Chemistry

The Chemistry PhD program is designed towards developing the ability to do creative scientific research. Accordingly, the single most important facet of the curriculum for an individual is his or her own research project. In keeping with the goal of fostering an atmosphere of scholarly, independent study, formal course requirements are minimal and vary among disciplines. Advisers tailor course requirements to best prepare the student for the chosen research field.

The doctoral program includes the following concentrations, each of which has specific degree requirements:

1. **Physical Chemistry:** In general, the Physical Chemistry Graduate Program encompasses experimental physical, analytical, nuclear, biophysical, and theoretical chemistry.
2. **Synthetic Chemistry:** The Synthetic Chemistry Graduate Program includes emphases in preparation of organic or inorganic compounds, development of methods for their synthesis, and their characterization and use.
3. **Chemical Biology:** The Chemical Biology Graduate Program covers research areas at the interface of chemistry and biology, ranging from the synthesis of bioactive materials to the characterization of living systems.

Admission to the University

Applying for Graduate Admission

Thank you for considering UC Berkeley for graduate study! UC Berkeley offers more than 120 graduate programs representing the breadth and depth of interdisciplinary scholarship. The Graduate Division hosts a complete list (https://grad.berkeley.edu/admissions/choosing-your-program/list/) of graduate academic programs, departments, degrees offered, and application deadlines can be found on the Graduate Division website.

Prospective students must submit an online application to be considered for admission, in addition to any supplemental materials specific to the program for which they are applying. The online application and steps to take to apply can be found on the Graduate Division website (https://grad.berkeley.edu/admissions/steps-to-apply/).

Admission Requirements

The minimum graduate admission requirements are:

1. A bachelor's degree or recognized equivalent from an accredited institution;
2. A satisfactory scholastic average, usually a minimum grade-point average (GPA) of 3.0 (B) on a 4.0 scale; and
3. Enough undergraduate training to do graduate work in your chosen field.

For a list of requirements to complete your graduate application, please see the Graduate Division's Admissions Requirements page (https://grad.berkeley.edu/admissions/steps-to-apply/requirements/). It is also important to check with the program or department of interest, as they may have additional requirements specific to their program of study and degree. Department contact information can be found here (https://guide.berkeley.edu/graduate/degree-programs/).

Where to apply?

Visit the Berkeley Graduate Division application page (http://grad.berkeley.edu/admissions/apply/).

The Requirements for a PhD Degree in Chemistry

- Coursework: There is no formal coursework requirement, however, the equivalent of four semester-long courses is normally taken. Courses you will take will depend on your background and research interests.
- Graduate student instructor service: A total of three semesters of graduate student instructor service is required with a fourth semester as optional. Graduate Student Instruction is usually fulfilled in the first semester and one semester in each of the next two years.
- Research:

  First-year report (synthetic and chemical biology division): An original, journal-quality research proposal no more than 10 pages read by two chemistry faculty.

  Second-year seminar (all divisions): A 25-minute presentation to the department on your research progress.
- Qualifying examination (all divisions): An oral examination with a committee of three chemistry faculty and one outside department faculty member on your research and defense of an original research proposal (synthetic) or critical analysis of a recent outside paper (non-synthetic).
- Dissertation (all divisions): Submission of your dissertation approved by a committee of your research adviser, a second chemistry faculty member, and one outside department faculty member. No dissertation defense.

Chemistry

CHEM 200 Chemistry Fundamentals 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
Review of bonding, structure, stereochemistry, conformation, thermodynamics and kinetics, and arrow-pushing formalisms.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 201 Fundamentals of Inorganic Chemistry 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
Review of bonding, structure, MO theory, thermodynamics, and kinetics.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 208 Structure Analysis by X-Ray Diffraction 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
The theory and practice of modern, single-crystal X-ray diffraction. Groups of four students determine the crystal and molecular structure of newly synthesized materials from the College of Chemistry. The laboratory work involves the mounting of crystals and initial evaluation by X-ray diffraction film techniques, the collection of intensity data by automated diffractometer procedures, and structure analysis and refinement.
Rules & Requirements

Prerequisites: Consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 214 Heterocyclic Chemistry 3 Units

Terms offered: Spring 2024, Spring 2022, Spring 2020
Advanced topics in organic chemistry with a focus on the reactivity and synthesis of aromatic heterocycles. Classic and modern methods for the synthesis of indoles, pyridines, furans, pyrroles, and quinolines will be covered, as well as complex, multi-heteroatom ring systems. Applications to medicinal and bioorganic chemistry will be included where appropriate.
Rules & Requirements

Prerequisites: Graduate student standing or consent of instructor. A year of organic chemistry with a grade of B- or better is required for undergraduate enrollment

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Instructor: Maimone

CHEM 220A Thermodynamics and Statistical Mechanics 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
A rigorous presentation of classical thermodynamics followed by an introduction to statistical mechanics with the application to real systems.
Rules & Requirements

Prerequisites: 120B

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 220B Statistical Mechanics 3 Units

Terms offered: Spring 2025, Spring 2023, Spring 2022
Principles of statistical mechanics and applications to complex systems.
Rules & Requirements

Prerequisites: 220A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 221A Advanced Quantum Mechanics 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Basic principles/postulates of quantum mechanics, Hilbert space and representation theory, quantum theory of measurements, advanced descriptions of harmonic oscillator and theory of angular momentum, time independent and time dependent approximation methods, applications to quantum mechanics of atoms and molecules.

Rules & Requirements

Prerequisites: Chem120A or Physics137A, Chem120B and Chem122, or equivalents

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture and 0-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 221B Advanced Quantum Mechanics 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
Time dependence, interaction of matter with radiation, scattering theory. Molecular and many-body quantum mechanics.

Rules & Requirements

Prerequisites: 221A

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 222 Spectroscopy 3 Units

Terms offered: Fall 2017, Spring 2017, Spring 2015
This course presents a survey of experimental and theoretical methods of spectroscopy, and group theory as used in modern chemical research. The course topics include experimental methods, classical and quantum descriptions of the interaction of radiation and matter. Qualitative and quantitative aspects of the subject are illustrated with examples including application of linear and nonlinear spectroscopies to the study of molecular structure and dynamics and to quantitative analysis. This course is offered jointly with 122.

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 223A Chemical Kinetics 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2022
Deduction of mechanisms of complex reactions. Collision and transition state theory. Potential energy surfaces. Unimolecular reaction rate theory. Molecular beam scattering studies.

Rules & Requirements

Prerequisites: 220A (may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM C230 Protein Chemistry, Enzymology, and Bio-organic Chemistry 2 Units

Terms offered: Spring 2020, Spring 2015, Spring 2014, Spring 2013
The topics covered will be chosen from the following: protein structure; protein-protein interactions; enzyme kinetics and mechanism; enzyme design. Intended for graduate students in chemistry, biochemistry, and molecular and cell biology.

Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring:
10 weeks - 3 hours of lecture per week
15 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Also listed as: MCELLBI C214

CHEM C234 Green Chemistry: An Interdisciplinary Approach to Sustainability 3 Units

Terms offered: Spring 2016, Spring 2015, Spring 2014, Spring 2013
Meeting the challenge of global sustainability will require interdisciplinary approaches to research and education, as well as the integration of this new knowledge into society, policymaking, and business. Green Chemistry is an intellectual framework created to meet these challenges and guide technological development. It encourages the design and production of safer and more sustainable chemicals and products.

Rules & Requirements

Prerequisites: One year of chemistry, including a semester of organic chemistry, or consent of instructors based on previous experience

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Summer: 6 weeks - 20 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Instructors: Arnold, Bergman, Guth, Iles, Kokai, Mulvihill, Schwarzman, Wilson

Also listed as: ESPM C234/PB HLTH C234

CHEM 236 Bioorganic Chemistry and Advanced Chemical Biology 3 Units

Terms offered: Fall 2025
Chem 236 is intended for Chemical Biology grad students who previously completed BS or BA degrees in Chemistry, Biochemistry, or Biology. Undergraduates are welcome to take the course if they have a solid command of the background material. The course will review, reinforce, and build upon organic and biophysical chemistry skills needed for ChemBio research. This will include a review of reaction mechanisms and arrow pushing skills, the chemical reactions of biomolecules, a survey of biochemical structural features, and a discussion of reaction energetics. Following this, contemporary areas of Chemical Biology will be surveyed, including drug design, immunotherapy techniques, CRISPR/Cas9 strategies, drug delivery, and more

Rules & Requirements

Prerequisites: Chem 12A/B or Chem 3A/3B (or equivalent at prior institution) required Chem 135 or MCB 102 (or equivalent at prior institution) required. Concurrent enrollment OK Waiver of prerequisites required consent of course instructor

Repeat rules: Course may be repeated for credit with instructor consent.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM C236 Energy Solutions: Carbon Capture and Sequestration 3 Units

Terms offered: Fall 2018, Spring 2017, Spring 2015, Spring 2014, Spring 2013
After a brief overview of the chemistry of carbon dioxide in the land, ocean, and atmosphere, the course will survey the capture and sequestration of CO2 from anthropogenic sources. Emphasis will be placed on the integration of materials synthesis and unit operation design, including the chemistry and engineering aspects of sequestration. The course primarily addresses scientific and engineering challenges and aims to engage students in state-of-the-art research in global energy challenges.

Rules & Requirements

Prerequisites: Chemistry 4B or 1B, Mathematics 1B, and Physics 7B, or equivalents

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Instructors: Bourg, DePaolo, Long, Reimer, Smit

Also listed as: CHM ENG C295Z/EPS C295Z

CHEM C238 The Berkeley Lectures on Energy: Energy from Biomass 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013
After an introduction to the different aspects of our global energy consumption, the course will focus on the role of biomass. The course will illustrate how the global scale of energy guides the biomass research. Emphasis will be places on the integration of the biological aspects (crop selection, harvesting, storage, and distribution, and chemical composition of biomass) with the chemical aspects to convert biomass to energy. The course aims to engage students in state-of-art research.

Rules & Requirements

Prerequisites: Biology 1A; Chemistry 1B or 4B, Mathematics 1B

Repeat rules: Course may be repeated for credit under special circumstances: Repeatable when topic changes with consent of instructor.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Instructors: Bell, Blanch, Clark, Smit, C. Somerville

Also listed as: BIO ENG C281/CHM ENG C295A/PLANTBI C224

CHEM C242 Machine Learning, Statistical Models, and Optimization for Molecular Problems 4 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
An introduction to mathematical optimization, statistical models, and advances in machine learning for the physical sciences. Machine learning prerequisites are introduced including local and global optimization, various statistical and clustering models, and early meta-heuristic methods such as genetic algorithms and artificial neural networks. Building on this foundation, current machine learning techniques are covered including deep learning artificial neural networks, Convolutional neural networks, Recurrent and long short term memory (LSTM) networks, graph neural networks, decision trees.

Objectives & Outcomes

Course Objectives: To build on optimization and statistical modeling to the field of machine learning techniques
To introduce the basics of optimization and statistical modeling techniques relevant to chemistry students
To utilize these concepts on problems relevant to the chemical sciences.

Student Learning Outcomes: Students will be able to understand the landscape and connections between numerical optimization, stand-alone statistical models, and machine learning techniques, and its relevance for chemical problems.

Rules & Requirements

Prerequisites: Math 53 and Math 54; Chem 120A or 120B or BioE 103; or consent of intructor

Credit Restrictions: Students will receive no credit for BIO ENG C242 after completing BIO ENG 242. A deficient grade in BIO ENG C242 may be removed by taking BIO ENG 242.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Instructor: Teresa Head-Gordon

Formerly known as: Bioengineering C242/Chemistry C242

Also listed as: BIO ENG C242

CHEM 243 Advanced Nuclear Structure and Reactions 3 Units

Terms offered: Spring 2013, Fall 2009, Fall 2008
Selected topics on nuclear structure and nuclear reactions.
Rules & Requirements

Prerequisites: 143 or equivalent and introductory quantum mechanics

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 250A Introduction to Bonding Theory 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
An introduction to group theory, symmetry, and representations as applied to chemical bonding.
Rules & Requirements

Prerequisites: 200 or 201 or consent of instructor and background in the use of matrices and linear algebra

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 250B Inorganic Spectroscopy 1 Unit

Terms offered: Spring 2015, Spring 2014, Spring 2013
The theory of vibrational analysis and spectroscopy as applied to inorganic compounds.
Rules & Requirements

Prerequisites: 250A or consent of instructor

Hours & Format

Fall and/or spring:
6 weeks - 3 hours of lecture per week
15 weeks - 0 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 251A Coordination Chemistry I 1 Unit

Terms offered: Fall 2018, Fall 2017, Fall 2016
Structure and bonding, synthesis, and reactions of the d-transition metals and their compounds.
Rules & Requirements

Prerequisites: 250A or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 251B Coordination Chemistry II 1 Unit

Terms offered: Spring 2019, Spring 2018, Spring 2014
Synthesis, structure analysis, and reactivity patterns in terms of symmetry orbitals.
Rules & Requirements

Prerequisites: 251A or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 252A Organometallic Chemistry I 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2022
An introduction to organometallics, focusing on structure, bonding, and reactivity.
Rules & Requirements

Prerequisites: 200 or 201 or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 252B Organometallic Chemistry II 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2022
Applications of organometallic compounds in synthesis with an emphasis on catalysis.
Rules & Requirements

Prerequisites: 252A or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 253A Materials Chemistry I 1 Unit

Terms offered: Spring 2023, Spring 2022, Fall 2019
Introduction to the descriptive crystal chemistry and electronic band structures of extended solids.
Rules & Requirements

Prerequisites: 200 or 201, and 250A, or consent of instructor

Hours & Format

Fall and/or spring:
6 weeks - 3 hours of lecture per week
15 weeks - 0 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 253B Materials Chemistry II 1 Unit

Terms offered: Spring 2023, Spring 2022, Fall 2019
General solid state synthesis and characterization techniques as well as a survey of important physical phenomena including optical, electrical, and magnetic properties.
Rules & Requirements

Prerequisites: 253A or consent of instructor

Hours & Format

Fall and/or spring:
6 weeks - 3 hours of lecture per week
15 weeks - 0 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 253C Materials Chemistry III 1 Unit

Terms offered: Spring 2023, Spring 2022, Fall 2019
Introduction to surface catalysis, organic solids, and nanoscience. Thermodynamics and kinetics of solid state diffusion and reaction will be covered.
Rules & Requirements

Prerequisites: 253A or consent of instructor

Hours & Format

Fall and/or spring: 5 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Instructors: Somorjai, Yang

CHEM 254 Bioinorganic Chemistry 1 Unit

Terms offered: Spring 2015, Spring 2014, Spring 2013
A survey of the roles of metals in biology, taught as a tutorial involving class presentations.
Hours & Format

Fall and/or spring:
6 weeks - 3 hours of lecture per week
15 weeks - 0 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 259 Polymer Organic Chemistry 3 Units

Terms offered: Spring 2025
This course will introduce concepts pertaining to the synthesis of modern polymers. We will focus on the major polymerization methods including step-growth, radical, anionic, cationic, ring-opening, and organometallic polymerizations with emphasis given to the mechanisms, kinetics, and thermodynamics of each polymerization method. More specialized topics such as “living” and “controlled” polymerizations, stereochemistry, and polymer sustainability will also be discussed in detail. Throughout the course we will emphasize the historical developments and people behind the advancements in the field of polymer science.
Rules & Requirements

Prerequisites: Required: 1st semester organic chemistry (Chem 3A or 12A) + concurrent enrollment in 2nd semester organic chemistry (Chem 3B or 12B). Strongly Preferred: 2 semesters of organic chemistry (3A/B + 12A/B) completed

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 260 Reaction Mechanisms 2 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Advanced methods for studying organic reaction mechanisms. Topics include kinetic isotope effects, behavior of reactive intermediates, chain reactions, concerted reactions, molecular orbital theory and aromaticity, solvent and substituent effects, linear free energy relationships, photochemistry.

Rules & Requirements

Prerequisites: 200 or consent of instructor

Hours & Format

Fall and/or spring: 10 weeks - 3 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Formerly known as: 260A-260B

CHEM 261A Organic Reactions I 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
Features of the reactions that comprise the vocabulary of synthetic organic chemistry.

Rules & Requirements

Prerequisites: 200 or 201 or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 261B Organic Reaction II 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
More reactions that are useful to the practice of synthetic organic chemistry.

Rules & Requirements

Prerequisites: 261A or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 261C Organic Reactions III 1 Unit

Terms offered: Fall 2013, Fall 2012, Fall 2011
This course will consider further reactions with an emphasis on pericyclic reactions such as cycloadditions, electrocyclizations, and sigmatropic rearrangements.

Rules & Requirements

Prerequisites: 261B or consent of instructor

Hours & Format

Fall and/or spring: 6 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 262 Metals in Organic Synthesis 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
Transition metal-mediated reactions occupy a central role in asymmetric catalysis and the synthesis of complex molecules. This course will describe the general principles of transition metal reactivity, coordination chemistry, and stereoselection. This module will also emphasize useful methods for the analysis of these reactions.

Rules & Requirements

Prerequisites: 261B or consent of instructor

Hours & Format

Fall and/or spring:
6 weeks - 3 hours of lecture per week
15 weeks - 0 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 263A Synthetic Design I 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course will provide an exposure to the range of catalytic reactions of organometallic systems, the identity of the catalysts for these reactions, and the scope and limitations of these reactions. Emphasis will be placed on understanding the mechanisms of homogeneous catalytic processes. Students will see the types of molecular fragments generated by catalytic organometallic chemistry and see the synthetic disconnections made possible by these reactions. The scope of transformations will encompass those forming commodity chemicals on large scale, pharmaceuticals on small scale, and both commodity and specialty polymers

Rules & Requirements

Prerequisites: 262 or consent of instructor

Hours & Format

Fall and/or spring: 5 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 263B Synthetic Design II 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course will provide an exposure to the range of catalytic reactions of organometallic systems, the identity of the catalysts for these reactions, and the scope and limitations of these reactions. Emphasis will be placed on understanding the mechanisms of homogeneous catalytic processes. Students will see the types of molecular fragments generated by catalytic organometallic chemistry and see the synthetic disconnections made possible by these reactions. The scope of transformations will encompass those forming commodity chemicals on large scale, pharmaceuticals on small scale, and both commodity and specialty polymers.
Rules & Requirements

Prerequisites: 263A or consent of instructor

Hours & Format

Fall and/or spring: 5 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 265 Nuclear Magnetic Resonance Theory and Application 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
The theory behind practical nuclear magnetic resonance spectroscopy and a survey of its applications to chemical research.
Rules & Requirements

Prerequisites: 200 or 201 or consent of instructor

Hours & Format

Fall and/or spring:
6 weeks - 3 hours of lecture per week
15 weeks - 0 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 268 Mass Spectrometry 2 Units

Terms offered: Spring 2025, Spring 2023, Spring 2022
Principles, instrumentation, and application in mass spectrometry, including ionization methods, mass analyzers, spectral interpretation, multidimensional methods (GC/MS, HPLC/MS, MS/MS), with emphasis on small organic molcules and bioanalytical applications (proteins, peptides, nucleic acids, carbohydrates, noncovalent complexes); this will include the opportunity to be trained and checked out on several open-access mass spectrometers.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 10 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 270A Advanced Biophysical Chemistry I 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
Underlying principles and applications of methods for biophysical analysis of biological macromolecules.
Rules & Requirements

Prerequisites: 200 or consent of instructor

Hours & Format

Fall and/or spring: 7.5 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 270B Advanced Biophysical Chemistry II 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
More applications of methods for biophysical analysis of biological macromolecules.
Rules & Requirements

Prerequisites: 270A or consent of instructor

Hours & Format

Fall and/or spring: 7.5 weeks - 2 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM C271A Chemical Biology I - Structure, Synthesis and Function of Biomolecules 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course will present the structure of proteins, nucleic acids, and oligosaccharides from the perspective of organic chemistry. Modern methods for the synthesis and purification of these molecules will also be presented.

Hours & Format

Fall and/or spring: 5 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Also listed as: MCELLBI C212A

CHEM C271B Chemical Biology II - Enzyme Reaction Mechanisms 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course will focus on the principles of enzyme catalysis. The course will begin with an introduction of the general concepts of enzyme catalysis which will be followed by detailed examples that will examine the chemistry behind the reactions and the three-dimensional structures that carry out the transformations.

Hours & Format

Fall and/or spring: 5 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Also listed as: MCELLBI C212B

CHEM C271C Chemical Biology III - Contemporary Topics in Chemical Biology 1 Unit

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course will build on the principles discussed in Chemical Biology I and II. The focus will consist of case studies where rigorous chemical approaches have been brought to bear on biological questions. Potential subject areas will include signal transduction, photosynthesis, immunology, virology, and cancer. For each topic, the appropriate bioanalytical techniques will be emphasized.

Hours & Format

Fall and/or spring: 5 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Also listed as: MCELLBI C212C

CHEM 272 Python for the Molecular Science 3 Units

Terms offered: Summer 2025
This course introduces programming concepts and techniques required for scientific computing using Python. Students will learn basic syntax, use cases, and ecosystems for Python programming in the molecular sciences. Students will become familiar with tools and practices commonly used in software development such as version control, documentation, and testing. The course will also provide a brief introduction to C++ and compare the functionalities of the two languages.

Rules & Requirements

Prerequisites: Admission to the MSSE program

Hours & Format

Summer: 13 weeks - 3 hours of lecture, 1 hour of discussion, and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 273 Numerical Methods for Computational Science 3 Units

Terms offered: Summer 2025
In computational molecular science, numerical methods are essential for solving mathematical problems that are too complex for analytical solutions. Using Python and its scientific libraries as a tool, this course covers the key numerical methods required for computational science from the following core mathematical areas: Linear Algebra, Calculus, Probability and Statistics, and Numerical Analysis.

Rules & Requirements

Prerequisites: Admittance to the MSSE degree

Hours & Format

Summer: 13 weeks - 3 hours of lecture, 1 hour of discussion, and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 274A Programming Languages for Molecular Sciences: Python and C++ 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Course provides in-depth coverage of programming concepts and techniques required for
scientific computing, data science, and high-performance computing using C++ and Python. Course will compare and contrast the functionalities of the two languages. Topics include classes, overloading, data abstraction, information hiding, encapsulation, file processing, exceptions, and
low-level language features. Exercises based on molecular science problems will
provide hands-on experience needed to learn these languages. Course serves as a
prereq to later MSSE courses: Data Science, Machine Learning Algorithms, Software
Engineering for Scientific Computing, Numerical Algorithms Applied to Computational Quantum
Chemistry, and Applications Parallel Comp.
Rules & Requirements

Prerequisites: Prior exposure to basic programming methodology or the consent of the instructor

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture, 2-2 hours of discussion, and 0-2 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 274B Software Engineering Fundamentals for Molecular Sciences 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Course will advance students' understanding of fundamental knowledge and techniques for
developing complex software. Students will gain an in-depth view of computer system
architecture as well as abstraction techniques as means to manage program complexity. Students
will collaboratively develop a software engineering package, gaining experience in all
aspects of the software development process. Course serves as a prerequisite to later MSSE
courses: Data Science, Machine Learning Algorithms, Software Engineering for Scientific
Computing, Numerical Algorithms Applied to Computational Quantum Chemistry, and
Applications of Parallel Computers
Rules & Requirements

Prerequisites: Chem 274A - MSSE's Introduction to Programming Languages – C++ and Python -

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture, 2-2 hours of discussion, and 0-2 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 275A Introduction to Programming Languages C++ and Python 3 Units

Terms offered: Fall 2021, Fall 2020

This course provides in-depth coverage of programming concepts and techniques required for scientific computing, data science, and high-performance computing using C++ and Python. The course will compare and contrast the functionalities of the two languages. Topics include classes, overloading, data abstraction, information hiding, encapsulation, inheritance, polymorphism, file processing, templates, exceptions, container classes, and low-level language features. Numerous exercises based on molecular science problems will provide the hands-on experience needed to learn these languages

Objectives & Outcomes

Student Learning Outcomes: Upon successfully completing this course, students will be able to

A.

Develop the necessary skills to effectively interact with machine learning environments.

B.

Acquire the skills needed to develop high-performance computing software.

Rules & Requirements

Prerequisites: Prior exposure to basic programming methodology or the consent of the instructor

Hours & Format

Fall and/or spring: 8 weeks - 5 hours of web-based lecture and 6 hours of web-based discussion per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 275B Introduction to Software Engineering Best Practices 3 Units

Terms offered: Fall 2021, Fall 2020

This course will advance students' understanding of the different steps involved in software design. Students will acquire hands-on experience in practical problems such as specifying, designing, building, testing, and delivering reliable software systems for scientific computing. Students will collaboratively develop a software engineering package, thus gaining experience in all aspects of the software development process from the feasibility study to the final delivery of the product. This course is a prerequisite to MSSE courses in Software Engineering for Scientific Computing, Computational Chemistry and Materials Science, and Parallel Computing.

Objectives & Outcomes

Student Learning Outcomes: Upon successfully completing this course, students will have the skills needed to develop high-performance computing software.

Rules & Requirements

Prerequisites: Chem 275 - MSSE's Introduction to Programming Languages – C++ and Python

Hours & Format

Fall and/or spring: 8 weeks - 5 hours of web-based lecture and 6 hours of web-based discussion per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 277B Machine Learning Algorithms 3 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
An introduction to mathematical optimization and statistics and "non-algorithmic" computation using machine learning. Machine learning prerequisites are introduced including local and global optimization, various statistical and clustering models, and early meta-heuristic methods such as genetic algorithms and artificial neural networks. Building on this foundation, current machine learning techniques are covered including Deep Learning networks, Convolutional neural networks, Recurrent and long short term memory (LSTM) networks, and support vector machines and Gaussian ridge regression. Various case studies in applying optimization, statistical modeling, and machine learning methods as classification and regression task

Objectives & Outcomes

Student Learning Outcomes: A.
To introduce the basics of optimization and statistical modeling techniques relevant to machine learning
B.
To build on optimization and statistical modeling to the recent field of machine learning techniques.
C.
To understand data and algorithms relevant to machine learning

Rules & Requirements

Prerequisites: The students will have had MSSE courses (1) Chem 270 - Intro to Programming, (2) Chem 271 - Software Best Practices, and (3) DS100 courses

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of lecture and 2 hours of discussion per week

Summer: 8 weeks - 4.5 hours of lecture and 5.5 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 278 Ethical Topics for Professional Software Engineering 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
This course will expose students to applied ethics in professional ethics, information technology, intellectual property, and corporate ethics that are topic relevant to the MSSE degree.

Rules & Requirements

Prerequisites: Acceptance into the MSSE program

Hours & Format

Fall and/or spring: 5 weeks - 1 hour of web-based lecture and 1 hour of web-based discussion per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 279 Numerical Algorithms applied to Computational Quantum Chemistry 3 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Introduction to numerical algorithms, their application to computational quantum chemistry, and best practices for software implementation and reuse. This course covers a toolbox of useful algorithms from applied mathematics that are used in physical simulations. Illustrated via computer implementation of density functional theory for modeling chemical reaction mechanisms from quantum mechanics. Topics covered include local optimization, numerical derivatives and integration, dense linear algebra the symmetric eigenvalue problem, the singular value decomposition, and the fast Fourier transform. Students are guided through principles of procedural and object-oriented programming C++ and usage of efficient numerical libraries..

Objectives & Outcomes

Course Objectives: 1.
To introduce computer-based physical simulation via computational quantum chemistry.
2.
To develop the core numerical algorithms needed to efficiently implement computational quantum chemistry methods, as well as other physical simulations.
3.
To reinforce programming skills directed to sustainable software as well as intelligent use of optimized libraries to implement numerical kernels.

Rules & Requirements

Prerequisites: Students will have had MSSE courses (1) Chem 275A Intro to Programming, (2) Chem 275B Software Best Practices, and (3) Data Science 100 courses. In addition, undergraduate physical chemistry (Chem 120A or equivalent) or permission of instructor is required

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 280 Foundations of Programming and Software Engineering for Molecular Sciences 2 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
This course provides an overview of topics relevant to programming and creating software projects. The course will be taught in collaboration with members of the Molecular Sciences Software Institute (MolSII). Students will learn basic syntax, use cases, and ecosystems for Python and C ++. Students will become familiar with tools and practices commonly used in software development such as version control, documentation, and testing. Central to this course is a hands on molecular simulation project where students work in groups to create a software package using concepts taught in the course.

Rules & Requirements

Prerequisites: Acceptance to MSSE program

Hours & Format

Fall and/or spring: 2 weeks - 20 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 281 Software Engineering for Scientific Computing 3 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
The course covers computer architecture and software features that have the
greatest impact on performance. It addresses debugging and performance tunning, detecting
memory and stack overwrites, malloc corruption, hotspot, paging, cache misses. A toolbox with
common algorithms: sorting, searching, hashing, trees, graph traversing, is followed by common
patterns used in object-oriented design. It describes programming paradigms, dynamic libraries,
distributed architectures, and services. Lectures on linear algebra and performance libraries are
provided as background for future courses. HPC paradigms and GPU programming are introduced.
Software packaging, extensibility, and interactivity is followed by team development, testing and
hardening.

Objectives & Outcomes

Course Objectives: The objective of this recurrent
course is to equip students with the skills and tools every software engineer must master for a
successful professional career.

Rules & Requirements

Prerequisites: Students will have had MSSE courses (1) C275A Intro to Programming, (2) C275B Software Best Practices. Students are expected to be familiar with programming in C++ and have a basic understanding of LINUX. Additional materials will be provided for students to peruse as necessary

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 282 MSSE Leadership Bootcamp 2 Units

Terms offered: Spring 2024, Spring 2023, Spring 2022
This boot camp for the Master of Molecular Science and Software Engineering program is a two-week intensive course that introduces program participants to the leadership, management and entrepreneurial skills necessary in today's professional environment. Using the capstone project as a baseline, this course aims to provide program participants an understanding of the key aspects of management and leadership disciplines; team and organization dynamics; leading and participating in cross functional teams; engineering economic, finance and accounting concepts; effective communication skills and project management.

Rules & Requirements

Prerequisites: Concurrent enrollment in Chem 283 Capstone Project Course

Hours & Format

Fall and/or spring: 2 weeks - 17-17 hours of lecture and 25-25 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 282A MSSE Leadership Bootcamp 1 Unit

Terms offered: Spring 2025
This is the first of the two one-unit courses that make up the Master of Molecular Science and Software Engineering (MSSE) program leadership course. Together, these two one-unit courses aim to introduce program participants to a number of key professional skills that will enhance their performance in today's business environment. Topics covered in this course include key aspects of management and leadership disciplines; engineering, economic, finance and accounting concepts; effective communication skills, and a technologist's role in marketing and business strategy formulation and execution.

Hours & Format

Fall and/or spring: 2 weeks - 12.5 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 282B MSSE Leadership and Project Management 1 Unit

Terms offered: Spring 2025
MSSE Leadership and Project Management (CHEM 282B) will be taken concurrently with the capstone project (CHEM 283) course. Tightly integrating with the Capstone Project Course, this course aims to reinforce the key aspects of leading and participating in cross functional teams and project management. Program participants will also be able to apply the project management and teamwork skills in completing their capstone team projects.
Rules & Requirements

Prerequisites: Must be taken in the same semester as CHEM 283

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 283 MSSE Capstone Project Course 3 Units

Terms offered: Spring 2025, Spring 2024, Spring 2023
This course provides students with a multifaceted experience managing a project involving the application and development of software for Computational Sciences. Students exercise leadership, team building, and critical thinking skills resulting in a Capstone project deliverables and final report. Capstone projects are an essential part of the MSSE program because students transfer skills learned in other MSSE courses to a real-world application in particular applying several software engineering, algorithmic and scientific concepts This course is also designed to be tightly integrated with MSSE's Leadership Bootcamp. Capstone projects are developed with MSSE industrial and academic partners, individually or in cross-functional teams.
Rules & Requirements

Prerequisites: All courses in the MSSE program curriculum are prerequisite of the Capstone Project course. Concurrent enrollment in Chem 282-MSSE Leadership Bootcamp and CS267-Applications of Parallel Computers is required

Hours & Format

Fall and/or spring: 15 weeks - 1-1 hours of lecture and 2-2 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 284 High Performance Computing for the Molecular Sciences 3 Units

Terms offered: Not yet offered
This course introduces parallel programming concepts commonly encountered in computational molecular sciences codes, including distributed-memory parallelization, shared-memory parallelization, and GPU parallelization. Students will become familiar with MPI, OpenMP, and CUDA, while also learning specific strategies for addressing performance challenges associated with key computational chemistry algorithms. Special emphasis is placed on the execution of machine learning techniques within a high performance computing environment, as well as challenges arising from processing large amounts of data.
Rules & Requirements

Prerequisites: Admission to the Master of Molecular Science and Software Engineering. CHEM 277B: Machine Learning Algorithms or instructor approval

Credit Restrictions: Students will receive no credit for CHEM 284 after completing COMPSCI 267.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 295 Special Topics 1 - 3 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Lecture series on topics of current interest. Recently offered topics: Natural products synthesis, molecular dynamics, statistical mechanics, molecular spectroscopy, structural biophysics, organic polymers, electronic structure of molecules and bio-organic chemistry.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CHEM 297 Field Study in Chemistry for Graduate Students 1 - 4 Units

Terms offered: Not yet offered
Supervised experience in off-campus organizations relevant to specific aspects and applications of chemistry as part of the student's progress towards a PhD degree. Written report required at the end of the term. Course does not satisfy unit or residence requirements for the bachelor's degree.

Rules & Requirements

Prerequisites: Graduate student in good standing and consent of instructor; a written proposal for the internship, signed by the faculty sponsor must receive approval from the department chair

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of fieldwork per week

Summer: 8 weeks - 6-6 hours of fieldwork per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CHEM 298 Seminars for Graduate Students 1 - 3 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
In addition to the weekly Graduate Research Conference and weekly seminars on topics of interest in biophysical, organic, physical, nuclear, and inorganic chemistry, there are group seminars on specific fields of research. Seminars will be announced at the beginning of each semester.

Rules & Requirements

Prerequisites: Graduate standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of colloquium per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

CHEM 299 Research for Graduate Students 1 - 9 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Facilities are available to graduate students pursuing original investigations toward an advanced
degree in Chemistry or related fields at the University of California, Berkeley. Investigations may
include experiment, theory, data analysis, and dissemination of accomplishments or discoveries
in the form of oral and written presentations or manuscripts submitted for peer-reviewed
publication. Such work is done under the supervision and direction of a faculty member or their
designee.

Objectives & Outcomes

Course Objectives: Provide opportunities for graduate students to engage in original research under the direction,
support, and mentorship of a faculty member in the chemistry department at UC Berkeley.

Student Learning Outcomes: Students will learn the skills and techniques necessary to complete a PhD in the field of
Chemistry and ultimately become a world expert in their thesis research area. Students will
show progress in the following areas related to their chosen field of study, including, but not
limited to the following:
Creativity, intellectual ownership, initiative, technical proficiency, resilience, communication both
orally and in writing, ability to solve challenging problems, broad understanding of relevant
disciplinary background (literature), the ability to initiate new research directions aimed toward
solving important scientific challenges.

Rules & Requirements

Prerequisites: Graduate standing. Consent of Instructor Required

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 0-0 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

CHEM 300 Professional Preparation: Supervised Teaching of Chemistry 2 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
Discussion, curriculum development, class observation, and practice teaching in chemistry.
Rules & Requirements

Prerequisites: Graduate standing and appointment as a graduate student instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Letter grade.

CHEM 301 Pre-High School Chemistry Classroom Immersion 1 Unit

Terms offered: Fall 2025, Fall 2024, Fall 2023
Provides training and opportunity for graduate students to make presentations in local public schools. Training ensures that presenters are aware of scientific information mandated by the State of California for particular grade levels, and that presentations are intellectually stimulating, relevant to the classroom students' interests, and age-appropriate. Time commitment an average of two to three hours/week, but actual time spent is concentrated during preparation and classroom delivery of presentations, which are coordinated between teachers' needs and volunteers' availability.
Rules & Requirements

Prerequisites: Graduate standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructor: Bergman

CHEM 301A Undergraduate Lab Instruction 2 Units

Terms offered: Fall 2017, Spring 2017, Fall 2016
Tutoring of students in 1AL and 1B laboratory. Students attend one hour of the regular GSI preparatory meeting and hold one office hour per week to answer questions about laboratory assignments.
Rules & Requirements

Prerequisites: Junior standing or consent of instructor; 1A, 1AL, and 1B with grades of B- or higher

Repeat rules: Course may be repeated for credit up to a total of 4 units.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 4 hours of tutorial per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Offered for pass/not pass grade only.

CHEM 301B Undergraduate Chemistry Instruction 2 Units

Terms offered: Fall 2017, Spring 2017, Fall 2016
Tutoring of students in 1A-1B. Students attend a weekly meeting on tutoring methods at the Student Learning Center and attend 1A-1B lectures.
Rules & Requirements

Prerequisites: Sophomore standing; 1A, 1AL, and 1B with grades of B- or higher

Repeat rules: Course may be repeated for credit up to a total of 4 units.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 5 hours of tutorial per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Offered for pass/not pass grade only.

Formerly known as: 301

CHEM 301C Chemistry Teacher Scholars 2 Units

Terms offered: Fall 2025, Spring 2025, Fall 2024
The Chemistry Undergraduate Teacher Scholar Program places undergraduate students as apprentice instructors in lower division laboratory and discussion sections. In a weekly meeting with instructors, participants learn about teaching, review chemistry knowledge, and are coached to mentor students.
Rules & Requirements

Prerequisites: Chemistry 1A or Chemistry 4A or equivalent. Consent of instructor required

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1.5-1.5 hours of lecture and 1-1 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Offered for pass/not pass grade only.

CHEM 301D Undergraduate Chemistry Course Instruction 1 - 2 Units

Terms offered: Fall 2017, Spring 2017, Fall 2016
Tutoring of students enrolled in an undergraduate chemistry course.
Rules & Requirements

Prerequisites: Junior standing or consent of instructor; completion of tutored course with a grade of B- or better

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2-4 hours of tutorial per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Offered for pass/not pass grade only.

CHEM 301T Undergraduate Preparation for Teaching or Instruction in Teaching 2 Units

Terms offered: Spring 2015, Spring 2014, Spring 2013
Rules & Requirements

Prerequisites: Junior standing, overall GPA 3.1, and consent of instructor

Repeat rules: Course may be repeated for credit up to a total of 8 units.

Hours & Format

Fall and/or spring: 15 weeks - 2-3 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Letter grade.

CHEM 301W Supervised Instruction of Chemistry Scholars 2 Units

Terms offered: Fall 2017, Spring 2017, Fall 2016
Tutoring of students in the College of Chemistry Scholars Program who are enrolled in general or organic chemistry. Students attend a weekly meeting with instructors.
Rules & Requirements

Prerequisites: Sophomore standing and consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of independent study and 4-5 hours of tutorial per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Offered for pass/not pass grade only.

CHEM 375 Professional Preparation: Supervised Teaching of Chemistry 2 Units

Terms offered: Fall 2023, Fall 2021
Discussion, curriculum development, class observation, and practice teaching in chemistry.

Rules & Requirements

Prerequisites: Graduate standing and appointment as a graduate student instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Chemistry/Professional course for teachers or prospective teachers

Grading: Letter grade.

CHEM 602 Individual Study for Doctoral Students 1 - 8 Units

Terms offered: Fall 2017, Spring 2017, Fall 2016
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D. degree. May not be used for unit or residence requirements for the doctoral degree.

Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-8 hours of independent study per week

Summer: 8 weeks - 1.5-15 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Graduate examination preparation

Grading: Offered for satisfactory/unsatisfactory grade only.

CHEM 700 QB3 Colloquium for Graduate Students 0.0 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021
Weekly Graduate colloquium on topics of interest in QB3 research.

Rules & Requirements

Prerequisites: Graduate standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-2 hours of colloquium per week

Additional Details

Subject/Course Level: Chemistry/Graduate examination preparation

Grading: Offered for satisfactory/unsatisfactory grade only.

Formerly known as: Chemistry 999