# CHEMISTRY (CHEM)

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<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<th>Lecture + Lab + Other</th>
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<tr>
<td>CHEM F100X</td>
<td>Chemistry in Complex Systems</td>
<td>(n) 4</td>
<td>Fall, Spring and Summer</td>
<td>Placement in WRTG F111X; placement in MATH F105.</td>
<td>UAF GER Natural Science Req</td>
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<td>CHEM F103X</td>
<td>Introduction to General Chemistry</td>
<td>(n) 4</td>
<td>Fall</td>
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<td>CHEM F104X</td>
<td>Introduction to Organic Chemistry and Biochemistry</td>
<td>(n) 4</td>
<td>Spring</td>
<td>Placement in WRTG F111X; placement in MATH F105.</td>
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<tr>
<td>CHEM F105X</td>
<td>General Chemistry I</td>
<td>(n) 4</td>
<td>Fall, Spring and Summer</td>
<td>Placement in WRTG F111X; placement in MATH F105; or a B- or better in CHEM F103X; or permission of instructor and department.</td>
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<td>CHEM F106X</td>
<td>General Chemistry II</td>
<td>(n) 4</td>
<td>Fall, Spring and Summer</td>
<td>Grade of C- or better in CHEM F105X; placement in WRTG F111X; placement in MATH F151X; or permission of instructor and department chair.</td>
<td>UAF GER Natural Science Req</td>
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<td>CHEM F111X</td>
<td>Introduction to Environmental Chemistry of the Arctic</td>
<td>(a) 4</td>
<td>As Demand Warrants</td>
<td>Placement in MATH F105.</td>
<td>UAF GER Natural Science Req</td>
<td>3 + 3 + 0</td>
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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 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.  
Lecture + Lab + Other: 1 + 3 + 0  
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 F221; CHEM F202.  
Corequisites:  
CHEM F332.  
Lecture + Lab + Other: 1 + 3 + 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  
(O)  
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  
CHEM F474  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 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  
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 in the closed session for critiquing and suggestions for improvement and later, in the open seminar for evaluation by all.  
**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.  
Lecture + Lab + Other: 3 + 0 + 0  

CHEM F605  Aquatic Chemistry  
3 Credits  
Offered Fall Even-numbered Years  
Chemistry of aquatic systems, including the development of equilibrium and kinetic models to understanding the speciation, transformation and partitioning of inorganic chemical species in natural and engineered water 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  Aquatic and Environmental Geochemistry  
3 Credits  
Offered Spring Odd-numbered Years  
Chemistry of aquatic and terrestrial environments, covering thermodynamic, kinetic and structural principles involved in aqueous geochemical systems; builds on prior physical chemistry courses. Emphasis on aquatic speciation and heterogeneous interactions (dissolution/precipitation, sorption and microbial processes) involved in the partitioning, transformation and transport of chemical species in the environment.  
**Prerequisites:** ENVE F641 or GEOS F618.  
**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.  
**Cross-listed 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: protein 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.
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 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 include 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