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.
Attributes: UAF GER Natural Science Req
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.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F104L CHEM F104X Laboratory
0 Credit
Co-requisites: CHEM F104X.
Attributes: UAF GER Natural Science Req
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.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F105L Chemistry F105X Lab
0 Credit
Attributes: UAF GER Natural Science Req
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
Attributes: UAF GER Natural Science Req
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
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
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
<th>Prerequisites</th>
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<tr>
<td>CHEM F106X</td>
<td>Organic Chemistry I (n)</td>
<td>4</td>
<td>Offered Spring</td>
<td>Prerequisites: CHEM F321.</td>
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<td>Lecture + Lab + Other: 3 + 3 + 0</td>
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<tr>
<td>CHEM F325</td>
<td>Organic Chemistry II (n)</td>
<td>4</td>
<td>Offered Spring</td>
<td>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.</td>
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<td>Lecture + Lab + Other: 3 + 3 + 0</td>
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<td>CHEM F212</td>
<td>Chemical Equilibrium and Analysis (n)</td>
<td>4</td>
<td>Offered Fall</td>
<td>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.</td>
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<td>CHEM F288</td>
<td>Introduction to Chemical Research</td>
<td>2</td>
<td>Offered As Demand Warrants</td>
<td>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.</td>
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<td>Lecture + Lab + Other: 1 + 3 + 0</td>
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<td>CHEM F314</td>
<td>Analytical Instrumental Laboratory (W, n)</td>
<td>3</td>
<td>Offered Spring</td>
<td>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.</td>
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<td>CHEM F321</td>
<td>Organic Chemistry I (n)</td>
<td>4</td>
<td>Offered Fall</td>
<td>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.</td>
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<td>Lecture + Lab + Other: 3 + 3 + 0</td>
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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: 1 + 3 + 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  (0)
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.
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 cellular and molecular underpinnings of signaling in the nervous system. Topics include properties of excitable membranes, synaptic transmission, neurological integration, the cellular and molecular basis of learning and memory, and pharmacological 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
CHEM F474  Neurochemistry
3 Credits
Offered Fall Odd-numbered Years
Covers basic and applied aspects of interneuronal signaling of specific
eurotransmitter 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 F676.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F481  Seminar
1 Credit
Offered Fall and Spring
Introduction to the techniques and style of technical oral presentation
generally accepted by professional chemists. Class will meet two
hours per week, the first hour in closed session, the second, open to the
public. Seminar attendance and participation in observing and critiquing
presentations by graduate students, chemistry faculty, and their peers is
required.
Prerequisites: COJO F131X or COJO F141X.
Special Notes: Oral communication intensive credit is earned upon
successful completion of CHEM F482.
Lecture + Lab + Other: 2 + 0 + 0

CHEM F482  Seminar (O)
2 Credits
Offered Fall and Spring
Introduction to the techniques and style of technical oral presentation
generally accepted by professional chemists. Class will meet two hours
per week, the first hour in closed session, the second, open to the public.
Preparation of a 40 minute presentation to be delivered twice, first, to
others in the course.
Prerequisites: CHEM F481; COJO F131X or COJO F141X.
Lecture + Lab + Other: 2 + 0 + 0

CHEM F488  Undergraduate Chemistry and Biochemistry Research
2-3 Credits
Offered Fall and Spring
Advanced research topics from outside the usual undergraduate
laboratory offerings. The student will be required to make presentations
and turn in a final report. Research areas range from atmospheric
chemistry to molecular biology. A substantial level of chemistry or
biochemistry background is assumed.
Prerequisites: CHEM F434 or CHEM F314.
Lecture + Lab + Other: 0 + 6-9 + 0

CHEM F498  Research
1-9 Credits
Lecture + Lab + Other: 0 + 0 + 0

CHEM F601  Introduction to Atmospheric Sciences
3 Credits
Offered Fall
Fundamentals of atmospheric science. Includes energy and mass
conservation, internal energy and entropy, atmospheric water vapor,
cloud microphysics, equations of motion, hydrostatics, phase
oxidation, heterogeneous chemistry, the ozone layer, fundamentals of
biogeochemical cycles, solar and terrestrial radiation and radiative-
convective equilibrium. Also includes molecular, cloud and aerosol
absorption and scattering.
Prerequisites: Graduate standing.
Cross-listed with ATM F601.
Stacked with ATM F401.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F603  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.
Stacked with CHEM F403.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F605  Aquatic Chemistry
3 Credits
Offered As Demand Warrants
Chemistry of aquatic systems, including the development of equilibrium
and kinetic models to understanding the speciation, transformation and
partitioning of inorganic chemical species in aqueous systems. Emphasis
is on the study of acid-base chemistry, complexation, precipitation-
dissolution and reduction-oxidation reactions.
Prerequisites: Graduate standing.
Cross-listed with ENVE F641.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F606  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: ATM F601.
Cross-listed with ATM F606.
Stacked with CHEM F406.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F609  Aqueous and Environmental Geochemistry
3 Credits
Offered Spring Odd-numbered Years
Chemistry of aquatic and terrestrial environments, including
thermodynamic, kinetic and structural principles applied to aqueous
geochemical systems. Emphasis on aqueous speciation and
heterogeneous interactions (e.g., dissolution/precipitation and sorption)
involved in the partitioning, transformation and transport of chemical
species in the environment.
Prerequisites: CHEM F331 or Graduate standing.
Cross-listed with GEOS F633.
Lecture + Lab + Other: 3 + 0 + 0
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 control the chemical composition of seawater. Boundary 
interactions with the atmosphere and lithosphere, biogeochemical cycles 
and tracers of these complex cycles are examined. The marine chemistry 
of inorganic carbon is considered in detail.  
Prerequisites: Graduate standing.  
Cross-listed with MSL F660.  
Stacked with MSL F461.  
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 
grauate 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 cellular and molecular underpinnings of signaling in the nervous 
system. Topics include properties of excitable membranes, synaptic 
transmission, neurological integration, the cellular and molecular basis 
of learning and memory, and pharmacological 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.  
Special Notes: CHEM F106X or concurrent enrollment.  
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 biochemical 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.  
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