CHEMISTRY (CHEM)

College of Natural Science and Mathematics
Department of Chemistry and Biochemistry (https://www.uaf.edu/chem/)
907-474-5510

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.
Prerequisites: Placement in WRTG F111X; placement in MATH F105.
Special Notes: For non-science majors.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0
Grading System: Letter Grades with option of Plus/Minus

CHEM F101L  CHEM F101X Laboratory
0 Credit
Co-requisites: CHEM F101X.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 0 + 0 + 0
Grading System: Non-Graded

CHEM F103L  CHEM F103X Laboratory
0 Credit
Co-requisites: CHEM F103X.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 0 + 0 + 0
Grading System: Non-Graded

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

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
Grading System: Letter Grades with option of Plus/Minus

CHEM F105L  Chemistry F105X Lab
0 Credit
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 0 + 0 + 0
Grading System: Non-Graded

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, phases, oxidation-reduction, nuclear chemistry, problem-solving (applied mathematics), and special topics. Students must be enrolled in both CHEM F105X and CHEM F106X to receive full credit.
Prerequisites: B- or better in CHEM F103X or (placement in WRTG F111X; placement in MATH F151X) 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
Grading System: Letter Grades with option of Plus/Minus

CHEM F106L  Chemistry F106X Lab
0 Credit
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 0 + 0 + 0
Grading System: Non-Graded
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  
Grading System: Letter Grades with option of Plus/Minus  

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. Presented both on-campus and by distance.  
Prerequisites: MATH F105.  
Attributes: UAF GER Natural Science Req  
Lecture + Lab + Other: 3 + 3 + 0  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Pass/Fail Grades  
Repeatability for Credit: May be taken 4 times for up to unlimited credits  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

CHEM F314  Analytical Instrumental Laboratory  (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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
<th>Description</th>
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<tbody>
<tr>
<td>CHEM F331</td>
<td>Physical Chemistry I</td>
<td>4</td>
<td>Fall</td>
<td>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.</td>
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<td><strong>Prerequisites:</strong> CHEM F106X; MATH F252X; PHYS F124X or PHYS F212X.</td>
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<td><strong>Grading System:</strong> Letter Grades with option of Plus/Minus</td>
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<tr>
<td>CHEM F332</td>
<td>Physical Chemistry II</td>
<td>4</td>
<td>Spring</td>
<td>Atomic and molecular structure, and spectroscopy, and statistical mechanics. Course teaches these concepts using both lecture and laboratory instruction.</td>
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<td><strong>Prerequisites:</strong> CHEM F331; MATH F253X.</td>
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<td><strong>Grading System:</strong> Letter Grades with option of Plus/Minus</td>
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<td>CHEM F360</td>
<td>Cell and Molecular Biology</td>
<td>3</td>
<td>Fall, Spring</td>
<td>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.</td>
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<td><strong>Prerequisites:</strong> BIOL F260; CHEM F105X; CHEM F106X (may be taken concurrently).</td>
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<td><strong>Cross-listed with:</strong> BIOL F360.</td>
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<td><strong>Special Notes:</strong> Taught asynchronously online in fall, face to face in spring.</td>
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<td><strong>Grading System:</strong> Letter Grades with option of Plus/Minus</td>
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<tr>
<td>CHEM F402</td>
<td>Inorganic Chemistry</td>
<td>3</td>
<td>Fall</td>
<td>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.</td>
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<td><strong>Prerequisites:</strong> CHEM F202; CHEM F325.</td>
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<tr>
<td>CHEM F403</td>
<td>Biological Inorganic Chemistry</td>
<td>3</td>
<td>Fall</td>
<td>Survey of structure, functions, and chemical properties of natural metalloproteins and metalloenzymes, roles of metalloproteins in nucleic acid formation and replication, metal-based medicines.</td>
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<td><strong>Prerequisites:</strong> CHEM F202; CHEM F449.</td>
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<td>CHEM F406</td>
<td>Atmospheric Chemistry</td>
<td>3</td>
<td>Spring Odd-numbered Years</td>
<td>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 &quot;greenhouse&quot; effect, urban smog and stratospheric ozone depletion.</td>
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<td><strong>Prerequisites:</strong> CHEM F332.</td>
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<td><strong>Stacked with:</strong> CHEM F606; ATM F606.</td>
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<td><strong>Lecture + Lab + Other:</strong> 3 + 0 + 0</td>
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<td><strong>Grading System:</strong> Letter Grades with option of Plus/Minus</td>
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<td>CHEM F419</td>
<td>Practical Nuclear Magnetic Resonance</td>
<td>2</td>
<td>Spring</td>
<td>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.</td>
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<td><strong>Prerequisites:</strong> CHEM F321.</td>
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<td><strong>Grading System:</strong> Letter Grades with option of Plus/Minus</td>
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<tr>
<td>CHEM F420</td>
<td>Applications of NMR Spectroscopy</td>
<td>3</td>
<td>Fall Even-numbered Years</td>
<td>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.</td>
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<td>CHEM F434</td>
<td>Chemistry Capstone Laboratory</td>
<td>3</td>
<td>Fall</td>
<td>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.</td>
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<td><strong>Prerequisites:</strong> WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; CHEM F212; CHEM F202; CHEM F332 (may be taken concurrently).</td>
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<td>CHEM F449</td>
<td>General Biochemistry: Metabolism</td>
<td>3</td>
<td>Spring</td>
<td>This course is an introduction to metabolism at the molecular level and covers the molecular structures and classification of the three major macromolecules: carbohydrates, lipids and proteins. Individual metabolic pathways and regulation will be studied, as well as the big picture and how all the pathways are tied together.</td>
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<td><strong>Prerequisites:</strong> CHEM F321.</td>
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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
Grading System: Letter Grades with option of Plus/Minus

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 F449 or one semester each of organic chemistry and cell or molecular biology; COM F121X, COM F131X or COM F141X; WRTG F111X, WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X.
Cross-listed with BIOL F455.
Stacked with BIOL F656; CHEM F655.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

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
Grading System: Letter Grades with option of Plus/Minus

CHEM F470  Cellular and Molecular Neuroscience
3 Credits
Offered Spring Odd-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 F230X or MATH F251X.
Recommended: MATH F252X.
Stacked with CHEM F670; BIOL F679.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

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.
Prerequisites: BIOL F115X; CHEM F325; BIOL F417 or CHEM F470 or PSY F335.
Stacked with CHEM F676.
Special Notes: Students will learn to prepare "peer reviews" of selected papers and critically discuss original research.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

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 meets two hours/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: COM F131X or COM F141X.
Special Notes: Oral communication intensive credit is earned upon successful completion of CHEM F482.
Lecture + Lab + Other: 2 + 0 + 0
Grading System: Pass/Fail Grades

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.
Prerequisites: CHEM F481; COM F131X or COM F141X.
Lecture + Lab + Other: 2 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

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
Grading System: Letter Grades with option of Plus/Minus
Repeatable for Credit: May be taken 4 times for up to 12 credits

CHEM F498  Research
1-9 Credits
Lecture + Lab + Other: 0 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus
Repeatable for Credit: May be taken unlimited times for up to 99 credits
Grading System:
Lecture + Lab + Other:

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 CHEM F403.  
Lecture + Lab + Other: 3 + 0 + 0  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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  
Grading System: Letter Grades with option of Plus/Minus  

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 F449.  
Lecture + Lab + Other: 3 + 0 + 0  
Grading System: Letter Grades with option of Plus/Minus
Chemistry (CHEM)

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 F449 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
Grading System: Letter Grades with option of Plus/Minus

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 F449; CHEM F450.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

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 OCN F660.
Stacked with OCN F460.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

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 who have an interest in science teaching.
Prerequisites: Graduate standing.
Lecture + Lab + Other: 2 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

CHEM F670  Cellular and Molecular Neuroscience
3 Credits
Offered Spring Odd-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 F230X or MATH F251X.
Recommended: MATH F252X.
Cross-listed with BIOL F679.
Stacked with CHEM F470.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

CHEM F671  Receptor Pharmacology
3 Credits
Offered Fall Even-numbered Years
Covers basic drug/receptor theory to train students to assess affinity and efficacy of receptor ligands, interpret functional assays and binding results, and critically evaluate original research regarding receptor pharmacology with an emphasis on ligand-gated ion channels and G-protein coupled receptors.
Prerequisites: Upper-division or graduate biochemistry or neurochemistry course.
Recommended: BIOL F417.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

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 F449; CHEM F450.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus

CHEM F675  Cellular Signaling
3 Credits
Offered Spring Odd-numbered Years
Cellular signaling is vitally important 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 mammals. Major topics include G-proteins, protein kinases, signaling molecules, lipid mediators, and adaptor proteins.
Prerequisites: Upper division or graduate biochemistry or neurochemistry course.
Lecture + Lab + Other: 3 + 0 + 0
Grading System: Letter Grades with option of Plus/Minus
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.  
Prerequisites: BIOL F115X; CHEM F325; BIOL F417 or CHEM F470 or PSY F335.  
Stacked with CHEM F474.  
Special Notes: Students will learn to prepare "peer reviews" of selected papers and critically discuss original research.  
Lecture + Lab + Other: 3 + 0 + 0  
Grading System: Letter Grades with option of Plus/Minus

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  
Grading System: Letter Grades with option of Plus/Minus  
Repeatable for Credit: May be taken 2 times for up to 4 credits

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  
Grading System: Letter Grades with option of Plus/Minus

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  
Grading System: Letter Grades with option of Plus/Minus  
Repeatable for Credit: May be taken 3 times for up to 3 credits

CHEM F692  Seminar  
1-6 Credits  
Graded Pass/Fail.  
Lecture + Lab + Other: 1-6 + 0 + 0  
Grading System: Letter Grades with option of Plus/Minus  
Repeatable for Credit: May be taken unlimited times for up to 99 credits

CHEM F698  Non-thesis Research/Project  
1-9 Credits  
Graded Pass/Fail.  
Lecture + Lab + Other: 0 + 1-9 + 0  
Grading System: Pass/Fail Grades  
Repeatable for Credit: May be taken unlimited times for up to 99 credits

CHEM F699  Thesis  
1-12 Credits  
Offered Fall, Spring and Summer  
Lecture + Lab + Other: 0 + 0 + 0  
Grading System: Pass/Fail Grades  
Repeatable for Credit: May be taken unlimited times for up to 99 credits