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  
**Format:** LEC

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). CHEM 105 is 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 situation.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC  
**Prerequisite for:** AGRO 327, HORT 327, TLMT 327; ASCI 240; NRES 319  
**ACE:** ACE 4 Science

CHEM 106 Chemistry in Context II

**Prerequisites:** CHEM 105

**Notes:** Continuation of CHEM 105. CHEM 106 will not serve as a prerequisite for any chemistry course. Students planning to take CHEM 251-252 or 263-264, should take CHEM 109-110 or 113-114 (general chemistry sequence). CHEM 106 is 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  
**Format:** LEC  
**Prerequisite for:** ASCI 320

CHEM 109 General Chemistry I

**Prerequisites:** MATH 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  
**Format:** LEC  
**Prerequisite for:** AGRO 327, HORT 327, TLMT 327; AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455; ASCI 340; BIOC 205; CHME 114; CHME 202; FDST 401, FDST 801; FORS 300; FORS 411; GEOL 210; MATL 360; NRES 319  
**ACE:** ACE 4 Science

CHEM 110 General Chemistry II

**Prerequisites:** CHEM 109

**Description:** Lecture and laboratory serving as an introduction to intermolecular forces, kinetics, chemical equilibrium, thermodynamics, and electrochemistry.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC  
**Prerequisite for:** AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455; ASCI 340; BSEN 355; CHEM 221; CHEM 251; CHEM 255; CHEM 261; CHEM 263; FORS 300; FORS 411  
**ACE:** ACE 4 Science

CHEM 111 Chemistry for Engineering and Technology

**Prerequisites:** Math Placement Test score for MATH 106; one unit high school chemistry; one unit high school physics.

**Notes:** Credit towards the degree may be earned in only one: CHEM 105, 109, 111, 113, or 195. Not open to chemical engineering majors. CHEM 111 is a one semester introduction to the fundamentals of chemistry course for engineering students.

**Description:** Fundamentals of chemistry for engineering.

**Credit Hours:** 4  
**Max credits per semester:** 4  
**Max credits per degree:** 4  
**Format:** LEC  
**Prerequisite for:** BSEN 355; MATL 360

CHEM 113 Fundamental Chemistry I

**Prerequisites:** A Math Placement Test score for MATH 106; one unit of high school chemistry; and one unit high school physics.

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

**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  
**Format:** LEC  
**Prerequisite for:** CHEM 114; CHME 114; CHME 202; GEOL 210  
**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  
Format: LEC  
Prerequisite for: BSEN 355; CHEM 251; CHEM 255; CHEM 261; CHEM 263

CHEM 116 Quantitative Chemistry Laboratory  
Prerequisites: CHEM 113.  
Notes: Parallel: CHEM 114. Designed for students (including chemistry  
and chemical engineering) who wish to take advanced laboratory  
instruction in such courses as CHEM 263, 264, 471/871, 482/882, and  
484/884. Credit may not be earned in both CHEM 116 and 221.  
Description: Elementary quantitative laboratory instruction in analytical  
methods and preparations including titrimetry, gravimetry, separations,  
and use of pH meter and spectrophotometer, qualitative chemical  
analysis.  
Credit Hours: 2  
Max credits per semester: 2  
Max credits per degree: 2  
Format: LEC

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  
Format: LEC  
Prerequisite for: FDST 301  
ACE: ACE 4 Science

CHEM 191H Freshman Honors Chemistry I  
Prerequisites: Open to freshman only; good standing in the University  
Honors Program; and concurrent registration in CHEM 109 or 111 or 113;  
3 units of high school mathematics including algebra and geometry; 1  
unit high school chemistry; 1 unit of high school physics.  
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  
Format: LEC  
Prerequisite for: CHEM 192H

CHEM 192H Freshman Honors Chemistry II  
Prerequisites: Open to freshman only; good standing in the University  
Honors Program; CHEM 109 or 111 or 113, with a minimum grade of "B";  
recommendation(s) from chemistry instructor(s) from previous semester;  
concurrent registration in CHEM 110 or 114; and permission.  
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  
Format: LEC

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  
Format: LEC

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: Introduction to principles of quantitative analytical  
chemistry, including ionic equilibria and solution stoichiometry. Lab  
instruction includes titrimetry, gravimetry, separations, and use of pH  
meter and spectrophotometer.  
Credit Hours: 4  
Max credits per semester: 4  
Max credits per degree: 4  
Format: LEC  
Prerequisite for: AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455

CHEM 251 Organic Chemistry I  
Prerequisites: CHEM 110 or 114 with a minimum grade of C.  
Notes: This course is designed to be taken parallel with CHEM 253  
Organic Chemistry Laboratory. CHEM 251 and 252, with their  
corresponding labs of CHEM 253 and 254, form a continuous basic  
course in organic chemistry.  
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  
Format: LEC  
Prerequisite for: AGRO 455, AGRO 855, NRES 455, NRES 855, SOIL 455;  
BIOC 321; VBMS 403

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  
Format: LEC
CHEM 253 Organic Chemistry I Laboratory
Prerequisites: CHEM 110 or 114, with a grade of C; CHEM 251.
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: 3
Max credits per semester: 1
Max credits per degree: 1
Format: LAB

CHEM 254 Organic Chemistry II Laboratory
Prerequisites: CHEM 251, 253; CHEM 252 or parallel.
Description: Synthesis of representative organic compounds. Qualitative analysis of organic compounds. Naturally occurring compounds.
Credit Hours: 3
Max credits per semester: 1
Max credits per degree: 1
Format: LAB

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
Format: LEC
Prerequisite for: BIOC 321

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
Format: LAB

CHEM 261 Organic Chemistry
Prerequisites: CHEM 110 or 114 with minimum grades of C.
Notes: This course was designed to be taken in parallel with CHEM 263 Organic Chemistry Laboratory. Students having credit in CHEM 251 or its equivalent may receive only 1 hour of credit in CHEM 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
Format: LEC
Prerequisite for: CHEM 262; CHEM 264; CHEM 264A

CHEM 262 Organic Chemistry
Prerequisites: CHEM 261
Description: Continuation of CHEM 261.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CHEM 263 Organic Chemistry Laboratory
Prerequisites: CHEM 110 or CHEM 114 with minimum grades of C.
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
Format: LEC
Prerequisite for: CHEM 264

CHEM 264 Organic Chemistry Laboratory
Prerequisites: Same as for CHEM 261.
Notes: Students having credit in CHEM 251 or its equivalent may receive only 1 hour of credit in CHEM 264.
Description: Students having credit in CHEM 251 or its equivalent should elect this course.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC

CHEM 264A Organic Chemistry Laboratory
Prerequisites: CHEM 261 and 263A
Notes: Parallel: CHEM 262.
Description: Continuation of CHEM 263. Lab work in qualitative organic analysis.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LEC

CHEM 291H Honors: Sophomore Chemistry I
Prerequisites: Sophomore standing; good standing in the University Honors Program; CHEM 110 or 114, with minimum grade of "B"; recommendation(s) from chemistry instructor(s) from previous semester; concurrent registration in CHEM 221 or 251 or 261; and permission.
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
Format: LEC

CHEM 292H Honors: Sophomore Chemistry II
Prerequisites: good standing in the University Honors Program; CHEM 221 or 251 or 261, with minimum grade of "B"; recommendation(s) from chemistry instructor(s) from previous semester; concurrent registration in CHEM 251 or 252 or 262; and permission.
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
Format: LEC
CHEM 396 Independent Study  
Credit Hours: 1-12  
Min credits per semester: 1  
Max credits per semester: 12  
Max credits per degree: 12  
Format: IND

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  
Format: IND

CHEM 421 Analytical Chemistry  
Crosslisted with: CHEM 821  
Prerequisites: CHEM 471/871 or 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  
Format: LEC  
ACE: ACE 10 Integrated Product

CHEM 423 Analytical Chemistry Laboratory  
Crosslisted with: CHEM 823  
Prerequisites: Same as for CHEM 421/821.  
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

CHEM 431 Structure and Metabolism  
Crosslisted with: BIOC 431, BIOC 831, BIOS 431, BIOS 831, CHEM 831  
Prerequisites: CHEM 252 or CHEM 262 with a grade of C or better. LIFE 120 and BIOS 206 are recommended  
Notes: 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  
Format: LEC  
Prerequisite for: VBMS 410

CHEM 432 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 206 or AGRO 215.  
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  
Format: LEC  
Prerequisite for: BIOC 435; BIOC 934, BIOS 934, CHEM 934

CHEM 433 Biochemistry Laboratory  
Crosslisted with: BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 833  
Prerequisites: BIOC 431/831 (or concurrent enrollment) 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

CHEM 434 Plant Biochemistry  
Crosslisted with: AGRO 434, BIOC 434, BIOS 434, AGRO 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  
Format: LEC

CHEM 435 Chemical Biology  
Crosslisted with: CHEM 835  
Prerequisites: Chem 252 or 262, and Chem 221  
Notes: Credit toward the undergraduate or graduate degree cannot be earned in both CHEM 435/835, and 431/831 and/or 432/832 or their equivalents.  
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  
Format: LEC
CHEM 441 Inorganic Chemistry
Crosslisted with: CHEM 841
Prerequisites: CHEM 221 with at least a C; CHEM 252 or CHEM 262.
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
Format: LEC
ACE: ACE 10 Integrated Product

CHEM 443 Inorganic Chemistry Laboratory
Crosslisted with: CHEM 843
Prerequisites: CHEM 252 or 252-254.
Notes: Parallel: CHEM 441/841 or permission.
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
Format: LEC

CHEM 463 Advanced Organic Preparations
Crosslisted with: CHEM 863
Prerequisites: CHEM 252 or 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
Format: LAB

CHEM 471 Physical Chemistry
Crosslisted with: CHEM 871
Prerequisites: CHEM 114 and 116, or 221, with a grade of 'C' or better; MATH 106 and 238, or 107; one year college physics.
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
Format: LEC

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 481/881.
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
Format: LEC

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
Format: LEC

CHEM 484 Physical Chemical Measurements
Crosslisted with: CHEM 884
Prerequisites: CHEM 481/881. Parallel with CHEM 482/882.
Notes: Lab designed to accompany CHEM 482.
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
Format: LAB

CHEM 484A Physical Chemical Measurements
Crosslisted with: CHEM 884A
Prerequisites: CHEM 481/881.
Notes: Parallel with CHEM 482/882.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LAB

CHEM 486 Advanced Topics in Biophysical Chemistry
Crosslisted with: BIOC 486, BIOC 886, BIOS 486, BIOS 886, CHEM 886
Prerequisites: CHEM 471/871 or 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
Format: LEC
CHEM 498 Undergraduate Research
Prerequisites: BIOL 433 and permission
Description: Research on a specific biochemical project under the supervision of a biological chemistry faculty member.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: LEC