

CHEMISTRY (CHEM)

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 105A Chemistry in Context I

Prerequisites: MATH 101, MATH 103, or Math Placement Exam score for MATH 102, MATH 104, or MATH 106.

Notes: Ideally, CHEM 105A and CHEM 105L should be taken together.

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 situation.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: ASCI 240; CHEM 105L; CHEM 106A; FDST 369; NRES 319; PLAS 327

ACE: ACE 4 Science

CHEM 105L Chemistry in Context I Laboratory

Prerequisites: CHEM 105A or parallel.

Notes: Ideally, CHEM 105A and CHEM 105L should be taken together. Credit may be earned in only one of CHEM 105 or CHEM 105L.

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: CHEM 106L; FDST 369; NRES 319; PLAS 327

Course and Laboratory Fee: \$50

CHEM 106A Chemistry in Context II

Prerequisites: C, P, or better in CHEM 105A or CHEM 109A. CHEM 106L recommended parallel. Credit toward the degree may be earned in only one of CHEM 106A, CHEM 110A, or CHEM 114

Notes: Ideally, CHEM 106A and CHEM 106L should be taken together.

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; FDST 367, AGST 367

CHEM 106L Chemistry in Context II Laboratory

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

Notes: Ideally, CHEM 106A and CHEM 106L should be taken together.

Credit may be earned in only one of CHEM 106 or CHEM 106L.

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: FDST 367, AGST 367

Course and Laboratory Fee: \$45

CHEM 109A General Chemistry I

Prerequisites: MATH 102, 103, or a Math Placement Exam score for MATH 106; CHEM 109L recommended parallel. Credit towards the degree may be earned in only one of CHEM 109A or 113A.

Notes: Ideally, CHEM 109A and CHEM 109L should be taken together.

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: ASCI 240; BIOC 205; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; CHEM 106A; CHEM 110A; CHME 114; ENVE 210; FDST 205; FDST 369; FORS 300; FORS 445; GEOL 200; MATL 260; MATL 360; NRES 319; PLAS 327; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

ACE: ACE 4 Science

CHEM 109L General Chemistry I Laboratory

Notes: Ideally, CHEM 109A and CHEM 109L should be taken together. Credit may be earned in only one of CHEM 109 or CHEM 109L.

Description: Use scientific methods, skills, and knowledge to examine matter in ways that address chemical questions relating to the mole concept, properties of the states of matter, atomic structure, periodic properties, chemical bonding, and molecular structure.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: CHEM 106L; CHEM 110L; FDST 369; GEOL 200; NRES 319; PLAS 327; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

Course and Laboratory Fee: \$50

CHEM 110A General Chemistry II

Prerequisites: A grade of C, P, or better in CHEM 109A; CHEM 110L recommended parallel. Credit toward the degree may be earned in only one of CHEM 106A, CHEM 110A, or CHEM 114

Notes: Ideally, CHEM 110A and CHEM 110L should be taken together.

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: ASCI 320; ASCI 321; ASCI 340; BSEN 244; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; BSEN 355; CHEM 110L; CHEM 221A; CHEM 221L; CHEM 251; CHEM 261; CHME 202; FDST 205; FDST 367, AGST 367; FORS 300; FORS 411; FORS 445; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

ACE: ACE 4 Science

CHEM 110L General Chemistry II Laboratory

Prerequisites: CHEM 109L; CHEM 110A or parallel.

Notes: Ideally, CHEM 110A and CHEM 110L should be taken together. Credit may be earned in only one of CHEM 110 or CHEM 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: ASCI 340; CHEM 261; CHME 202; FDST 367, AGST 367; FORS 411; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

Course and Laboratory Fee: \$50

CHEM 113A Fundamental Chemistry I

Prerequisites: MATH 102, MATH 103 or a Math Placement Exam score for MATH 106; CHEM 113L recommended parallel. Credit towards the degree may be earned in only one of CHEM 109A or CHEM 113A.

Notes: Ideally, CHEM 113A and CHEM 113L should be taken together.

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: BIOC 205; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; CHEM 110A; CHEM 113L; CHEM 114; CHME 114; ENVE 210; FDST 369

ACE: ACE 4 Science

CHEM 113L Fundamental Chemistry I Laboratory

Prerequisites: CHEM 113A or parallel.

Notes: Ideally, CHEM 113A and CHEM 113L should be taken together. Credit may be earned in only one of CHEM 113 or CHEM 113L.

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: FDST 369

Course and Laboratory Fee: \$50

CHEM 114 Fundamental Chemistry II

Prerequisites: A grade of C, P, or better in CHEM 113A. CHEM 113L recommended. Credit toward the degree may be earned in only one of CHEM 106A, CHEM 110A, or CHEM 114

Notes: CHEM 221L is the associated laboratory course and is recommended parallel.

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 221A; CHEM 221L; CHEM 251; CHEM 261; CHME 202

CHEM 131 The Science of Food

Crosslisted with: FDST 131, NUTR 131

Description: Covers general and food chemistry, nutrition, food microbiology, food safety and quality, standards that are enforced by regulatory agencies, and food processes applied to improve food quality, shelf life and safety.

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

Course and Laboratory Fee: \$5

CHEM 131H The Science of Food

Crosslisted with: FDST 131H, NUTR 131H

Prerequisites: Credit toward the degree cannot be earned in both FDST/CHEM/NUTR 131 and FDST/CHEM/NUTR 131H.

Description: Covers general and food chemistry, nutrition, food microbiology, food safety and quality, standards that are enforced by regulatory agencies, and food processes applied to improve food quality, shelf life and safety.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

ACE: ACE 4 Science

Course and Laboratory Fee: \$5

CHEM 191 Special Topics in Chemistry

Description: Topics vary.

Credit Hours: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 6

Grading Option: Graded with Option

CHEM 221A Elementary Quantitative Analysis

Prerequisites: C, P, or better in CHEM 110A or CHEM 114; or CHEM 114 parallel.

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.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

CHEM 221L Elementary Quantitative Analysis Laboratory

Prerequisites: CHEM 110A or CHEM 114; or CHEM 114 parallel.

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: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

Offered: FALL/SPR

Course and Laboratory Fee: \$65

CHEM 251 Organic Chemistry I

Prerequisites: A grade of C, P, or better in CHEM 110A or CHEM 114.

Credit toward the degree may be earned in only one of CHEM 251 or 261.

Notes: It is suggested that CHEM 253 be taken parallel with CHEM 251.

Description: Chemistry of carbon compounds including basic principles of bonding and structure; properties and reactions of alkanes, alkenes, alkynes, alkyl halides; stereochemistry, and spectroscopy.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: BIOS 302; BIOS 312; BIOS 314; BIOS 326; BIOS 443, BIOS 843, VBMS 843, MBIO 443, VBMS 443; CHEM 252; CHEM 253; CHEM 254; FORS 340; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455; VBMS 403

CHEM 252 Organic Chemistry II

Prerequisites: C, P, or better in CHEM 251 and 253.

Description: Properties, synthesis, and reactivity of alcohols, ethers, conjugated systems, aromatic systems, heterocycles, carbonyl 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

Offered: FALL/SPR

Prerequisite for: CHEM 254; FORS 415

CHEM 253 Organic Chemistry I Laboratory

Prerequisites: CHEM 251 or parallel.

Notes: CHEM 221 or CHEM 221A & CHEM 221L 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 252; CHEM 254; FORS 340

Course and Laboratory Fee: \$65

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

Prerequisite for: FORS 415

Course and Laboratory Fee: \$65

CHEM 261 Mechanistic Organic Chemistry I

Prerequisites: A grade of C, P, or better in CHEM 110A and CHEM 110L, or CHEM 114. Credit toward the degree may be earned in only one of CHEM 251 or 261.

Notes: CHEM 261 is recommended to be taken in parallel with CHEM 263. CHEM 261 and 262, with their corresponding labs of CHEM 263 and 264, form a continuous course in organic chemistry mechanisms.

Description: Mechanism-based approach to the properties, synthesis, and reactivity of important carbon-based functional groups. Topics include bonding and structure; stereochemistry; and the chemistry of alkenes, alkyl halides, alcohols, thiols, and ethers.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: FALL

Prerequisite for: BIOS 302; BIOS 312; BIOS 314; BIOS 326; BIOS 443, BIOS 843, VBMS 843, MBIO 443, VBMS 443; CHEM 254; CHEM 262; CHEM 263; CHEM 263A

CHEM 262 Mechanistic Organic Chemistry II

Prerequisites: A grade of C, P, or better in CHEM 261.

Notes: It is suggested that CHEM 264 be taken parallel with CHEM 262. CHEM 261 and 262, with their corresponding labs of CHEM 263 and 264, form a continuous course in organic chemistry mechanisms.

Description: Mechanism-based approach to the properties, reactivity, synthesis, and applications of conjugated systems, carbonyl compounds, heterocycles, and nitrogen compounds.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: SPRING

Prerequisite for: CHEM 254; CHEM 264; CHEM 264A

CHEM 263 Mechanistic Organic Chemistry I Laboratory**Prerequisites:** CHEM 261 or parallel.**Notes:** It is suggested that CHEM 263 be taken parallel with CHEM 261. Not for Engineering students.**Description:** Lab work in qualitative organic analysis from a mechanistic perspective.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Offered:** FALL**Prerequisite for:** CHEM 254; CHEM 264; CHEM 264A**Course and Laboratory Fee:** \$65**CHEM 263A Mechanistic Organic Chemistry I Laboratory****Prerequisites:** CHEM 261 or parallel.**Notes:** Lab accompanying CHEM 261 for Engineering students. It is ideal for CHEM 263A be taken parallel with CHEM 261.**Description:** Lab work in qualitative organic analysis from a mechanistic perspective.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**Offered:** FALL**Prerequisite for:** CHEM 254; CHEM 264A**Course and Laboratory Fee:** \$65**CHEM 264 Mechanistic Organic Chemistry II Laboratory****Prerequisites:** CHEM 262 or parallel; CHEM 263.**Notes:** It is suggested that CHEM 264 be taken parallel with CHEM 262. Not for Engineering Students.**Description:** Continuation of CHEM 263. Lab work in qualitative organic analysis from a mechanistic perspective.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Offered:** SPRING**Course and Laboratory Fee:** \$65**CHEM 264A Mechanistic Organic Chemistry II Laboratory****Prerequisites:** CHEM 262 or parallel; CHEM 263 or CHEM 263A.**Notes:** Lab accompanying CHEM 262 for Engineering students. It is ideal for CHEM 264A to be taken parallel with CHEM 262.**Description:** Continuation of CHEM 263A. Lab work in qualitative organic analysis from a mechanistic perspective.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**Offered:** SPRING**Course and Laboratory Fee:** \$65**CHEM 391 Special Topics in Chemistry****Description:** Topics vary.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 6**Grading Option:** Graded with Option**CHEM 396 Independent Study in Chemistry****Prerequisites:** Permission.**Description:** Independent reading or research under direction of a faculty member.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 6**Grading Option:** Graded with Option**CHEM 398 Undergraduate Research in Chemistry****Prerequisites:** Permission.**Description:** 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:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 12**Grading Option:** Graded with Option**Experiential Learning:** Research**CHEM 421 Analytical Chemistry****Crosslisted with:** CHEM 821**Prerequisites:** CHEM 221 or CHEM 221A & CHEM 221L and MATH 106; 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**Offered:** SPRING**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**Course and Laboratory Fee:** \$65

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 201 or PLAS 215 is recommended. First course of a two-semester, comprehensive biochemistry course sequence.

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

Offered: FALL/SPR

Prerequisite for: ASCI 820; ASCI 917; ASCI 925, NUTR 925; ASCI 926, NUTR 926; ASCI 927, NUTR 927; BIOC 305; BIOC 390; BIOC 432, BIOC 832, BIOS 432, CHEM 432, CHEM 832, BIOS 832; BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 433, CHEM 833; BIOC 433H; BIOC 440; FDST 470, FDST 870; NUTR 450; NUTR 455; NUTR 820, NUTR 420; NUTR 821; PLAS 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834; VBMS 410; VBMS 805; VBMS 950

CHEM 432 Biochemistry II: Metabolism and Biological Information

Crosslisted with: BIOC 432, BIOC 832, BIOS 432, CHEM 832, BIOS 832

Prerequisites: BIOC 431/831 with a grade of C or better; BIOS 201 or PLAS 215 with a grade of C or better.

Notes: Continuation of BIOC 431/831.

Description: Major metabolic pathways of anabolism, structural and biochemical aspects of biological information flow and use in biotechnology.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: ASCI 949, BIOC 949, NUTR 949; BIOC 435; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 934, BIOS 934, CHEM 934; BIOC 935, BIOS 935, CHEM 935; BIOC 998; VBMS 919; VBMS 950; VBMS 951

CHEM 433 Biochemistry Laboratory

Crosslisted with: BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 833

Prerequisites: BIOC 431/831 or parallel; or CHEM 435/835.

Description: Introduction to techniques used in biochemical and biotechnology research, including measurement of pH, spectroscopy, analysis of enzymes, chromatography, fractionation of macromolecules, electrophoresis, and centrifugation.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

Offered: FALL/SPR

Prerequisite for: BIOC 437, BIOC 837, BIOS 437, BIOS 837; BIOC 898

Course and Laboratory Fee: \$50

CHEM 434 Plant Biochemistry

Crosslisted with: PLAS 434, BIOC 434, BIOS 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834

Prerequisites: BIOC/BIOS/CHEM 431/831.

Description: 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.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

CHEM 435 Chemical Biology

Crosslisted with: CHEM 835

Prerequisites: CHEM 252 or 262, and CHEM 221A/CHEM 221L

Description: 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.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: FALL

Prerequisite for: BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 433, CHEM 833; CHEM 437, CHEM 837

CHEM 437 Chemical Biology Laboratory

Crosslisted with: CHEM 837

Prerequisites: BIOC/BIOS/CHEM 431/831 or CHEM 435/835 or parallel

Description: 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.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

Offered: SPRING

Course and Laboratory Fee: \$65

CHEM 438 Computational Chemical Biology

Crosslisted with: CHEM 838

Description: Introduction to computational chemistry applications including molecular dynamics simulations, density functional theory optimizations, and computational docking of small molecules to protein targets.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: SPRING

CHEM 441 Inorganic Chemistry**Crosslisted with:** CHEM 841**Prerequisites:** CHEM 221 or CHEM 221A & CHEM 221L with a minimum grade of C; CHEM 252 or 262.**Notes:** CHEM 443 is recommended to be taken parallel.**Description:** 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.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CHEM 845**ACE:** ACE 10 Integrated Product**CHEM 443 Inorganic Chemistry Laboratory****Crosslisted with:** CHEM 843**Prerequisites:** CHEM 441 or parallel.**Notes:** It is suggested that CHEM 443 be taken in parallel with CHEM 441.**Description:** Introduction to typical inorganic chemistry laboratory techniques through the preparation and characterization of inorganic compounds.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Prerequisite for:** CHEM 845**Course and Laboratory Fee:** \$65**CHEM 453 Biosynthetic Pathways****Crosslisted with:** CHEM 853**Prerequisites:** CHEM 251 or CHEM 261**Description:** Biosynthetic pathways for bioactive natural products and pathway engineering with an emphasis on those that are medically significant, including the biosynthesis of fatty acids, polyketides, phenylpropanoids, terpenoids, steroids, alkaloids, non-ribosomal peptides, and carbohydrates.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** SPRING**CHEM 463 Advanced Organic Preparations****Crosslisted with:** CHEM 863**Prerequisites:** CHEM 252 and CHEM 254.**Notes:** For students who wish additional laboratory work in organic chemistry.**Credit Hours:** 1-5**Min credits per semester:** 1**Max credits per semester:** 5**Max credits per degree:** 5**Grading Option:** Graded with Option**CHEM 471 Physical Chemistry****Crosslisted with:** CHEM 871**Prerequisites:** CHEM 221 or CHEM 221A & CHEM 221L; MATH 107; and PHYS 142 or 212. Credit toward the degree may be earned in only one of CHEM 471 or 481.**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, CHEM 486, CHEM 886**CHEM 481 Physical Chemistry I****Crosslisted with:** CHEM 881**Prerequisites:** CHEM 221 or CHEM 221A & CHEM 221L with grade of at least C; MATH 208; PHYS 212. Credit toward the degree may be earned in only one of CHEM 471 or 481.**Description:** CHEM 481/881 and 482/882 with accompanying lab 484/884 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, CHEM 486, CHEM 886; CHEM 482, CHEM 882; CHEM 484, CHEM 884; CHEM 484A, CHEM 884A; CHEM 991J; PHYS 422, PHYS 822, ECEN 422, ECEN 822**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:** CHEM 484, CHEM 884; CHEM 484A, CHEM 884A; CHEM 845; CHEM 987A; CHEM 987B; CHEM 991J; CHME 925; MATL 962; MATL 972**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**Course and Laboratory Fee:** \$65

**CHEM 484A Physical Chemical Measurements**

Crosslisted with: CHEM 884A

Prerequisites: CHEM 481/881; CHEM 482/882 or parallel.

Notes: It is suggested that CHEM 484A/884A be taken in parallel with CHEM 482/882.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

Course and Laboratory Fee: \$65

CHEM 486 Advanced Topics in Biophysical Chemistry

Crosslisted with: BIOC 486, BIOC 886, CHEM 886

Prerequisites: CHEM 471/871 or CHEM 481/881.

Description: Applications of thermodynamics to biochemical phenomena, optical properties of proteins and polynucleotides, and kinetics of rapid reactions.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

CHEM 499 Undergraduate Thesis

Prerequisites: Permission

Description: Independent research leading to a thesis.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 6

Grading Option: Graded with Option

CHEM 499H Honors Undergraduate Thesis

Prerequisites: Permission. Credit toward the degree cannot be earned in CHEM 499 and CHEM 499H.

Description: Independent research leading to a thesis.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 6

Grading Option: Graded with Option