CHEMISTRY (CHEM)

CHEM F100X Chemistry in Complex Systems (n)
4 Credits
Offered Fall, Spring and Summer
Fundamentals of chemistry with an emphasis on the role of chemistry in environmental and life systems. The role of feedback systems on chemical behavior is illustrated in atmospheric, aquatic, nuclear and nutritional systems. For non-science majors.

Prerequisites: Placement in WRTG F111X; placement in MATH F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F103L CHEM F103X Laboratory
0 Credit
Co-requisites: CHEM F103X.
Lecture + Lab + Other: 0 + 0 + 0

CHEM F103X Introduction to General Chemistry (n)
4 Credits
Offered Fall
Introductory chemistry survey course for health science majors and preparatory course for science majors. Topics include: measurement, energy and matter, periodic trends, chemical composition, chemical reactions, solutions, bond theory, phases, oxidation-reduction, nuclear chemistry, problem-solving (applied mathematics), and special topics.

Prerequisites: Placement in WRTG F111X; placement in MATH F105.
Special Notes: This course fulfills the laboratory part of the natural science requirement and provides preparation for subsequent training in chemistry in CHEM F104X and CHEM F105X.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F104L CHEM F104X Laboratory
0 Credit
Co-requisites: CHEM F104X.
Lecture + Lab + Other: 0 + 0 + 0

CHEM F104X Introduction to Organic Chemistry and Biochemistry (n)
4 Credits
Offered Spring
This is the second semester course in the sequence for health-science majors and comprises a survey of the fundamentals of chemistry as applied to biological systems. Topics include nomenclature of organic compounds, organic functional groups and reactions, biochemical processes and pathways, biological macromolecules, and metabolites.

Prerequisites: CHEM F103X; placement in WRTG F111X; placement in MATH F105.
Co-requisites: CHEM F104L.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F105L Chemistry F105X Lab
0 Credit
Lecture + Lab + Other: 0 + 0 + 0

CHEM F105X General Chemistry I (n)
4 Credits
Offered Fall, Spring and Summer
This course is an introduction to general chemistry and explores topics to a much greater depth than preparatory courses. Topics include: measurement, energy and matter, periodic trends, chemical composition, chemical reactions, solutions, bond theory, gases, thermodynamics, problem-solving (applied mathematics), and special topics. Students must be enrolled in both CHEM F105X and CHEM F105L to receive full credit.

Prerequisites: Placement in WRTG F111X; placement in MATH F151X; or a B- or better in CHEM F103X; or permission of instructor and department.
Corequisite: CHEM F105L.
Special Notes: CHEM F105X-CHEM F106X, together with their laboratory components, constitute the standard one year engineering and science major general chemistry course.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F106L Chemistry F106X Lab
0 Credit
Lecture + Lab + Other: 0 + 0 + 0

CHEM F106X General Chemistry II (n)
4 Credits
Offered Fall, Spring and Summer
The second semester in the general chemistry sequence. Topics include: kinetics, equilibrium chemistry (including acids and bases, solubility, and complex ion formation), nuclear chemistry, electrochemistry, thermodynamics, and special topics. Students must be enrolled in both CHEM F106X and CHEM F106L to receive full credit.

Prerequisites: Grade of C- or better in CHEM F105X; placement in WRTG F111X; placement in MATH F151X; or permission of instructor and department chair.
Corequisites: CHEM F106L.
Special Notes: CHEM F105X-CHEM F106X, together with their laboratory components, constitute the standard one year engineering and science major general chemistry course.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F111X Introduction to Environmental Chemistry of the Arctic (a)
4 Credits
Offered As Demand Warrants
This course introduces students to environmental chemistry through investigating the air, water and soil quality of the Arctic environment as affected by natural and anthropogenic cycling of nutrients and contaminants. The lab component will focus on characterization of natural waters collected around the state. This course is offered on-campus and by distance.

Prerequisites: MATH F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0
CHEM F190  Alaska Statewide High School Science Symposium  2 Credits
Offered Spring
Students employ the scientific method to approach a problem of personal interest. Student work is molded into a research paper delivered orally in a formal scientific presentation for judges with wide-ranging experiences.
Prerequisites: High School student grades 9-12.
Recommended: Research completion, abstract and paper writing/submission, ASHSSS presentation.
Lecture + Lab + Other: 0 + 10 + 0

CHEM F202  Basic Inorganic Chemistry (n)  3 Credits
Offered Spring
Introduction to coordination theory, crystal field theory, kinetics and mechanisms of substitutions and redox reactions, unit cells and ionic bonding, periodic law, and descriptive chemistry of selected main group elements.
Prerequisites: CHEM F106X.
Lecture + Lab + Other: 2 + 3 + 0

CHEM F212  Chemical Equilibrium and Analysis (n)  4 Credits
Offered Fall
Aqueous chemical equilibrium as applied to chemical analysis, separations, spectrophotometry, potentiometry and factors considered in the analytical approach. Lab portion will include introductory experiments in analytical and instrumental techniques.
Prerequisites: Grade of C or better in CHEM F106X; MATH F151X.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F288  Introduction to Chemical Research  2 Credits
Offered As Demand Warrants
Scientific research is creative and engaging when properly planned and executed. This course introduces students to the process of planning and executing a research project. We will begin with an idea, review primary literature, brainstorm project ideas, pose a testable hypothesis, plan experiments and execute a small research project.
Prerequisites: CHEM F212, CHEM F321.
Lecture + Lab + Other: 1 + 3 + 0

CHEM F314  Analytical Instrumental Laboratory (W, n)  3 Credits
Offered Spring
A laboratory course focusing on the acquisition and interpretation of spectroscopic and chromatographic data for qualitative characterization and quantitative chemical measurements. Students will learn to design and execute experiments with a variety of instruments, critically evaluate experimental data, and communicate their findings through scientific writing.
Prerequisites: CHEM F212; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; must be a chemistry major.
Lecture + Lab + Other: 1 + 6 + 0

CHEM F321  Organic Chemistry I (n)  4 Credits
Offered Fall
A systematic study of the more important functional groups of carbon compounds, including their mechanisms of reaction, methods of synthesis, and physical and spectroscopic properties. Lab portion will include an introduction to synthetic techniques and spectroscopy.
Prerequisites: CHEM F106X.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F325  Organic Chemistry II (n)  4 Credits
Offered Spring
A systematic study of the more important functional groups of carbon compounds, including their mechanisms of reaction, methods of synthesis and physical and spectroscopic properties. Lab portion will include synthesis and characterization by spectroscopy.
Prerequisites: CHEM F321.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F331  Physical Chemistry I (n)  4 Credits
Offered Fall
Principles of thermodynamics and kinetics with applications to phase equilibria, solutions, chemical equilibrium and electrochemistry. Course teaches these concepts using both lecture and laboratory instruction.
Prerequisites: CHEM F106X; MATH F252X; PHYS F124X or PHYS F212X.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F332  Physical Chemistry II (n)  4 Credits
Offered Spring
Atomic and molecular structure, and spectroscopy, and statistical mechanics. Course teaches these concepts using both lecture and laboratory instruction.
Prerequisites: CHEM F331; MATH F253X.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F351  General Biochemistry: Metabolism  3 Credits
Offered Spring
The biochemistry of metabolism. Topics include: chemistry of amino acids and its implication, protein structure-function, enzyme catalysis, glucose and glycogen metabolism and regulation, bioenergetics, lipid metabolism and biomembranes, amino acid metabolism and regulation of metabolism. Biomedical relevance and contemporary techniques will be addressed if appropriate.
Prerequisites: CHEM F321.
Recommended: CHEM F331.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F360  Cell and Molecular Biology (n)  3 Credits
Offered Spring
An introduction to the structure and function of cells. Topics include: the structure and function of cellular components, including proteins, membranes and organelles; understanding how cells communicate; and how information is processed in the cell via DNA replication, transcription and translation.
Prerequisites: BIOL F260; CHEM F105X; CHEM F106X (may be taken concurrently).
Cross-listed with BIOL F360.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F402  Inorganic Chemistry (n)  3 Credits
Offered Fall
Symmetry and group theory, molecular orbital theory, solid state chemistry, acids and bases, redox reactions, non-aqueous solvents, descriptive chemistry of some main group elements.
Prerequisites: CHEM F202; CHEM F325.
Lecture + Lab + Other: 1 + 6 + 0
CHEM F403  Biological Inorganic Chemistry
3 Credits
Offered Fall
Survey of structure, functions, and chemical properties of natural metalloproteins and metalloenzymes, roles of metalloproteins in nucleic acid formation and replication, metal-based medicines.
Prerequisites: CHEM F202; CHEM F351.
Stacked with CHEM F603.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F406  Atmospheric Chemistry
3 Credits
Offered Spring Odd-numbered Years
Chemistry of the lower atmosphere (troposphere and stratosphere) including photochemistry, kinetics, thermodynamics, box modeling, biogeochemical cycles and measurement techniques for atmospheric pollutants; study of important impacts to the atmosphere which result from anthropogenic emissions of pollutants, including acid rain, the “greenhouse” effect, urban smog and stratospheric ozone depletion.
Prerequisites: CHEM F332.
Stacked with CHEM F606; ATM F606.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F419  Practical Nuclear Magnetic Resonance
2 Credits
Offered Spring
Students will be trained in the basic operation of NMR instruments. Students will spend much of the class time getting hands-on experience on the NMR with student-driven NMR-based research projects. At the end of the course, students will present their projects to the rest of the class.
Prerequisites: CHEM F321.

CHEM F420  Applications of NMR Spectroscopy
3 Credits
Offered Fall Even-numbered Years
Applications of nuclear magnetic resonance (NMR) spectroscopy in the chemical and biochemical sciences. The course will focus on the implementation and interpretation of NMR experiments for solving research problems. Topics include the basic theory of NMR and one- and two-dimensional techniques.
Prerequisites: CHEM F321.
Stacked with CHEM F620.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F434  Chemistry Capstone Laboratory (W, n)
3 Credits
Offered Fall
A capstone laboratory course with three major components: 1) experiments related to concepts learned in physical, analytical and inorganic chemistry courses emphasizing kinetics, spectroscopy and thermodynamics; 2) computer use in problem solving, data analysis and word processing; and 3) technical writing with emphasis on preparation of papers for publication.
Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; CHEM F212; CHEM F202.
Corequisites: CHEM F332.
Lecture + Lab + Other: 1 + 6 + 0

CHEM F450  Information Storage and Transfer: Molecules and Pathways
3 Credits
Offered Fall
Focuses on the biochemistry of the two principal macromolecules: nucleic acids and proteins. Topics include: nucleotides metabolism, DNA structure and topology, DNA replication, DNA repair and recombination, cell cycle regulation, RNA transcription and processing. Gene expression, translation and protein metabolism. Biomedical relevance and contemporary techniques will be addressed if appropriate.
Prerequisites: CHEM F321.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F455  Environmental Toxicology
3 Credits
Offered Fall
Environmental toxicology will focus on the general properties and principles of persistent and/or poisonous (toxic) chemicals commonly encountered in air, water, fish and wildlife. Numerous natural and synthetic chemicals in the environment will be discussed from a global perspective with some bias towards Arctic and sub-Arctic regions.
Prerequisites: CHEM F351; or one semester each of organic chemistry and cell or molecular biology; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; COJO F121X or COJO F131X or COJO F141X.
Cross-listed with BIOL F455.
Stacked with BIOL F656; CHEM F655.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F466  Advanced Cell and Molecular Laboratory
3 Credits
Offered Spring
Modern molecular biological techniques including protein and nucleic acid gel electrophoresis, western blotting, cell fractionation, cellular respiration, enzymology and fluorescence microscopy. Lectures will be supplemented with reading from the primary literature. Student projects in this course may satisfy the capstone project requirements of the biological science degree. Student must also enroll in BIOL F400 to receive capstone credit.
Prerequisites: BIOL F360 or CHEM F360 may be taken concurrently.
Cross-listed with BIOL F466.
Lecture + Lab + Other: 2 + 4 + 0

CHEM F470  Cellular and Molecular Neuroscience
3 Credits
Offered Fall Even-numbered Years
The goal of this course is to provide an overview of the cellular and molecular underpinnings of signaling in the nervous system. Discussions will be focused on properties of excitable membranes, synaptic transmission, and neurological integration. Fundamentals of the functional properties of neurons will provide the background for discussions of small neuronal circuits that regulate behavior, the cellular/molecular basis of learning and memory, and pharmacological approaches for the treatment of neuronal pathologies.
Prerequisites: Two F300-level courses in BIOL or CHEM; MATH F251X or MATH F230X.
Recommended: MATH F252X.
Stacked with CHEM F670 and BIOL F679.
Lecture + Lab + Other: 3 + 0 + 0
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
<th>Offered</th>
<th>Lecture + Lab + Other</th>
<th>Special Notes</th>
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<tr>
<td>CHEM F474</td>
<td>Neurochemistry</td>
<td>3</td>
<td>BIOL F115X, CHEM F325, BIOL F417 or CHEM F470 or PSY F335.</td>
<td>Fall Odd-numbered</td>
<td>3 + 0 + 0</td>
<td>Cross-listed with BIOL F434.</td>
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<td>CHEM F481</td>
<td>Seminar</td>
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<td>Stacked with CHEM F676.</td>
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<td>CHEM F482</td>
<td>Seminar</td>
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<td>CHEM F488</td>
<td>Undergraduate Chemistry and Biochemistry Research</td>
<td>2-3</td>
<td>BIOL F131X or COJO F141X.</td>
<td>Fall and Spring</td>
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<td>CHEM F498</td>
<td>Research</td>
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<td>0 + 6-9 + 0</td>
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<td>CHEM F601</td>
<td>Introduction to Atmospheric Sciences</td>
<td>3</td>
<td>Graduate standing.</td>
<td>Fall</td>
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<td>CHEM F603</td>
<td>Biological Inorganic Chemistry</td>
<td>3</td>
<td>BIOL F131X or COJO F141X.</td>
<td>As Demand Warrants</td>
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<td>Cross-listed with CHEM F603.</td>
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<td>CHEM F605</td>
<td>Aquatic Chemistry</td>
<td>3</td>
<td>ATM F601.</td>
<td>Fall</td>
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<td>CHEM F606</td>
<td>Atmospheric Chemistry</td>
<td>3</td>
<td>ATM F601.</td>
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<td>3 + 0 + 0</td>
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<tr>
<td>CHEM F609</td>
<td>Aquatic and Environmental Geochemistry</td>
<td>3</td>
<td>ATM F601.</td>
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<td>3 + 0 + 0</td>
<td>Cross-listed with GEOS F633.</td>
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CHEM F620  Applications of NMR Spectroscopy  
3 Credits  
Offered Fall Even-numbered Years  
Applications of nuclear magnetic resonance (NMR) spectroscopy in the chemical and biochemical sciences. The course will focus on the implementation and interpretation of NMR experiments for solving research problems. Topics include the basic theory of NMR and one- and two-dimensional techniques.  
Prerequisites: Graduate standing.  
Stacked with CHEM F420.  
Lecture + Lab + Other: 3 + 0 + 0  

CHEM F631  Environmental Fate and Transport  
3 Credits  
Offered Spring Even-numbered Years  
Examination of the physical properties that govern the behavior, fate and transport of contaminants released into the environment. Topics include air-water partitioning and exchange, organic solvent-water partitioning, diffusion, sorption, chemical and biological transformation reactions, and modeling concepts.  
Cross-listed with ATM F631.  
Lecture + Lab + Other: 3 + 0 + 0  

CHEM F632  Molecular Spectroscopy  
3 Credits  
Offered Fall Odd-numbered Years  
Application of quantum mechanics to molecular bonding and spectroscopy. Topics include: applications of lasers to probe chemical reactivity, photochemistry and the detection of trace compounds in mixtures. Variable content. May be repeated for credit.  
Prerequisites: CHEM F332.  
Lecture + Lab + Other: 3 + 0 + 0  

CHEM F654  Protein Structure and Function  
3 Credits  
Offered Spring Even-numbered Years  
Contemporary topics in peptide and protein biochemistry. Topics include peptide synthesis, protein modification, comparative aspects of structure, protein engineering, enzyme and receptor function as well as molecular modeling.  
Prerequisite: CHEM F351.  
Lecture + Lab + Other: 3 + 0 + 0  

CHEM F655  Environmental Toxicology  
3 Credits  
Offered Fall  
Environmental toxicology will focus on the general properties and principles of persistent and/or poisonous (toxic) chemicals commonly encountered in air, water, fish and wildlife. Numerous natural and synthetic chemicals in the environment will be discussed from a global perspective with some bias towards Arctic and sub-Arctic regions.  
Prerequisites: CHEM F351; or one semester each of organic chemistry and cell or molecular biology.  
Cross-listed with BIOL F656.  
Stacked with BIOL F455, CHEM F455.  
Lecture + Lab + Other: 3 + 0 + 0  

CHEM F657  Molecular Foundations of Gene Expression  
3 Credits  
Offered Spring Even-numbered Years  
The molecular regulation of gene expression in prokaryotes and eukaryotes in the context of development and disease. Major topics include: protein/DNA interactions, structure-function relations of transcription factors, signal transduction, control of transcription and translation, chromatin structure and DNA replication.  
Prerequisites: CHEM F351; CHEM F450.  
Lecture + Lab + Other: 3 + 0 + 0  

CHEM F660  Chemical Oceanography  
3 Credits  
Offered Spring  
An integrated study of the chemical, biological, geological and physical processes that determine the distribution of chemical variables in the sea. Topics include biogeochemical cycles and the use of tracers to follow these complex chemical cycles. The chemistry of carbon is considered in detail. Interactions with the atmosphere and lithosphere (including implications of the mid-ocean ridge vent system to ocean chemistry) are examined.  
Prerequisites: Graduate standing.  
Cross-listed with MSL F660.  
Lecture + Lab + Other: 3 + 0 + 0  

CHEM F666  Scientific Teaching  
2 Credits  
Offered Spring Even-numbered Years  
This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment and course management that have been shown by research to improve student learning. This course is intended for graduate students in the sciences who have an interest in improving their teaching skills. The course format will be a mixture of discussion, workshops and seminars. If the course is over-enrolled, priority will be given to teaching assistants who are assigned to teach large, introductory level (100 or 200 level) courses during the semester they are taking this course.  
Prerequisites: Graduate standing.  
Lecture + Lab + Other: 2 + 0 + 0  

CHEM F670  Cellular and Molecular Neuroscience  
3 Credits  
Offered Fall Even-numbered Years  
The goal of this course is to provide an overview of the cellular and molecular underpinnings of signaling in the nervous system. Discussions will be focused on properties of excitable membranes, synaptic transmission, and neurological integration. Fundamentals of the functional properties of neurons will provide the background for discussions of small neuronal circuits that regulate behavior, the cellular/molecular basis of learning and memory, and pharmacological approaches for the treatment of neuronal pathologies.  
Prerequisites: Two F300-level courses in BIOL or CHEM; MATH F251X or MATH F230X.  
Recommended: MATH F252X.  
Cross-listed with BIOL F679.  
Stacked with CHEM F470.  
Lecture + Lab + Other: 3 + 0 + 0
CHEM F671 Receptor Pharmacology
3 Credits
Offered Fall Even-numbered Years
Covers basic drug/receptor theory to train students to a) assess affinity and efficacy of receptor ligands; b) work with and interpret functional assays and binding results; c) critically evaluate original research regarding receptor pharmacology with an emphasis on ligand-gated ion channels and G-protein coupled receptors; and c) identify testable hypotheses and design experiments to test these hypotheses.
Prerequisites: Upper-division or graduate biochemistry or neurochemistry course.
Recommended: BIOL F417.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F674 Membrane Biochemistry and Biophysics
3 Credits
Offered Fall Even-numbered Years
Basic biophysical and molecular processes associated with membrane-mediated events in the context of cellular physiology. Major topics includes biochemical and biophysical characteristics of membrane lipids; structure-function relation of membrane proteins; protein trafficking/targeting; vesicle transport and membrane fusion/exocytosis; the nature of membrane excitability; and the role of membrane in bioenergetics.
Prerequisites: CHEM F351; CHEM F450.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F675 Cellular Signaling
3 Credits
Offered Spring Odd-numbered Years
Cellular signaling is of vital importance in complex biomolecular systems, development, physiology, and pathology and thus, constitutes a major topic in modern medical and pharmacological research. This course concentrates on cellular signal transduction and regulation in higher animals and humans. Major topics include G-proteins, Protein kinases, Ca2, cAMP lipid mediators, adaptor proteins and signal recognition domains.
Prerequisites: Upper division or graduate biochemistry or neurochemistry course.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F676 Neurochemistry
3 Credits
Offered Fall Odd-numbered Years
Covers basic and applied aspects of interneuronal signaling of specific neurotransmitter systems. Lectures will be based on chapters from assigned text as well as recent and historical literature relevant to these topics. Basic concepts introduced in lectures will be applied through guided discussion of original research papers. Students will learn to prepare "peer reviews" of selected papers and critically discuss original research.
Prerequisites: BIOL F115X; CHEM F325; BIOL F417 or CHEM F470 or PSY F335.
Stacked with CHEM F474.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F686 Chemical Research Mentoring
2 Credits
Offered As Demand Warrants
This course provides graduate students the opportunity to mentor undergraduates in chemical research within a structured environment, from developing a research idea to executing a small research project. the focus of this course is to refine mentoring skills that contribute to the professional development of maturing chemical professionals.
Prerequisites: Graduate standing in a scientific discipline.
Lecture + Lab + Other: 1 + 3 + 0

CHEM F688 Biochemical and Molecular Biology Seminar
1 Credit
Offered Fall and Spring
A seminar on various topics related to biochemistry and molecular biology including discussions of recent literature and research results.
Lecture + Lab + Other: 1 + 0 + 0

CHEM F691 Research Presentation Techniques
1 Credit
Offered Fall
Review of recent research in chemistry to expose students to recent findings, methodologies and concepts in a broad range of chemistry and related disciplines. How to present and defend research proposals. Course may be repeated for credit.
Prerequisites: Graduate standing in physical sciences.
Lecture + Lab + Other: 1 + 0 + 0

CHEM F692 Seminar
1-6 Credits
Graded Pass/Fail.
Lecture + Lab + Other: 1-6 + 0 + 0

CHEM F698 Non-thesis Research/Project
1-9 Credits
Graded Pass/Fail.
Lecture + Lab + Other: 0 + 1-9 + 0

CHEM F699 Thesis
1-12 Credits
Offered Fall, Spring and Summer
Lecture + Lab + Other: 0 + 0 + 0