CHEM 101 Career Opportunities in Chemistry

**Description:** Introduction to chemistry careers and faculty research interests in the Department of Chemistry. This course is required for all chemistry majors (B.S. and B.A.) but is open to all students interested in learning about the chemistry program and its relationship to careers.

**Credit Hours:** 1
**Max credits per semester:** 1
**Max credits per degree:** 1
**Grading Option:** Pass No Pass

CHEM 105 Chemistry in Context I

**Prerequisites:** MATH 101, or placement into MATH 102 or above.

**Notes:** Credit toward the degree may be earned in only one of: CHEM 105, 109, 111, 113, or 195. Students planning to take CHEM 251 and 252, or CHEM 261 and 262, should register for CHEM 109 and 110, or CHEM 113 and 114 (the general chemistry sequence). The first part of a two-semester sequence, along with CHEM 106, to constitute the "Chemistry in Context" series.

**Description:** The extraordinary chemistry of ordinary things. The chemical model of solids, liquids, gases, molecules, and salts. How these models are used to explore chemical aspects of biological, social, or economic situations.

**Credit Hours:** 4
**Max credits per semester:** 4
**Max credits per degree:** 4
**Grading Option:** Graded with Option
**Prerequisite for:** AGRO 327, HORT 327, TLMT 327, ASCI 240; CHEM 106L parallel.

ACE: ACE 4 Science

CHEM 105A Chemistry in Context I

**Prerequisites:** MATH 101, MATH 103, or Math Placement Exam score for MATH 102 or above; CHEM 105L parallel.

**Notes:** Credit toward the degree may be earned in only one of: CHEM 105, 105A, 109A, 111, 113, or 113A. Students planning to take Organic Chemistry should register for CHEM 109 and 110, or CHEM 113 and 114.

**Description:** The extraordinary chemistry of ordinary things. The chemical model of solids, liquids, gases, molecules, and salts. How these models are used to explore chemical aspects of biological, social, or economic situations.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Graded with Option
**Prerequisite for:** AGRO 327, HORT 327, TLMT 327, ASCI 240; CHEM 106; CHEM 106A; NRES 319

ACE: ACE 4 Science

CHEM 105L Chemistry in Context I Laboratory

**Prerequisites:** CHEM 105A parallel.

**Description:** Accompanying lab to CHEM 105A.

**Credit Hours:** 1
**Max credits per semester:** 1
**Max credits per degree:** 1
**Grading Option:** Graded with Option
**Prerequisite for:** AGRO 327, HORT 327, TLMT 327; ASCI 240; CHEM 106; CHEM 106A; NRES 319

ACE: ACE 4 Science

CHEM 106 Chemistry in Context II

**Prerequisites:** CHEM 105, or CHEM 109

**Notes:** Continuation of CHEM 105. Will not serve as a prerequisite for any chemistry course. Students planning to take CHEM 251-252 or CHEM 263-264, should take CHEM 109-110 or CHEM 113-114 (general chemistry sequence). The second part of a two-semester sequence, along with CHEM 105, to constitute the "Chemistry in Context" series.

**Description:** How organic chemistry and biochemistry complement one another. Chemical aspects of biological, social, or economic situations.

**Credit Hours:** 4
**Max credits per semester:** 4
**Max credits per degree:** 4
**Grading Option:** Graded with Option
**Offered:** SPRING

**Prerequisite for:** ASCI 320; ASCI 321

CHEM 106A Chemistry in Context II

**Prerequisites:** CHEM 105A and 105L, or CHEM 109A and CHEM 109L; CHEM 106L parallel.

**Notes:** Credit toward the degree may be earned in only one of CHEM 106, 106A, 110, 110A, or 114. Will not serve as a prerequisite for any chemistry course. Students planning to take Organic Chemistry should take CHEM 109-110 or CHEM 113-114.

**Description:** How organic chemistry and biochemistry complement one another. Chemical aspects of biological, social, or economic situations.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3
**Grading Option:** Graded with Option
**Offered:** SPRING

**Prerequisite for:** ASCI 320; ASCI 321

CHEM 106L Chemistry in Context II Laboratory

**Prerequisites:** CHEM 106A parallel.

**Description:** Accompanying lab for CHEM 106A.

**Credit Hours:** 1
**Max credits per semester:** 1
**Max credits per degree:** 1
**Grading Option:** Graded with Option
**Prerequisite for:** ASCI 320; ASCI 321

CHEM 109 General Chemistry I

**Prerequisites:** MATH 102 or 103, or a Math Placement Test score for MATH 104 or 106

**Notes:** Credit toward the degree may be earned in only one of: CHEM 105, 109, 111, 113 or 195.

**Description:** Lecture and laboratory serving as an introduction to chemical reactions, the mole concept, properties of the states of matter, atomic structure, periodic properties, chemical bonding, and molecular structure.

**Credit Hours:** 4
**Max credits per semester:** 4
**Max credits per degree:** 4
**Grading Option:** Graded with Option
**Prerequisite for:** AGRO 327, HORT 327, TLMT 327; AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455; ASCI 240; BIOC 205; BSEN 326, CIVE 326; GEOL 200; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L; MATL 260; MATL 360; NRES 319

ACE: ACE 4 Science
Chemistry (CHEM)

CHEM 109A General Chemistry I
Prerequisites: MATH 102, 103, or a Math Placement Exam score for MATH 104 or 106; CHEM 109L parallel.
Notes: Credit toward the degree may be earned in only one of CHEM 105, 106A, 109A, 111, 113, or 113A.
Description: Lecture serving as an introduction to chemical reactions, the mole concept, properties of the states of matter, atomic structure, periodic properties, chemical bonding, and molecular structure.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: AGRO 327, HORT 327, TLMT 327; AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455; ASCI 240, BIOC 205; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHEM 106; CHEM 106A; CHEM 110; CHEM 110A; CHEM 190H; CHEM 192H; CHME 114; FDST 205; FORS 300; FORS 411; GEOL 200; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L; ACE 4 Science

CHEM 109L General Chemistry I Laboratory
Prerequisites: CHEM 109A parallel.
Notes: Credit toward the degree may be earned in only one of CHEM 109 or 109L.
Description: Accompanying laboratory for CHEM 109A.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: AGRO 327, HORT 327, TLMT 327; AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455; ASCI 240, BIOC 205; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHEM 106; CHEM 106A; CHEM 110; CHEM 110A; CHEM 190H; CHEM 192H; CHME 114; FDST 205; FORS 300; FORS 411; GEOL 200; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L; ACE 4 Science

CHEM 110A General Chemistry II
Prerequisites: A grade of C, P or better in CHEM 109 or 109A and CHEM 109L parallel.
Notes: Credit toward the degree may be earned in only one of CHEM 106, 106A, 109A, or 114.
Description: Lecture serving as an introduction to intermolecular forces, kinetics, chemical equilibrium, thermodynamics, and electrochemistry.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455; ASCI 321; ASCI 340; BSEN 244; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHEM 221; CHEM 251; CHEM 255; CHEM 261; CHEM 291H; FDST 205; FORS 300; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L
ACE: ACE 4 Science

CHEM 110L General Chemistry II Laboratory
Prerequisites: CHEM 110A parallel.
Notes: Credit toward the degree may be earned in only one of 110 or 110L.
Description: Accompanying laboratory for CHEM 110A.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455; ASCI 321; ASCI 340; BSEN 244; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHEM 221; CHEM 251; CHEM 255; CHEM 261; CHEM 291H; FDST 205; FORS 300; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L

CHEM 111 Chemistry for Engineering and Technology
Prerequisites: Math Placement Test score for MATH 106.
Notes: Credit towards the degree may be earned in only one: CHEM 105, 109, 111, 113 or 195. Not open to chemical engineering majors.
Description: A one semester introduction to the fundamentals of chemistry for engineering students.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHEM 191H; CHEM 192H; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; MATL 260; MATL 360
ACE: ACE 4 Science
CHEM 113 Fundamental Chemistry I
Prerequisites: Math Placement Test score for MATH 106.
Notes: Credit towards the degree may be earned in only one: CHEM 105, 109, 111, 113 or 115.
Description: Fundamentals of chemistry for students in physical sciences or chemical engineering. Includes atomic and molecular structure, chemical bonding, states of matter, solutions, and acid-base reactions. Intended for students who plan to take upper-level courses in chemistry.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BIOL 205; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHEM 110; CHEM 114; CHEM 192H; CHME 114; CHME 202; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L
ACE: ACE 4 Science

CHEM 113A Fundamental Chemistry I Laboratory
Prerequisites: MATH 102, 103 or a Math Placement Exam score for MATH 106; CHEM 113L parallel.
Notes: Credit towards the degree may be earned in only one: CHEM 105, 105A, 109, 109A, 111, 113 or 113A.
Description: Fundamentals of chemistry for students in physical sciences or chemical engineering. Includes atomic and molecular structure, chemical bonding, states of matter, solutions, and acid-base reactions. Intended for students who plan to take upper-level courses in chemistry.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: BIOL 205; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHEM 110; CHEM 114; CHEM 191H; CHEM 192H; CHME 114; CHME 202; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L
ACE: ACE 4 Science

CHEM 113L Fundamental Chemistry I Laboratory
Prerequisites: CHEM 113A parallel.
Description: Accompanying lab for CHEM 113A.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: BIOL 205; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHEM 110; CHEM 114; CHEM 191H; CHEM 192H; CHME 114; CHME 202; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L
ACE: ACE 4 Science

CHEM 114 Fundamental Chemistry II
Prerequisites: CHEM 113.
Notes: Parallel: CHEM 221 is the associated laboratory course.
Description: Chemical kinetics, oxidation-reduction reactions and electrochemistry, ionic solution equilibria, thermodynamic concepts, and chemistry of selected elements.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: BSEN 244; BSEN 355; CHEM 251; CHEM 255; CHEM 261; CHEM 291H; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; GEOL 418L, GEOL 818L, NRES 419L, NRES 819L, WATS 418L

CHEM 131 The Science of Food
Crosslisted with: FDST 131, NUTR 131
Description: General scientific concepts in biology, chemistry, and physics using food as a model. What food is from both chemical and nutritional perspectives, and the fate of food from when it leaves the farm to when it becomes a part of the individual. Assists students in making intelligent decisions about many food related controversial issues (e.g., food irradiation, food additives, health foods).
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: FDST 205
ACE: ACE 4 Science

CHEM 191H Freshman Honors Chemistry I
Prerequisites: Freshman standing; Good standing in the University Honors Program; CHEM 109, 111 or 113 parallel.
Description: Seminar in which special topics in chemistry are taught at a level appropriate for the student population.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded

CHEM 192H Freshman Honors Chemistry II
Prerequisites: Freshman standing; Good standing in the University Honors Program; CHEM 109, 111 or 113 with a minimum grade of "B"; CHEM 110 or 114 parallel.
Description: Seminar in which special topics in chemistry are taught at a level appropriate for the student population.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded

CHEM 195 Today's Chemistry in Education
Description: Interactive, practical approach to learning chemistry and its relationship to today's world. Intended for elementary and middle-level education majors. Uses the Operation Chemistry model to help students learn the essential chemistry content and teaching practices for elementary-level classrooms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

CHEM 221 Elementary Quantitative Analysis
Prerequisites: CHEM 110 or parallel CHEM 114
Notes: This is the laboratory course for CHEM 114 as well as a stand-alone course in quantitative analysis. Credit may not be earned in both CHEM 221 and 116.
Description: Methods of statistical data evaluation and rigorous treatment of chemical equilibria, including chemical activity and coupled equilibria, will provide a foundation for understanding classical chemical quantitation techniques. Emphasis on laboratory techniques, including gravimetric and volumetric methods.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Offered: FALL/SPR
Prerequisite for: AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455; CHEM 292H
CHEM 251 Organic Chemistry I
Prerequisites: CHEM 110 or 114 with a minimum grade of C.
Notes: It is suggested that CHEM 253 be taken parallel with CHEM 251. CHEM 251 and 252, with their corresponding labs of CHEM 253 and 254, form a continuous basic course in organic chemistry. Credit toward the degree may be earned in only one of: CHEM 251 or 261.
Description: Chemistry of carbon compounds. Applications to the biological sciences, agriculture and pre-professional programs including premedical and pre-dental. Emphasizes basic principles.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: CHEM 252; CHEM 254

CHEM 252 Organic Chemistry II
Prerequisites: CHEM 251 and 253.
Description: Chemistry of carbonyl compounds. Aspects of aromatic chemistry, heterocycles, carbohydrates and nitrogen compounds, with some emphasis on the organic compounds found in nature.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: CHEM 254

CHEM 253 Organic Chemistry I Laboratory
Prerequisites: CHEM 251 or parallel.
Notes: CHEM 221 recommended. Shares a quiz section with CHEM 251 and normally accompanies it.
Description: Basic techniques of organic chemistry. Structure, identification, physical properties of compounds, molecular modeling, and introduction to the spectroscopic characteristics of organic compounds.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: CHEM 254

CHEM 254 Organic Chemistry II Laboratory
Prerequisites: CHEM 251, 253; CHEM 252 or parallel.
Notes: Shares a quiz section with CHEM 252 and normally accompanies it.
Description: Synthesis of representative organic compounds. Qualitative analysis of organic compounds. Naturally occurring compounds.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option

CHEM 255 Biological Organic Chemistry
Prerequisites: CHEM 110 or 114
Notes: This course should not be taken by majors in Chemistry or Chemical Engineering.
Description: One-semester organic chemistry course in which biological molecules and biochemical reactions will be used to explain and illustrate the central concepts of organic chemistry.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: BIOS 302; BIOS 312; BIOS 313; BIOS 314; BIOS 326; BIOS 443, BIOS 843, VBMS 843, MBIO 443

CHEM 257 Biological Organic Chemistry Laboratory
Prerequisites: CHEM 255 or concurrent
Description: Basic techniques in organic chemistry with a focus on biomolecules. Structure, identification, and physical properties of compounds, accompanied with molecular modeling and introduction to spectroscopy.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option

CHEM 261 Organic Chemistry
Prerequisites: CHEM 110 or 114 with minimum grades of C.
Notes: It is suggested that CHEM 263 be taken parallel with CHEM 261. Credit toward the degree may be earned in only one of: CHEM 251 or 261.
Description: CHEM 261 and 262, together with lab courses 263 and 264, form a continuous basic course covering the important compounds of carbon.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: BIOS 302; BIOS 312; BIOS 313; BIOS 314; BIOS 326; BIOS 443, BIOS 843, VBMS 843, MBIO 443

CHEM 262 Organic Chemistry
Prerequisites: CHEM 261
Notes: It is suggested that CHEM 264 be taken parallel with CHEM 262.
Description: Continuation of CHEM 261.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: BIOS 302; BIOS 312; BIOS 313; BIOS 314; BIOS 326; BIOS 443, BIOS 843, VBMS 843, MBIO 443; CHEM 252; CHEM 254; CHEM 262; CHEM 263; CHEM 263A; CHEM 292H

CHEM 263 Organic Chemistry Laboratory
Prerequisites: CHEM 261
Notes: It is suggested that CHEM 263 be taken parallel with CHEM 261.
Description: Students following the professional curriculum in chemistry should elect this course.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded with Option
Prerequisite for: CHEM 252; CHEM 254; CHEM 264; CHEM 264A
CHEM 263A Organic Chemistry Laboratory
Prerequisites: CHEM 261 or parallel.
Notes: It is suggested that CHEM 263A be taken parallel with CHEM 261.
Description: Students having credit in CHEM 251 and CHEM 253 or its equivalent should elect this course.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
Prerequisite for: CHEM 252; CHEM 254; CHEM 264A

CHEM 264 Organic Chemistry Laboratory
Prerequisites: CHEM 262 or parallel; CHEM 263.
Notes: It is suggested that CHEM 264 be taken parallel with CHEM 262.
Description: Continuation of CHEM 263. Lab work in qualitative organic analysis.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
CHEM 264A Organic Chemistry Laboratory
Prerequisites: CHEM 262 or parallel; CHEM 263 or CHEM 263A.
Notes: It is suggested that CHEM 264A be taken parallel with CHEM 262.
Description: Continuation of CHEM 263A.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
CHEM 291H Honors: Sophomore Chemistry I
Prerequisites: Sophomore standing; Good standing in the University Honors Program; CHEM 110 or 114 with a minimum grade of "B"; CHEM 221 or 251 or 261 parallel.
Description: Seminar in which special topics in chemistry are taught at a level appropriate for the student population.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
CHEM 292H Honors: Sophomore Chemistry II
Prerequisites: Good standing in the University Honors Program; CHEM 221 or 251 or 261 with a minimum grade of "B"; CHEM 251 or 252 or 262 parallel.
Description: Seminar in which special topics in chemistry are taught at a level appropriate for the student population.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Grading Option: Graded with Option
CHEM 396 Independent Study
Credit Hours: 1-12
Min credits per semester: 1
Max credits per semester: 12
Max credits per degree: 12
Grading Option: Graded with Option
CHEM 399 Undergraduate Research in Chemistry
Prerequisites: Permission.
Description: Open to undergraduates desiring to undertake a special research project under the direction of a member of the departmental faculty. The grade will be awarded following the submission of a written progress and/or final report.
Credit Hours: 1-12
Min credits per semester: 1
Max credits per semester: 12
Max credits per degree: 12
Grading Option: Graded with Option
CHEM 421 Analytical Chemistry
Crosslisted with: CHEM 821
Prerequisites: CHEM 471/871 or CHEM 481/881; parallel CHEM 423/823
Description: Chemical and physical properties applied to quantitative chemical analysis. Solution equilibria, stoichiometry, and instrumental theory and techniques.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: CHEM 423, CHEM 823; CHEM 824; CHEM 825A; CHEM 825B; CHEM 825D; CHEM 825G; CHEM 825J; CHEM 991A
ACE: ACE 10 Integrated Product
CHEM 423 Analytical Chemistry Laboratory
Crosslisted with: CHEM 823
Prerequisites: CHEM 421/821 or parallel.
Notes: It is suggested that CHEM 423 be taken parallel with CHEM 421.
Description: Lab designed to accompany CHEM 421/821. Applications of analytical chemical principles to laboratory problems.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Grading Option: Graded with Option
Prerequisite for: CHEM 421, CHEM 821
CHEM 431 Biochemistry I: Structure and Metabolism
Crosslisted with: BIOC 431, BIOC 831, BIOS 431, BIOS 831, CHEM 831
Prerequisites: LIFE 120 with a grade of C or better; CHEM 252 or CHEM 262 with a grade of C or better.
Notes: BIOS 206 or AGRO 215 is recommended.
Description: Structure and function of proteins, nucleic acids, carbohydrates and lipids; nature of enzymes; major metabolic pathways of catabolism; and biochemical energy production.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option
Prerequisite for: CHEM 421, CHEM 821
CHEM 434 Biochemistry II: Structure and Metabolism
Crosslisted with: BIOC 434, BIOC 834, BIOS 434, CHEM 434, AGRO 834, BIOI 834, BIOM 834, CHEM 834; AGRO 810, BIOI 810, HORT 810; ASCI 820; ASCI 917; ASCI 925, NUTR 925; ASCI 926, NUTR 926; ASCI 927, NUTR 927; BIOC 305; BIOC 432, BIOC 832, BIOS 432, CHEM 432, CHEM 832, BIOS 832; BIOC 433, BIOS 833, BIOS 834, CHEM 433, CHEM 833; BIOC 440, BIOS 879; BIOS 950, VBMS 950; FDST 470, FDST 870; NUTR 450; NUTR 455; NUTR 820; NUTR 821; VBMS 410; VBMS 805
Offered: FALL/SPR
Prerequisite for: AGRO 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOI 834, BIOM 834, CHEM 834; AGRO 810, BIOI 810, HORT 810; ASCI 820; ASCI 917; ASCI 925, NUTR 925; ASCI 926, NUTR 926; ASCI 927, NUTR 927; BIOC 305; BIOC 432, BIOC 832, BIOS 432, CHEM 432, CHEM 832, BIOS 832; BIOC 433, BIOS 833, BIOS 834, CHEM 433, CHEM 833; BIOC 440, BIOS 879; BIOS 950, VBMS 950; FDST 470, FDST 870; NUTR 450; NUTR 455; NUTR 820; NUTR 821; VBMS 410; VBMS 805
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Crosslisted with</th>
<th>Prerequisites</th>
<th>Description</th>
<th>Grading Option</th>
<th>Max credits per semester</th>
<th>Max credits per degree</th>
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<tbody>
<tr>
<td>CHEM 432</td>
<td>Biochemistry II: Metabolism and Biological Information</td>
<td>BIOC 432, BIOC 832, BIOS 432, CHEM 832, BIOS 832</td>
<td>BIOC 431/831 with a grade of C or better; BIOS 206 or AGRO 215 with a grade of C or better.</td>
<td>Major metabolic pathways of anabolism, structural and biochemical aspects of biological information flow and use in biotechnology.</td>
<td>Graded with Option</td>
<td>3</td>
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<td>CHEM 433</td>
<td>Biochemistry Laboratory</td>
<td>BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 833</td>
<td>BIOC 431/831 or parallel; or CHEM 435/835.</td>
<td>Introduction to techniques used in biochemical and biotechnology research, including measurement of pH, spectroscopy, analysis of enzymes, chromatography, fractionation of macromolecules, electrophoresis, and centrifugation.</td>
<td>Graded with Option</td>
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<tr>
<td>CHEM 434</td>
<td>Plant Biochemistry</td>
<td>AGRO 434, BIOC 434, BIOS 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834</td>
<td>BIOC/BIOS/CHEM 431/831.</td>
<td>Biochemical metabolism unique to plants. Relationships of topics previously acquired in general biochemistry to biochemical processes unique to plants. Biochemical mechanisms behind physiological processes discussed in plant or crop physiology.</td>
<td>Graded with Option</td>
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<tr>
<td>CHEM 435</td>
<td>Chemical Biology</td>
<td>CHEM 835</td>
<td>CHEM 252 or 262, and CHEM 221</td>
<td>Fundamentals of chemical biology with an emphasis on the underlying principles of biomolecular structures, macromolecular-small molecule interactions, including mechanistic aspects of enzymes and cofactors, use of modified enzymes to alter biochemical pathways, and the use of chemical tools for understanding biological processes.</td>
<td>Graded with Option</td>
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<tr>
<td>CHEM 437</td>
<td>Chemical Biology Laboratory</td>
<td>CHEM 837</td>
<td>CHEM 435/835 or parallel</td>
<td>Introduction to techniques of chemical biology including the study of biological macromolecules and their interaction with small molecule ligands and effectors. Explore modern methods for macromolecular isolation, characterization, and for kinetic analysis and modeling.</td>
<td>Graded</td>
<td>2</td>
<td>2</td>
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<tr>
<td>CHEM 441</td>
<td>Inorganic Chemistry</td>
<td>CHEM 841</td>
<td>CHEM 221 with a minimum grade of C; CHEM 252 or 262.</td>
<td>CHEM 443 is recommended to be taken parallel.</td>
<td>Graded with Option</td>
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<tr>
<td>CHEM 443</td>
<td>Inorganic Chemistry Laboratory</td>
<td>CHEM 843</td>
<td>CHEM 441/841 and the accompanying lab course, CHEM 443/843, constitute a basic course in inorganic chemistry. Structure, bonding, properties, and reactions of inorganic compounds with emphasis on the relationships and trends that are embodied in the periodic table of the elements.</td>
<td>Graded</td>
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<td>3</td>
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<tr>
<td>CHEM 444</td>
<td>Advanced Organic Preparations</td>
<td>CHEM 863</td>
<td>CHEM 252 and CHEM 254.</td>
<td>CHEM 463 is recommended to be taken parallel.</td>
<td>Graded</td>
<td>1-5</td>
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Notes: CHEM 252 or 262, and CHEM 221 is the prerequisite for CHEM 435/835. CHEM 432 or 832, and CHEM 832 or 833 is the prerequisite for CHEM 437/837. CHEM 221 with a minimum grade of C; CHEM 252 or 262 is the prerequisite for CHEM 441. CHEM 443 is recommended to be taken parallel.
CHEM 471 Physical Chemistry
Crosslisted with: CHEM 871
Prerequisites: CHEM 221; MATH 107; and PHYS 142 or 212.
Notes: Credit may not be earned in both CHEM 471/871 and CHEM 481/881.
Description: Conceptual and mathematical foundations of classical and statistical thermodynamics. Applications of thermodynamics to phase and chemical equilibria. Thermodynamics of solutions of small molecules and of polymers. Biological applications of thermodynamics. Introduction to chemical and biochemical spectroscopy.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BIOC 486, BIOC 886, BIOS 486, BIOS 886, CHEM 486, CHEM 886, CHEM 421, CHEM 821

CHEM 481 Physical Chemistry I
Crosslisted with: CHEM 881
Prerequisites: CHEM 221 with grade of at least C; MATH 208; PHYS 212.
Notes: Credit may not be earned in both CHEM 471/871 and CHEM 481/881.
Description: CHEM 481/881 and 482/882 form a continuous basic course in physical chemistry for students interested in chemistry as a profession. Introduction to quantum mechanics and statistical mechanics; application to problems in atomic and molecular structure and to spectroscopy.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BIOC 486, BIOC 886, BIOS 486, BIOS 886, CHEM 486, CHEM 886, CHEM 421, CHEM 821

CHEM 482 Physical Chemistry II
Crosslisted with: CHEM 882
Prerequisites: CHEM 481/881
Notes: This course should parallel CHEM 484/884. Continuation of CHEM 481/881.
Description: Thermodynamics and statistical mechanics and their application to the study of solids, liquids, gases, solutions, phase equilibria, and chemical equilibria. Chemical kinetics and reaction dynamics.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Grading Option: Graded with Option
Prerequisite for: BIOC 486, BIOC 886, BIOS 486, BIOS 886, CHEM 486, CHEM 886, CHEM 482, CHEM 882; CHEM 484, CHEM 884; CHEM 484A, CHEM 884A; CHEM 991 J; PHYS 422, PHYS 822, ECEN 422, ECEN 822

CHEM 484 Physical Chemical Measurements
Crosslisted with: CHEM 884
Prerequisites: CHEM 481/881; CHEM 482/882 or parallel.
Notes: It is suggested that CHEM 484/884 be taken in parallel with CHEM 482/882.
Description: Applications of physical measurements and principles to study chemical systems and processes.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded with Option