Bio-Chemical Biology Elective

CHEM 5800 - Fundamentals and Design of Nanomaterials
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 5920 - Research Seminar
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.)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

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

CHEM 5970 - Research Topics
1-3 Credits (Repeatable for credit)
Prior permission of guiding professor required.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5980 - Graduate Independent Study in Chemistry
1-3 Credits (Repeatable for credit)
Prior permission of guiding professor and department chairperson required.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 5990 - Thesis Research
0-6 Credits (Repeatable for credit)
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

CHEM 6900 - Introduction to Proposal Writing and Oral Presentations
1 Credit
This course will introduce students to the complex process of proposal writing and the art of preparing and presenting effective oral presentations.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.

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

CHEM 6980 - Graduate Independent Study in Chemistry
1 or 3 Credits (Repeatable for credit)

CHEM 6990 - Dissertation Research
0-6 Credits (Repeatable for credit)
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.
Restrictions:
Enrollment is limited to students with a major in Chemical Biology or Chemistry.