

Chemistry (CHEM)

Courses

Expand all course descriptions [+]Collapse all course descriptions [-]

CHEM 1A General Chemistry 3 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020

Stoichiometry of chemical reactions, quantum mechanical description of atoms, the elements and periodic table, chemical bonding, real and ideal gases, thermochemistry, introduction to thermodynamics and equilibrium, acid-base and solubility equilibria, introduction to oxidation-reduction reactions, introduction to chemical kinetics.

General Chemistry: Read More [+]

Rules & Requirements

Prerequisites: High school chemistry recommended

Credit Restrictions: Students will receive no credit for CHEM 1A after completing CHEM 1AD or CHEM 4A. A deficient grade in CHEM 1A may be removed by taking CHEM 1AD.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture, 1-1 hours of discussion, and 0-2 hours of voluntary per week

Summer: 8 weeks - 6-6 hours of lecture, 2-2 hours of discussion, and 0-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry: Read Less [-]

CHEM 1AD General Chemistry (Digital) 3 Units

Terms offered: Spring 2016

An interactive general chemistry course that uses modern digital technology, offered in a smaller classroom setting to facilitate student participation and foster an engaging learning environment. Topics cover the Chemistry 1A curriculum, ranging from quantum mechanics and interactions of atoms and molecules to properties and equilibria of bulk materials. The course involves a blend of classroom lectures and peer learning with substantial web-based assignments and resources including web access to lecture videos. Lecture time is also devoted to ChemQuiz peer discussions and live demos of chemical properties and processes, which students generally find to be illuminating and valuable learning experiences.

General Chemistry (Digital): Read More [+]

Rules & Requirements

Prerequisites: High school chemistry recommended

Credit Restrictions: Students will receive no credit for Chemistry 1AD after completing Chemistry 1A or 4A. A deficient grade in Chemistry 1A may be removed by taking Chemistry 1AD.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Pines, Slack

General Chemistry (Digital): Read Less [-]

CHEM 1AL General Chemistry Laboratory 2 Units

Terms offered: Spring 2020, Fall 2019, Summer 2019 8 Week Session

An experimental approach to chemical sciences with emphasis on developing fundamental, reproducible laboratory technique and a goal of understanding and achieving precision and accuracy in laboratory experiments. Proper use of laboratory equipment and standard wet chemical methods are practiced. Areas of investigations include chemical equilibria, spectroscopy, nanotechnology, green chemistry, and thermochemistry. Completion of, or concurrent enrollment in 1A is required.

General Chemistry Laboratory: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: CHEM 1A, with min grade of C-; or co-enrollment in CHEM 1A; or AP CHEM with min score of 4; or CHEM HL IB with min score of 5; or GCE A-Level CHEM with min grade of C

Credit Restrictions: Students will receive no credit for 1AL after taking 4A.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture, 3 hours of laboratory, and 0 hours of voluntary per week

Summer: 8 weeks - 2 hours of lecture, 6 hours of laboratory, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

General Chemistry Laboratory: Read Less [\[-\]](#)

CHEM 1B General Chemistry 4 Units

Terms offered: Spring 2020, Spring 2019, Summer 2018 8 Week Session

Introduction to chemical kinetics, electrochemistry, properties of the states of matter, binary mixtures, thermodynamic efficiency and the direction of chemical change, quantum mechanical description of bonding introduction to spectroscopy. Special topics: Research topics in modern chemistry and biochemistry, chemical engineering.

General Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: CHEM 1A and CHEM 1AL with min grades of C-; or CHEM 4A with min grade of C-; or AP CHEM with min score of 4; or CHEM HL IB with min score of 5; or GCE A-Level CHEM with min grade of C

Credit Restrictions: Students will receive no credit for Chemistry 1B after completing Chemistry 4B.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of lecture, 4 hours of laboratory, and 0 hours of voluntary per week

Summer: 8 weeks - 6 hours of lecture, 8 hours of laboratory, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry: Read Less [\[-\]](#)

CHEM W1A General Chemistry 3 Units

Terms offered: Summer 2013 10 Week Session, Summer 2013 8 Week Session, Summer 2012 8 Week Session

Stoichiometry of chemical reactions, quantum mechanical description of atoms, the elements and periodic table, chemical bonding, real and ideal gases, thermochemistry, introduction to thermodynamics and equilibrium, acid-base and solubility equilibria, introduction to oxidation-reduction reactions, introduction to chemical kinetics. This course is web-based.

General Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: High school chemistry is recommended

Credit Restrictions: Students will receive no credit for CHEM W1A after passing CHEM 1A or CHEM 4A. A deficiency in CHEM 1A may be removed by taking CHEM W1A.

Hours & Format

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

Summer: 8 weeks - 6 hours of web-based lecture and 2 hours of web-based discussion per week

Online: This is an online course.

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry: Read Less [\[-\]](#)

CHEM 3A Chemical Structure and Reactivity 3 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020

Introduction to organic chemical structures, bonding, and chemical reactivity. The organic chemistry of alkanes, alkyl halides, alcohols, alkenes, alkynes, and organometallics.

Chemical Structure and Reactivity: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: CHEM 1A with min grade of C-; or AP Chem with min score of 4; or Chem HL IB with min score of 5; or GCE A-Level Chem with min grade of C

Credit Restrictions: Students will receive no credit for CHEM 3A after completing CHEM 12A; a deficient grade in CHEM 12A may be removed by taking CHEM 3A- will restrict credit if completed before Chemistry 3A.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Chemical Structure and Reactivity: Read Less [\[-\]](#)

CHEM 3AL Organic Chemistry Laboratory 2 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020

Introduction to the theory and practice of methods used in the organic chemistry laboratory. An emphasis is placed on the separation and purification of organic compounds. Techniques covered will include extraction, distillation, sublimation, recrystallization, and chromatography. Detailed discussions and applications of infrared and nuclear magnetic resonance spectroscopy will be included.

Organic Chemistry Laboratory: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: CHEM 1A and CHEM 1AL with min grades of C-; or CHEM 4A with min grade of C-; or AP CHEM with min score of 4; or CHEM HL IB with min score of 5; or GCE A-Level CHEM with min grade of C. Corequisite: CHEM 3A with min grade of C- or coenrollment in CHEM 3A

Credit Restrictions: Students will receive no credit for CHEM 3AL after taking CHEM 12A.

Hours & Format

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

Summer: 8 weeks - 2 hours of lecture and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Organic Chemistry Laboratory: Read Less [\[-\]](#)

CHEM 3B Chemical Structure and Reactivity 3 Units

Terms offered: Fall 2020, Summer 2020 8 Week Session, Spring 2020

Conjugation, aromatic chemistry, carbonyl compounds, carbohydrates, amines, carboxylic acids, amino acids, peptides, proteins, and nucleic acid chemistry. Ultraviolet spectroscopy and mass spectrometry will be introduced.

Chemical Structure and Reactivity: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: CHEM 3A and CHEM 3AL with min grades of C-

Credit Restrictions: Students will receive no credit for 3B after taking 12B.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Chemical Structure and Reactivity: Read Less [\[-\]](#)

CHEM 3BL Organic Chemistry Laboratory 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

The synthesis and purification of organic compounds will be explored. Natural product chemistry will be introduced. Advanced spectroscopic methods including infrared, ultraviolet, and nuclear magnetic resonance spectroscopy and mass spectrometry will be used to analyze products prepared and/or isolated. Qualitative analysis of organic compounds will be covered.

Organic Chemistry Laboratory: Read More [+]

Rules & Requirements

Prerequisites: CHEM 3AL with min grade of C-. Co-requisite: CHEM 3B with min grade of C- or co-enrollment in CHEM 3B

Credit Restrictions: Students will receive no credit for CHEM 3BL after taking CHEM 12B.

Hours & Format

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

Summer: 8 weeks - 2 hours of lecture and 8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Organic Chemistry Laboratory: Read Less [-]

CHEM N3AL Organic Chemistry Laboratory 2 Units

Terms offered: Summer 2018 8 Week Session, Summer 2017 8 Week Session, Summer 2015 8 Week Session

Introduction to the theory and practice of methods used in the organic chemistry laboratory. An emphasis is placed on the separation and purification of organic compounds. Techniques covered will include extraction, distillation, sublimation, recrystallization, and chromatography. Detailed discussions and applications of infrared and nuclear magnetic resonance spectroscopy will be included.

Organic Chemistry Laboratory: Read More [+]

Rules & Requirements

Prerequisites: CHEM 1A and CHEM 1AL with min grades of C-; or CHEM 4A with min grade of C-; or AP CHEM with min score of 4; or CHEM HL IB with min score of 5; or GCE A-Level CHEM with min grade of C. Co-requisite: CHEM 3A with min grade of C- or co-enrollment in CHEM 3A. CHEM 4A with approval of instructor

Credit Restrictions: Students will receive no credit for CHEM N3AL after taking CHEM 12A.

Hours & Format

Summer: 8 weeks - 2 hours of web-based lecture and 8 hours of laboratory per week

Online: This is an online course.

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Instructor: Pedersen

Organic Chemistry Laboratory: Read Less [-]

CHEM 4A General Chemistry and Quantitative Analysis 5 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

Series is intended for majors in physical, biological sciences, and engineering. It presents the foundation principles of chemistry, including stoichiometry, ideal and real gases, acid-base and solubility equilibria, oxidation-reduction reactions, thermochemistry, entropy, nuclear chemistry and radioactivity, the atoms and elements, the periodic table, quantum theory, chemical bonding, molecular structure, chemical kinetics, and descriptive chemistry. Examples and applications will be drawn from diverse areas of interest such as atmospheric, environmental, materials, polymer and computational chemistry, and biochemistry. Laboratory emphasizes quantitative work. Equivalent to 1A-1B plus 15 as prerequisite for further courses in chemistry.

General Chemistry and Quantitative Analysis: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: High school chemistry; calculus (may be taken concurrently); high school physics is recommended

Credit Restrictions: Students will receive no credit for 4A after taking 1A. Deficiency in 4A may be removed by successfully completing 1A and 1AL together in the same semester.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 4 hours of laboratory, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry and Quantitative Analysis: Read Less [\[-\]](#)

CHEM 4B General Chemistry and Quantitative Analysis 5 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018

Series is intended for majors in physical, biological sciences, and engineering. It presents the foundation principles of chemistry, including stoichiometry, ideal and real gases, acid-base and solubility equilibria, oxidation-reduction reactions, thermochemistry, entropy, nuclear chemistry and radioactivity, the atoms and elements, the periodic table, quantum theory, chemical bonding, molecular structure, chemical kinetics, and descriptive chemistry. Examples and applications will be drawn from diverse areas of interest such as atmospheric, environmental, materials, polymer and computational chemistry, and biochemistry. Laboratory emphasizes quantitative work. Equivalent to 1A-1B plus 15 as prerequisite for further courses in chemistry.

General Chemistry and Quantitative Analysis: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: High school chemistry; calculus (may be taken concurrently); high school physics is recommended

Credit Restrictions: Deficiency in 4B may be removed by successfully completing 15.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture, 4-4 hours of laboratory, and 0-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

General Chemistry and Quantitative Analysis: Read Less [\[-\]](#)

CHEM 12A Organic Chemistry 5 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

A study of all aspects of fundamental organic chemistry, including nomenclature, chemical and physical properties, reactions and syntheses of the major classes of organic compounds. The study includes theoretical aspects, reaction mechanisms, multistep syntheses, and the chemistry of polycyclic and heterocyclic compounds. This course is more extensive and intensive than 3A-3B and includes a greater emphasis on reaction mechanisms and multistep syntheses. 12A (F); 12B (SP)

Organic Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 12A: 1B or 4B with grade of C- or higher; 12B: 12A with grade of C- or higher. For students majoring in chemistry or a closely related field such as chemical engineering or molecular and cell biology

Credit Restrictions: Students will receive no credit for 12A after taking both 3A and 3AL. Deficiency in 12A may be removed by successfully completing 3A and 3AL in the same semester. Students will receive no credit for 12A after taking 112A. Chem 12A is formerly known as Chem 112A.

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture, 1-1 hours of discussion, 5-5 hours of laboratory, and 0-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Chemistry 112A

Organic Chemistry: Read Less [-]

CHEM 12B Organic Chemistry 5 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018

A study of all aspects of fundamental organic chemistry, including nomenclature, chemical and physical properties, reactions and syntheses of the major classes of organic compounds. The study includes theoretical aspects, reaction mechanisms, multistep syntheses, and the chemistry of polycyclic and heterocyclic compounds. This course is more extensive and intensive than 3A-3B and includes a greater emphasis on reaction mechanisms and multistep syntheses. 12A (F); 12B (SP)

Organic Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 12A: 1B or 4B with grade of C- or higher. 12B: 12A with grade of C- or higher. For students majoring in chemistry or a closely related field such as chemical engineering or molecular and cell biology

Credit Restrictions: Students will receive no credit for 12B after taking both 3B and 3BL. Deficiency in 12B may be removed by successfully completing 3B and 3BL in the same semester. Students will receive no credit for 12B after taking 112B. Chem 12B is formerly known as Chem 112B.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, 5 hours of laboratory, and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Chemistry 112B

Organic Chemistry: Read Less [-]

CHEM 15 Analytical and Bioanalytical Chemistry 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016

An introduction to analytical and bioanalytical chemistry including background in statistical analysis of data, acid-base equilibria, electrochemical, spectrometric, and chromatographic methods of analysis and some advanced topics in bioanalytical chemistry such as microfluidics, bioassay techniques, and enzymatic biosensors.

Analytical and Bioanalytical Chemistry: Read More [+]

Rules & Requirements

Prerequisites: 1A and 1AL or equivalent

Credit Restrictions: Deficiency in 15 may be removed by successfully completing 4B.

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Analytical and Bioanalytical Chemistry: Read Less [-]

CHEM 24 Freshman Seminar 1 Unit

Terms offered: Spring 2017, Spring 2016, Spring 2015

The Freshman Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Freshman seminars are offered in all campus departments, and topics may vary from department to department and semester to semester. Enrollment limited to 15 freshmen.

Freshman Seminar: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final Exam To be decided by the instructor when the class is offered.

Freshman Seminar: Read Less [-]

CHEM 32 Preparation for General Chemistry 2 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

Foundation and preparation for General Chemistry. Topics and concepts include elements, atoms, molecules, chemical reactions, chemical calculations, properties of gases and gas laws; thermodynamics, acid/base chemical equilibrium, and periodic trends. In addition, by practicing learning as a process, students will cultivate the habits, strategies, and mindset necessary to succeed in the sciences. Through rigorous practice and guided reflection, students will grow in their ability to master the subject matter and hone their disposition toward scientific learning.

Preparation for General Chemistry: Read More [+]

Rules & Requirements

Credit Restrictions: Students will receive no credit for CHEM 32 after taking and passing any other Chemistry course.

Hours & Format

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

Summer:

6 weeks - 5 hours of lecture and 2 hours of discussion per week
10 weeks - 3 hours of lecture and 3 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam required.

Preparation for General Chemistry: Read Less [-]

CHEM 32L Preparation for General Chemistry Laboratory 1 Unit

Terms offered: Not yet offered

An introduction to the experimental nature of chemistry. An emphasis is placed on gaining familiarity with equipment and experience with the rigorous approaches used in Chemistry laboratory courses. Areas of investigation include scientific calculations and statistical analysis, analytical measurements, acid-base chemistry, titration, equilibrium, solubility, and green chemistry.

Preparation for General Chemistry Laboratory: Read More [-]

Rules & Requirements

Prerequisites: Must be concurrently enrolled in Chem 32

Credit Restrictions: Students will receive no credit for CHEM 32L after completing CHEM 1AL. A deficient grade in CHEM 32L may be removed by taking CHEM 1AL.

Hours & Format

Summer: 6 weeks - 6 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Preparation for General Chemistry Laboratory: Read Less [-]

CHEM 49 Supplementary Work in Lower Division Chemistry 1 - 4 Units

Terms offered: Fall 2017, Fall 2016, Spring 2016

Students with partial credit in lower division chemistry courses may, with consent of instructor, complete the credit under this heading.

Supplementary Work in Lower Division Chemistry: Read More [+]

Rules & Requirements

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

Hours & Format

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

Summer:

6 weeks - 1-6 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Supplementary Work in Lower Division Chemistry: Read Less [-]

CHEM 96 Introduction to Research and Study in the College of Chemistry 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2017

Introduces sophomores and new transfer students to research activities and programs of study in the College of Chemistry. Includes lectures by faculty, an introduction to college library and computer facilities, the opportunity to meet alumni and advanced undergraduates in an informal atmosphere, and discussion of college and campus resources.

Introduction to Research and Study in the College of Chemistry: Read More [+]

Rules & Requirements

Prerequisites: Sophomore or junior standing in the College of Chemistry, or consent of instructor

Credit Restrictions: Students will receive no credit for CHEM 96 after completing CHEM C96.

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam required.

Introduction to Research and Study in the College of Chemistry: Read Less [-]

CHEM 98 Supervised Group Study 1 - 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Group study of selected topics.

Supervised Group Study: Read More [+]

Rules & Requirements

Prerequisites: Consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Group Study: Read Less [-]

CHEM 98W Directed Group Study 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

Topics vary with instructor. Enrollment restrictions apply.

Directed Group Study: Read More [+]

Rules & Requirements

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

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

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of directed group study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Study: Read Less [-]

CHEM 100 Communicating Chemistry 2 Units

Terms offered: Spring 2011, Spring 2010, Spring 2009

For undergraduate and graduate students interested in improving their ability to communicate their scientific knowledge by teaching chemistry in elementary schools. The course will combine instruction in inquiry-based chemistry teaching methods and learning pedagogy with 10 weeks of supervised teaching experience in a local school classroom. Thus, students will practice communicating scientific knowledge and receive mentoring on how to improve their presentations. Approximately three hours per week, including time spent in school classrooms.

Communicating Chemistry: Read More [+]

Rules & Requirements

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

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: 20

Communicating Chemistry: Read Less [-]

CHEM 103 Inorganic Chemistry in Living Systems 3 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

The basic principles of metal ions and coordination chemistry applied to the study of biological systems.

Inorganic Chemistry in Living Systems: [Read More](#) [+]

Rules & Requirements

Prerequisites: Chemistry 3A or 112A. Chemistry majors can only count 2 of the 3 units towards their Allied Subject requirement

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Inorganic Chemistry in Living Systems: [Read Less](#) [-]

CHEM 104A Advanced Inorganic Chemistry 3 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

The chemistry of metals and nonmetals including the application of physical chemical principles.

Advanced Inorganic Chemistry: [Read More](#) [+]

Rules & Requirements

Prerequisites: 1B, 4B, or 3A; 104A is prerequisite to 104B

Credit Restrictions: 104A: No restrictions; 104B: Chemical Biology majors can only count 2 of the 3 units towards their Allied Subject requirement for 104B after taking 103.

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture and 0 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Inorganic Chemistry: [Read Less](#) [-]

CHEM 104B Advanced Inorganic Chemistry 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018

The chemistry of metals and nonmetals including the application of physical chemical principles.

Advanced Inorganic Chemistry: [Read More](#) [+]

Rules & Requirements

Prerequisites: 104A or consent of instructor. Chemical Biology majors can only count 2 of the 3 units towards their Allied Subject requirement for 104B after taking 103

Hours & Format

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

Summer: 8 weeks - 6 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Inorganic Chemistry: [Read Less](#) [-]

CHEM 105 Instrumental Methods in Analytical Chemistry 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Principles, instrumentation and analytical applications of atomic spectroscopies, mass spectrometry, separations, electrochemistry and micro-characterization. Discussion of instrument design and capabilities as well as real-world problem solving with an emphasis on bioanalytical, environmental, and forensic applications. Hands-on laboratory work using modern instrumentation, emphasizing independent projects involving real-life samples and problem solving.

Instrumental Methods in Analytical Chemistry: [Read More](#) [+]

Rules & Requirements

Prerequisites: 4B; or 1B and 15; or 1B and a UC GPA of 3.3 or higher

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/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instrumental Methods in Analytical Chemistry: [Read Less](#) [-]

CHEM 108 Inorganic Synthesis and Reactions 4 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017

The preparation of inorganic compounds using vacuum line, air-and moisture-exclusion, electrochemical, high-pressure, and other synthetic techniques. Kinetic and mechanistic studies of inorganic compounds.

Inorganic Synthesis and Reactions: [Read More](#) [+]

Rules & Requirements

Prerequisites: 4B or 15; 104B with grade of C- or higher, or 103

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/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Inorganic Synthesis and Reactions: [Read Less](#) [-]

CHEM C110L General Biochemistry and Molecular Biology Laboratory 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Experimental techniques of biochemistry and molecular biology, designed to accompany the lectures in Molecular and Cell Biology 100B and 110.

General Biochemistry and Molecular Biology Laboratory: [Read More](#) [+]

Rules & Requirements

Prerequisites: 110 (may be taken concurrently)

Hours & Format

Fall and/or spring: 15 weeks - 2-2 hours of lecture and 6-8 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Also listed as: MCELLBI C110L

General Biochemistry and Molecular Biology Laboratory: [Read Less](#) [-]

CHEM 113 Advanced Mechanistic Organic Chemistry 3 Units

Terms offered: Fall 2020, Fall 2018, Fall 2016

Advanced topics in mechanistic and physical organic chemistry typically including kinetics, reactive intermediates, substitution reactions, linear free energy relationships, orbital interactions and orbital symmetry control of reactions, isotope effects, and photochemistry.

Advanced Mechanistic Organic Chemistry: [Read More](#) [+]

Rules & Requirements

Prerequisites: 3B or 112B with a minimum grade of B- or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Mechanistic Organic Chemistry: [Read Less](#) [-]

CHEM 114 Advanced Synthetic Organic Chemistry 3 Units

Terms offered: Spring 2020, Spring 2018, Spring 2017

Advanced topics in synthetic organic chemistry with a focus on selectivity. Topics include reductions, oxidations, enolate chemistry and the aldol reaction, reactions of non-stabilized anions, olefination reactions, pericyclic reactions and application to the synthesis of complex structures.

Advanced Synthetic Organic Chemistry: [Read More](#) [+]

Rules & Requirements

Prerequisites: 3B or 112B with a minimum grade of B- or consent of instructor

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Advanced Synthetic Organic Chemistry: [Read Less](#) [-]

CHEM 115 Organic Chemistry--Advanced Laboratory Methods 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Advanced synthetic methods, chemical and spectroscopic structural methods, designed as a preparation for experimental research.

Organic Chemistry--Advanced Laboratory Methods: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 112B with a grade of C- or higher

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 11 hours of laboratory per week

Summer:

6 weeks - 2.5 hours of lecture and 27.5 hours of laboratory per week

8 weeks - 2 hours of lecture and 20.5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Organic Chemistry--Advanced Laboratory Methods: Read Less [\[-\]](#)

CHEM 120A Physical Chemistry 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Kinetic, potential, and total energy of particles and forces between them; principles of quantum theory, including one-electron and many-electron atoms and its applications to chemical bonding, intermolecular interactions, and elementary spectroscopy.

Physical Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 4B or equivalent; Physics 7B or 8B; Mathematics 53; Mathematics 54 or consent of instructor

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/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Physical Chemistry: Read Less [\[-\]](#)

CHEM 120B Physical Chemistry 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Statistical mechanics, thermodynamics, equilibrium and applications to chemical systems: states of matter, solutions and solvation, chemical kinetics, molecular dynamics, and molecular transport.

Physical Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 120A (or may be taken concurrently); 4B or equivalent; Mathematics 53; Mathematics 54 (may be taken concurrently); Physics 7B or 8B

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/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Physical Chemistry: Read Less [\[-\]](#)

CHEM 121 Introduction to Computational Chemistry 3 Units

Terms offered: Fall 2020

This course demonstrates how computers are used to solve modern problems in physical chemistry. It focuses first on methods of electronic structure theory that reveal details of molecular structure and energetics, and secondly on simulation methods that explore fluctuations and dynamics of complex systems comprising many molecules. Students will use MATLAB to implement these numerical approaches for illustrative problems. No prior programming experience is required.

Introduction to Computational Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Chem 120A and Chem 120B are very strongly recommended as prerequisites, or co-requisites

Hours & Format

Fall and/or spring: 15 weeks - 3-3 hours of lecture and 1-2 hours of voluntary per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Introduction to Computational Chemistry: Read Less [\[-\]](#)

CHEM 122 Quantum Mechanics and Spectroscopy 3 Units

Terms offered: Fall 2020, Spring 2020, Spring 2019

Postulates and methods of quantum mechanics and group theory applied to molecular structure and spectra.

Quantum Mechanics and Spectroscopy: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 120A

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Quantum Mechanics and Spectroscopy: Read Less [\[-\]](#)

CHEM 125 Physical Chemistry Laboratory 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Experiments in thermodynamics, kinetics, molecular structure, and general physical chemistry.

Physical Chemistry Laboratory: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Two of the following: 120A, 120B, C130, or 130B with grades of C- or higher (one of which may be taken concurrently)

Credit Restrictions: Deficiency in 125 may be removed by successfully completing C182. Consent of instructor is required to enroll in 125 after completing C182 or EPS C182.

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Physical Chemistry Laboratory: Read Less [\[-\]](#)

CHEM 130B Biophysical Chemistry 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018

The weekly one-hour discussion is for problem solving and the application of calculus in physical chemistry. Molecular structure, intermolecular forces and interactions, biomolecular spectroscopy, high-resolution structure determinations.

Biophysical Chemistry: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Chemistry C130 or Molecular and Cell Biology C100A, or consent of instructor. Chemistry and Chemical Biology majors can only count 2 of the 3 units towards their Allied Subject requirement

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Biophysical Chemistry: Read Less [\[-\]](#)

CHEM C130 Biophysical Chemistry: Physical Principles and the Molecules of Life 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Thermodynamic and kinetic concepts applied to understanding the chemistry and structure of biomolecules (proteins, DNA, and RNA). Molecular distributions, reaction kinetics, enzyme kinetics. Bioenergetics, energy transduction, and motor proteins. Electrochemical potential, membranes, and ion channels.

Biophysical Chemistry: Physical Principles and the Molecules of Life: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Chemistry 3A or 112A, Mathematics 1A, Biology 1A and 1AL; Chemistry 3B or 112B recommended

Hours & Format

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

Summer: 8 weeks - 5.5 hours of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: MCELLBI C100A

Biophysical Chemistry: Physical Principles and the Molecules of Life: Read Less [\[-\]](#)

CHEM 135 Chemical Biology 3 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

One-semester introduction to biochemistry, aimed toward chemistry and chemical biology majors.

Chemical Biology: Read More [+]

Rules & Requirements

Prerequisites: 3B or 112B; Biology 1A; or consent of instructor

Credit Restrictions: Students will receive no credit for 135 after taking Molecular and Cell Biology 100B or 102.

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Chemical Biology: Read Less [-]

CHEM C138 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 placed 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-the-art research.

The Berkeley Lectures on Energy: Energy from Biomass: Read More [+]

Rules & Requirements

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

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/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

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

Also listed as: BIO ENG C181/CHM ENG C195A/PLANTBI C124

The Berkeley Lectures on Energy: Energy from Biomass: Read Less [-]

CHEM 143 Nuclear Chemistry 2 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017

Radioactivity, fission, nuclear models and reactions, nuclear processes in nature. Computer methods will be introduced.

Nuclear Chemistry: Read More [+]

Rules & Requirements

Prerequisites: Physics 7B or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Nuclear Chemistry: Read Less [-]

CHEM C146 Radiochemical Methods in Nuclear Technology and Forensics 3 Units

Terms offered: Not yet offered

Experimental illustrations of the interrelation between chemical and nuclear science and technology and nuclear forensics; radioactive decay and counting techniques; nuclear spectroscopy; fundamental radiochemical techniques; radiochemical separations techniques; tracers; activation analysis; forensic applications of radiochemistry; fusion, fission and nuclear reactors.

Radiochemical Methods in Nuclear Technology and Forensics: Read More [+]

Objectives & Outcomes

Course Objectives: Familiarize students with principles of nuclear and radiochemistry and its many important applications in our daily lives; provide hands-on training.

Student Learning Outcomes: A solid understanding of nuclear and radiochemistry; proficiency in safe handling of radioactive materials in the laboratory, and appreciation for the wide application of radiochemical techniques in chemistry, nuclear technology, and nuclear forensics.

Rules & Requirements

Prerequisites: CHEM 4B or CHEM 15; and CHEM 143 is recommended

Credit Restrictions: Students will receive no credit for CHEM 146 after completing CHEM 144, or CHEM C144.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture and 4.5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Chemistry 146

Also listed as: NUC ENG C146

Radiochemical Methods in Nuclear Technology and Forensics: Read Less [-]

CHEM 149 Supplementary Work in Upper Division Chemistry 1 - 4 Units

Terms offered: Spring 2016, Spring 2015, Spring 2014

Students with partial credit in upper division chemistry courses may, with consent of instructor, complete the credit under this heading.

Supplementary Work in Upper Division Chemistry: Read More [+]

Rules & Requirements

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

Hours & Format

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

Summer:

6 weeks - 2.5-10 hours of independent study per week

8 weeks - 1.5-7.5 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Supplementary Work in Upper Division Chemistry: Read Less [-]

CHEM C150 Introduction to Materials Chemistry 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018, Spring 2015

The application of basic chemical principles to problems in materials discovery, design, and characterization will be discussed. Topics covered will include inorganic solids, nanoscale materials, polymers, and biological materials, with specific focus on the ways in which atomic-level interactions dictate the bulk properties of matter.

Introduction to Materials Chemistry: Read More [+]

Rules & Requirements

Prerequisites: CHEM 104A. CHEM 104B recommended

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: MAT SCI C150

Introduction to Materials Chemistry: Read Less [-]

CHEM C170L Biochemical Engineering Laboratory 3 Units

Terms offered: Fall 2020, Spring 2020, Spring 2019, Fall 2018, Spring 2014, Spring 2013

Laboratory techniques for the cultivation of microorganisms in batch and continuous reactions. Enzymatic conversion processes. Recovery of biological products.

Biochemical Engineering Laboratory: Read More [a+]

Rules & Requirements

Prerequisites: Chemical Engineering 170A (may be taken concurrently) or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 7 hours of laboratory and 1 hour of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: CHM ENG C170L

Biochemical Engineering Laboratory: Read Less [-]

CHEM C178 Polymer Science and Technology 3 Units

Terms offered: Fall 2020, Spring 2020, Spring 2019, Fall 2016, Spring 2016, Spring 2015

An interdisciplinary course on the synthesis, characterization, and properties of polymer materials. Emphasis on the molecular origin of properties of polymeric materials and technological applications. Topics include single molecule properties, polymer mixtures and solutions, melts, glasses, elastomers, and crystals. Experiments in polymer synthesis, characterization, and physical properties.

Polymer Science and Technology: Read More [a+]

Rules & Requirements

Prerequisites: Junior standing

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: CHM ENG C178

Polymer Science and Technology: Read Less [-]

CHEM C182 Atmospheric Chemistry and Physics Laboratory 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018

Fluid dynamics, radiative transfer, and the kinetics, spectroscopy, and measurement of atmospherically relevant species are explored through laboratory experiments, numerical simulations, and field observations.

Atmospheric Chemistry and Physics Laboratory: Read More [a+]

Rules & Requirements

Prerequisites: Earth and Planetary Science 50 and 102 with grades of C- or higher (one of which may be taken concurrently) or two of the following: Chemistry 120A, 120B, C130, or 130B with grades of C- or higher (one of which may be taken concurrently)

Credit Restrictions: Deficiency in C182 may be removed by successfully completing 125. Consent of instructor is required to enroll in C182 after completing 125.

Hours & Format

Fall and/or spring: 15 weeks - 1.5 hours of lecture and 5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Formerly known as: Chemistry C182/Earth and Planetary Science C182

Also listed as: EPS C182

Atmospheric Chemistry and Physics Laboratory: Read Less [-]

CHEM C191 Quantum Information Science and Technology 3 Units

Terms offered: Fall 2020, Spring 2020, Spring 2019

This multidisciplinary course provides an introduction to fundamental conceptual aspects of quantum mechanics from a computational and informational theoretic perspective, as well as physical implementations and technological applications of quantum information science. Basic sections of quantum algorithms, complexity, and cryptography, will be touched upon, as well as pertinent physical realizations from nanoscale science and engineering.

Quantum Information Science and Technology: Read More [a+]

Rules & Requirements

Prerequisites: Linear Algebra (EECS 16A or PHYSICS 89 or MATH 54) AND either discrete mathematics (COMPSCI 70 or MATH 55), or quantum mechanics (PHYSICS 7C or PHYSICS 137A or CHEM 120A)

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Also listed as: COMPSCI C191/PHYSICS C191

Quantum Information Science and Technology: Read Less [-]

CHEM 192 Individual Study for Advanced Undergraduates 1 - 3 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

All properly qualified students who wish to pursue a problem of their own choice, through reading or nonlaboratory study, may do so if their proposed project is acceptable to the member of the staff with whom they wish to work.

Individual Study for Advanced Undergraduates: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor and adviser

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

Hours & Format

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

Summer:

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Individual Study for Advanced Undergraduates: Read Less [\[-\]](#)

CHEM H193 Senior Honors Thesis 3 Units

Terms offered: Spring 2016, Fall 2015, Spring 2015

A senior honors thesis is written in consultation with the student's faculty research advisor. This is a required course for students wishing to graduate with honors in Chemistry or Chemical Biology.

Senior Honors Thesis: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Senior standing, approval of faculty research advisor, overall GPA of 3.4 or higher at Berkeley

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

Hours & Format

Fall and/or spring: 15 weeks - 9-0 hours of independent study per week

Summer: 8 weeks - 16.5 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Senior Honors Thesis: Read Less [\[-\]](#)

CHEM H194 Research for Advanced Undergraduates 2 - 6 Units

Terms offered: Spring 2020, Fall 2016, Summer 2016 8 Week Session
Students may pursue original research under the direction of one of the members of the staff.

Research for Advanced Undergraduates: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Minimum GPA of 3.4 overall at Berkeley and consent of instructor and adviser

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

Hours & Format

Fall and/or spring: 15 weeks - 0-6 hours of independent study and 0-6 hours of laboratory per week

Summer:

6 weeks - 0-15 hours of independent study and 0-15 hours of laboratory per week

8 weeks - 0-11.5 hours of independent study and 0-11.5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Research for Advanced Undergraduates: Read Less [\[-\]](#)

CHEM 195 Special Topics 3 Units

Terms offered: Fall 2020, Fall 2019, Spring 2019

Special topics will be offered from time to time. Examples are: photochemical air pollution, computers in chemistry.

Special Topics: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Consent of instructor

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

Hours & Format

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

Summer: 10 weeks - 4.5 hours of lecture per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Special Topics: Read Less [\[-\]](#)

CHEM 196 Special Laboratory Study 2 - 6 Units

Terms offered: Spring 2020, Spring 2016, Fall 2015
Special laboratory work for advanced undergraduates.
Special Laboratory Study: Read More [+]

Rules & Requirements

Prerequisites: Consent of instructor and adviser

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

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of independent study and 0-1 hours of laboratory per week

Summer:

6 weeks - 2.5-10 hours of independent study and 0-2.5 hours of laboratory per week
8 weeks - 2-7.5 hours of independent study and 0-2 hours of laboratory per week
10 weeks - 1.5-6 hours of independent study and 0-1.5 hours of laboratory per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.

Special Laboratory Study: Read Less [-]

CHEM 197 Field Study in Chemistry 1 - 4 Units

Terms offered: Spring 2020, Summer 2016 8 Week Session, Spring 2016
Supervised experience in off-campus organizations relevant to specific aspects and applications of chemistry. Written report required at the end of the term. Course does not satisfy unit or residence requirements for the bachelor's degree.

Field Study in Chemistry: Read More [+]

Rules & Requirements

Prerequisites: Upper division standing and consent of instructor

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

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

Hours & Format

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

Summer: 8 weeks - 6 hours of fieldwork per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Field Study in Chemistry: Read Less [-]

CHEM 198 Directed Group Study 1 - 4 Units

Terms offered: Fall 2020, Spring 2020, Fall 2017

Group study of selected topics.

Directed Group Study: Read More [+]

Rules & Requirements

Prerequisites: Completion of 60 units of undergraduate study and in good standing

Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

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

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Study: Read Less [-]

CHEM 199 Supervised Independent Study and Research 1 - 4 Units

Terms offered: Fall 2020, Fall 2019, Spring 2016

Enrollment is restricted by regulations listed in the .

Supervised Independent Study and Research: Read More [+]

Rules & Requirements

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

Hours & Format

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

Summer:

6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Chemistry/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Supervised Independent Study and Research: Read Less [-]

CHEM 200 Chemistry Fundamentals 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

Review of bonding, structure, stereochemistry, conformation, thermodynamics and kinetics, and arrow-pushing formalisms.

Chemistry Fundamentals: Read More [\[+\]](#)

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.

Chemistry Fundamentals: Read Less [\[-\]](#)

CHEM 201 Fundamentals of Inorganic Chemistry 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

Review of bonding, structure, MO theory, thermodynamics, and kinetics.

Fundamentals of Inorganic Chemistry: Read More [\[+\]](#)

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.

Fundamentals of Inorganic Chemistry: Read Less [\[-\]](#)

CHEM 208 Structure Analysis by X-Ray Diffraction 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2017

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.

Structure Analysis by X-Ray Diffraction: Read More [\[+\]](#)

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.

Structure Analysis by X-Ray Diffraction: Read Less [\[-\]](#)

CHEM 214 Heterocyclic Chemistry 3 Units

Terms offered: Spring 2020, Spring 2018, Spring 2015

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.

Heterocyclic Chemistry: Read More [\[+\]](#)

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

Heterocyclic Chemistry: Read Less [\[-\]](#)

CHEM 220A Thermodynamics and Statistical Mechanics 3 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

A rigorous presentation of classical thermodynamics followed by an introduction to statistical mechanics with the application to real systems.

Thermodynamics and Statistical Mechanics: Read More [+]

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.

Thermodynamics and Statistical Mechanics: Read Less [-]

CHEM 220B Statistical Mechanics 3 Units

Terms offered: Spring 2019, Spring 2017, Spring 2016

Principles of statistical mechanics and applications to complex systems.

Statistical Mechanics: Read More [+]

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.

Statistical Mechanics: Read Less [-]

CHEM 221A Advanced Quantum Mechanics 3 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

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.

Advanced Quantum Mechanics: Read More [+]

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.

Advanced Quantum Mechanics: Read Less [-]

CHEM 221B Advanced Quantum Mechanics 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018

Time dependence, interaction of matter with radiation, scattering theory. Molecular and many-body quantum mechanics.

Advanced Quantum Mechanics: Read More [+]

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.

Advanced Quantum Mechanics: Read Less [-]

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.

Spectroscopy: Read More [\[+\]](#)

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.

Spectroscopy: Read Less [\[-\]](#)

CHEM 223A Chemical Kinetics 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018

Deduction of mechanisms of complex reactions. Collision and transition state theory. Potential energy surfaces. Unimolecular reaction rate theory. Molecular beam scattering studies.

Chemical Kinetics: Read More [\[+\]](#)

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.

Chemical Kinetics: Read Less [\[-\]](#)

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.

Protein Chemistry, Enzymology, and Bio-organic Chemistry: Read More [\[+\]](#)

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

Protein Chemistry, Enzymology, and Bio-organic Chemistry: Read Less [\[-\]](#)

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. Green Chemistry: An Interdisciplinary Approach to Sustainability: Read More [\[+\]](#)

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

Green Chemistry: An Interdisciplinary Approach to Sustainability: Read Less [\[-\]](#)

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.

Energy Solutions: Carbon Capture and Sequestration: Read More [\[+\]](#)

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

Energy Solutions: Carbon Capture and Sequestration: Read Less [\[-\]](#)

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 placed 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.

The Berkeley Lectures on Energy: Energy from Biomass: Read More [\[+\]](#)

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

The Berkeley Lectures on Energy: Energy from Biomass: Read Less [\[-\]](#)

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.

Advanced Nuclear Structure and Reactions: Read More [\[+\]](#)

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.

Advanced Nuclear Structure and Reactions: Read Less [\[-\]](#)

CHEM 250A Introduction to Bonding Theory 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

An introduction to group theory, symmetry, and representations as applied to chemical bonding.

Introduction to Bonding Theory: Read More [\[+\]](#)

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.

Introduction to Bonding Theory: Read Less [\[-\]](#)

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.

Inorganic Spectroscopy: Read More [\[+\]](#)

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.

Inorganic Spectroscopy: Read Less [\[-\]](#)

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.

Coordination Chemistry I: Read More [\[+\]](#)

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.

Coordination Chemistry I: Read Less [\[-\]](#)

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.

Coordination Chemistry II: Read More [\[+\]](#)

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.

Coordination Chemistry II: Read Less [\[-\]](#)

CHEM 252A Organometallic Chemistry I 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

An introduction to organometallics, focusing on structure, bonding, and reactivity.

Organometallic Chemistry I: Read More [\[+\]](#)

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.

Organometallic Chemistry I: Read Less [\[-\]](#)

CHEM 252B Organometallic Chemistry II 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

Applications of organometallic compounds in synthesis with an emphasis on catalysis.

Organometallic Chemistry II: Read More [\[+\]](#)

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.

Organometallic Chemistry II: Read Less [\[-\]](#)

CHEM 253A Materials Chemistry I 1 Unit

Terms offered: Fall 2019, Fall 2018, Fall 2017

Introduction to the descriptive crystal chemistry and electronic band structures of extended solids.

Materials Chemistry I: Read More [\[+\]](#)

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.

Materials Chemistry I: Read Less [\[-\]](#)

CHEM 253B Materials Chemistry II 1 Unit

Terms offered: Fall 2019, Fall 2018, Fall 2017

General solid state synthesis and characterization techniques as well as a survey of important physical phenomena including optical, electrical, and magnetic properties.

Materials Chemistry II: Read More [\[+\]](#)

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.

Materials Chemistry II: Read Less [\[-\]](#)

CHEM 253C Materials Chemistry III 1 Unit

Terms offered: Fall 2019, Fall 2018, Fall 2017

Introduction to surface catalysis, organic solids, and nanoscience.

Thermodynamics and kinetics of solid state diffusion and reaction will be covered.

Materials Chemistry III: Read More [+]

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

Materials Chemistry III: Read Less [-]

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.

Bioinorganic Chemistry: Read More [+]

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.

Bioinorganic Chemistry: Read Less [-]

CHEM 260 Reaction Mechanisms 2 Units

Terms offered: Fall 2020, Fall 2019, Fall 2018

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.

Reaction Mechanisms: Read More [+]

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

Reaction Mechanisms: Read Less [-]

CHEM 261A Organic Reactions I 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

Features of the reactions that comprise the vocabulary of synthetic organic chemistry.

Organic Reactions I: Read More [+]

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.

Organic Reactions I: Read Less [-]

CHEM 261B Organic Reaction II 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

More reactions that are useful to the practice of synthetic organic chemistry.

Organic Reaction II: Read More [\[+\]](#)

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.

Organic Reaction II: Read Less [\[-\]](#)

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.

Organic Reactions III: Read More [\[+\]](#)

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.

Organic Reactions III: Read Less [\[-\]](#)

CHEM 262 Metals in Organic Synthesis 1 Unit

Terms offered: Spring 2020, Spring 2019, Spring 2018

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.

Metals in Organic Synthesis: Read More [\[+\]](#)

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.

Metals in Organic Synthesis: Read Less [\[-\]](#)

CHEM 263A Synthetic Design I 1 Unit

Terms offered: Spring 2020, Spring 2019, Spring 2018

This course will describe the application of modern reactions to the total synthesis of complex target molecules. Natural products, such as alkaloids, terpenes, or polypropionates, as well as theoretically interesting "non-natural" molecules will be covered.

Synthetic Design I: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 262 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.

Synthetic Design I: Read Less [\[-\]](#)

CHEM 263B Synthetic Design II 1 Unit

Terms offered: Spring 2020, Spring 2019, Spring 2018

The principles of retrosynthetic analysis will be laid down and the chemistry of protecting groups will be discussed. Special attention will be given to the automated synthesis of biopolymers such as carbohydrates, peptides, and proteins, as well as nucleic acids.

Synthetic Design II: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: 263A 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.

Synthetic Design II: Read Less [\[-\]](#)

CHEM 265 Nuclear Magnetic Resonance Theory and Application 1 Unit

Terms offered: Fall 2020, Fall 2019, Fall 2018

The theory behind practical nuclear magnetic resonance spectroscopy and a survey of its applications to chemical research.

Nuclear Magnetic Resonance Theory and Application: Read More [\[+\]](#)

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.

Nuclear Magnetic Resonance Theory and Application: Read Less [\[-\]](#)

CHEM 268 Mass Spectrometry 2 Units

Terms offered: Spring 2019, Spring 2018, Spring 2017

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 molecules 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.

Mass Spectrometry: Read More [\[+\]](#)

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.

Mass Spectrometry: Read Less [\[-\]](#)

CHEM 270A Advanced Biophysical Chemistry I 1 Unit

Terms offered: Spring 2019, Spring 2018, Spring 2016

Underlying principles and applications of methods for biophysical analysis of biological macromolecules.

Advanced Biophysical Chemistry I: Read More [\[+\]](#)

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.

Advanced Biophysical Chemistry I: Read Less [\[-\]](#)

CHEM 270B Advanced Biophysical Chemistry II 1 Unit

Terms offered: Spring 2019, Spring 2018, Spring 2016

More applications of methods for biophysical analysis of biological macromolecules.

Advanced Biophysical Chemistry II: Read More [+]

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.

Advanced Biophysical Chemistry II: Read Less [-]

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

Terms offered: Spring 2020, Spring 2019, Spring 2018

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.

Chemical Biology I - Structure, Synthesis and Function of Biomolecules: Read More [+]

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

Chemical Biology I - Structure, Synthesis and Function of Biomolecules: Read Less [-]

CHEM C271B Chemical Biology II - Enzyme Reaction Mechanisms 1 Unit

Terms offered: Spring 2020, Spring 2019, Spring 2018

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.

Chemical Biology II - Enzyme Reaction Mechanisms: Read More [+]

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

Chemical Biology II - Enzyme Reaction Mechanisms: Read Less [-]

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

Terms offered: Spring 2020, Spring 2019, Spring 2018

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.

Chemical Biology III - Contemporary Topics in Chemical Biology: Read More [+]

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

Chemical Biology III - Contemporary Topics in Chemical Biology: Read Less [-]

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

Terms offered: 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

Introduction to Programming Languages C++ and Python: Read More [\[+\]](#)

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.

Introduction to Programming Languages C++ and Python: Read Less [\[-\]](#)

CHEM 275B Introduction to Software Engineering Best Practices 3 Units

Terms offered: 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.

Introduction to Software Engineering Best Practices: Read More [\[+\]](#)

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.

Introduction to Software Engineering Best Practices: Read Less [\[-\]](#)

CHEM 277B Machine Learning Algorithms 3 Units

Terms offered: Not yet offered

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

Machine Learning Algorithms: Read More [\[+\]](#)

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: 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.

Machine Learning Algorithms: Read Less [\[-\]](#)

CHEM 278 Ethical Topics for Professional Software Engineering 1 Unit

Terms offered: Not yet offered

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.

Ethical Topics for Professional Software Engineering: Read More [\[+\]](#)

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.

Ethical Topics for Professional Software Engineering: Read Less [\[-\]](#)

CHEM 295 Special Topics 1 - 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

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.

Special Topics: Read More [\[+\]](#)

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.

Special Topics: Read Less [\[-\]](#)

CHEM 298 Seminars for Graduate Students 1 - 3 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

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. Seminars for Graduate Students: Read More [\[+\]](#)

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.

Seminars for Graduate Students: Read Less [\[-\]](#)

CHEM 299 Research for Graduate Students 1 - 9 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

The facilities of the laboratory are available at all times to graduate students pursuing original investigations toward an advanced degree at this University. Such work is ordinarily in collaboration with a member of the staff.

Research for Graduate Students: Read More [\[+\]](#)

Rules & Requirements

Prerequisites: Graduate standing

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

Hours & Format

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

Additional Details

Subject/Course Level: Chemistry/Graduate

Grading: Letter grade.

Research for Graduate Students: Read Less [\[-\]](#)

CHEM 300 Professional Preparation: Supervised Teaching of Chemistry 2 Units

Terms offered: Fall 2020, Spring 2020, Fall 2019

Discussion, curriculum development, class observation, and practice teaching in chemistry.

Professional Preparation: Supervised Teaching of Chemistry: Read More [\[+\]](#)

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.

Professional Preparation: Supervised Teaching of Chemistry: Read Less [\[-\]](#)

CHEM 301 Pre-High School Chemistry Classroom Immersion 1 Unit

Terms offered: Fall 2020, Spring 2020, Fall 2019

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.

Pre-High School Chemistry Classroom Immersion: Read More [\[+\]](#)

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

Pre-High School Chemistry Classroom Immersion: Read Less [\[-\]](#)

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.

Undergraduate Lab Instruction: [Read More](#) [+]

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.

Undergraduate Lab Instruction: [Read Less](#) [-]

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.

Undergraduate Chemistry Instruction: [Read More](#) [+]

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

Undergraduate Chemistry Instruction: [Read Less](#) [-]

CHEM 301C Chemistry Teacher Scholars 2 Units

Terms offered: Spring 2020, Fall 2019, Spring 2019

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.

Chemistry Teacher Scholars: [Read More](#) [+]

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.

Chemistry Teacher Scholars: [Read Less](#) [-]

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.

Undergraduate Chemistry Course Instruction: [Read More](#) [+]

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.

Undergraduate Chemistry Course Instruction: [Read Less](#) [-]

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

Terms offered: Spring 2015, Spring 2014, Spring 2013

Undergraduate Preparation for Teaching or Instruction in Teaching: Read More [\[+\]](#)

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.

Undergraduate Preparation for Teaching or Instruction in Teaching: Read Less [\[-\]](#)

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.

Supervised Instruction of Chemistry Scholars: Read More [\[+\]](#)

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.

Supervised Instruction of Chemistry Scholars: Read Less [\[-\]](#)

CHEM 375 Professional Preparation: Supervised Teaching of Chemistry 2 Units

Terms offered: Prior to 2007

Discussion, curriculum development, class observation, and practice teaching in chemistry.

Professional Preparation: Supervised Teaching of Chemistry: Read More [\[+\]](#)

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.

Professional Preparation: Supervised Teaching of Chemistry: Read Less [\[-\]](#)

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.

Individual Study for Doctoral Students: Read More [\[+\]](#)

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.

Individual Study for Doctoral Students: Read Less [\[-\]](#)

CHEM 700 QB3 Colloquium for Graduate Students 0.0 Units

Terms offered: Spring 2020, Spring 2019, Fall 2017

Weekly Graduate colloquium on topics of interest in QB3 research.

QB3 Colloquium for Graduate Students: [Read More](#) [+]

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

QB3 Colloquium for Graduate Students: [Read Less](#) [-]