Chemistry-CHEM (CHEM)

Courses

CHEM 103 Chemistry in Context (GT-SC2) Credits: 3 (3-0-0)
Course Description: Chemistry, chemical principles from more conceptual, less mathematical perspective; how chemical substances, chemical reactions affect our daily lives.
Prerequisite: None.
Registration Information: For students who do not plan to take additional courses in chemistry. Sections may be offered: Online.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/o lab (GT-SC2).

CHEM 104 Chemistry in Context Laboratory (GT-SC1) Credit: 1 (0-2-0)
Course Description: Laboratory applications of principles covered in CHem 103.
Prerequisite: CHEM 103, may be taken concurrently.
Registration Information: Sections may be offered: Online.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: Yes.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/ lab (GT-SC1).

CHEM 107 Fundamentals of Chemistry (GT-SC2) Credits: 4 (4-0-0)
Course Description: Atomic/molecular theory, gases, liquids, solids, solutions, acid/base and oxidation/reduction reactions, kinetics, selected topics. Quantitative reasoning but with less focus on mathematical calculations than CHEM 111/CHEm 113.
Prerequisite: MATH 117 or MATH 141, may be taken concurrently or MATH 155, may be taken concurrently or MATH 160, may be taken concurrently or MATH 161, may be taken concurrently or MATH 229, may be taken concurrently or MATH 261, may be taken concurrently.
Registration Information: For students in science-related programs requiring one semester of general chemistry. Credit allowed for only one of the following: CHEM 107, CHEM 111, or CHEM 117. Sections may be offered: Online.
Terms Offered: Fall, CHEM 111, or CHEM 117. Sections may be offered: Online.
Grade Mode: Traditional.
Special Course Fee: No.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/ lab (GT-SC1).

CHEM 108 Fundamentals of Chemistry Laboratory (GT-SC1) Credit: 1 (0-2-0)
Course Description: Laboratory applications of principles presented in CHEM 107.
Prerequisite: CHEM 107, may be taken concurrently.
Registration Information: Credit not allowed for both CHEM 108 and CHEM 112.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: Yes.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/ lab (GT-SC1).

CHEM 111 General Chemistry I (GT-SC2) Credits: 4 (3-0-1)
Course Description: Fundamental aspects of chemistry and chemical principles; emphasis on structure, bonding, and stoichiometry.
Prerequisite: MATH 118 or MATH 141 or MATH 155 or MATH 160 or MATH 161 or MATH 229 or MATH 261.
Registration Information: Must register for lecture and recitation. Intended for science majors. Students should complete the sequence CHEM 111, CHEM 112, CHEM 113, and CHEM 114. Credit allowed for only one of the following: CHEM 111, CHEM 107, or CHEM 117. Sections may be offered: Online.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/o lab (GT-SC2).

CHEM 112 General Chemistry Lab I (GT-SC1) Credit: 1 (0-3-0)
Course Description: Laboratory applications of principles covered in CHEM 111.
Prerequisite: CHEM 111, may be taken concurrently or CHEM 117, may be taken concurrently.
Registration Information: Credit not allowed for both CHEM 112 and CHEM 108.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: Yes.
Additional Information: Biological & Physical Sciences 3A, Natural & Physical Sciences w/ lab (GT-SC1).

CHEM 113 General Chemistry II Credits: 3 (3-0-0)
Course Description: Acid/base equilibria, kinetics, thermodynamics, solubility, oxidation-reduction reactions, electrolyrochemistry, selected topics.
Prerequisites: (CHEM 107 or CHEM 111 or CHEM 117) and (MATH 124 or MATH 155, may be taken concurrently or MATH 160, may be taken concurrently or MATH 161, may be taken concurrently or MATH 229, may be taken concurrently or MATH 261, may be taken concurrently or MATH 141).
Registration Information: Sections may be offered: Online.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 114 General Chemistry Lab II Credit: 1 (0-3-0)
Course Description: Laboratory applications of principles covered in CHEM 113.
Prerequisites: CHEM 112 and CHEM 113, may be taken concurrently.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 115 General Chemistry II Recitation Credit: 1 (0-0-1)
Course Description: Problem solving applied to topics in, e.g., acid/base equilibria, kinetics, thermodynamics, solubility, oxidation-reduction reactions, electrolyrochemistry.
Prerequisite: None.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.
CHEM 117 General Chemistry I for Chemistry Majors Credits: 3 (3-0-0)
Course Description: Fundamental aspects of chemistry and chemical principles, with an emphasis placed on atomic and molecular structure, bonding and stoichiometry.
Prerequisite: MATH 118 or MATH 141 or MATH 155 or MATH 160 or MATH 161 or MATH 229 or MATH 261.
Registration Information: Credit allowed for only one of the following: CHEM 107, CHEM 117, or CHEM 111.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 192 Introductory Seminar in Chemistry Credit: 1 (0-0-1)
Course Description: Small-group discussions of aspects of chemistry.
Prerequisite: None.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 245 Fundamentals of Organic Chemistry Credits: 4 (4-0-0)
Course Description: Nomenclature, structure, bonding, reactions, mechanisms, synthesis, stereochemistry of organic compounds.
Prerequisite: CHEM 107 or CHEM 113.
Registration Information: Intended for students in science-related programs requiring one semester of organic chemistry. Credit allowed for only one of the following: CHEM 245, CHEM 341, and CHEM 345 Sections may be offered: Online.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 261 Fundamentals of Inorganic Chemistry Credits: 3 (3-0-0)
Course Description: Preparation, structures, properties, and reactions of chemical elements and inorganic compounds; periodic trends, organizing principles; applications.
Prerequisite: CHEM 113, may be taken concurrently.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 301 Advanced Scientific Writing—Chemistry (GT-CO3) Credits: 3 (1-4-0)
Course Description: Advanced scientific writing using the read-analyze-write approach and scientific poster preparation and presentation.
Prerequisites: (CO 150) and (CHEM 334 or CHEM 345).
Registration Information: CHEM 334 or CHEM 345 or a 300-level science laboratory course with written approval of instructor; CO 150. Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.
Additional Information: Addl Comm - Adv Writing 2, Advanced Writing (GT-CO3).

CHEM 311 Introduction to Nanoscale Science Credits: 3 (3-0-0)
Course Description: Synthesis, characterization, and applications of nanoscale materials.
Prerequisites: (CHEM 113) and (CHEM 346 or CHEM 343).
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 320 Chemistry of Addictions Credits: 3 (3-0-0)
Course Description: Chemical processes of addiction; receptor binding, molecular deactivation, and feedback in the context of protein-substrate molecular interactions.
Prerequisite: CHEM 103 or CHEM 107 or CHEM 111.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 334 Quantitative Analysis Laboratory Credit: 1 (0-3-0)
Course Description: Laboratory applications of principles presented in CHEM 335.
Prerequisites: CHEM 114 and CHEM 335, may be taken concurrently.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.

CHEM 335 Introduction to Analytical Chemistry Credits: 3 (3-0-0)
Course Description: Modern and classical applications and methods in analytical chemistry including statistical, kinetic, spectroscopic, and chromatographic analysis.
Prerequisites: CHEM 113 with a minimum grade of C and CHEM 334, may be taken concurrently.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 341 Modern Organic Chemistry I Credits: 3 (3-0-0)
Course Description: Structures, nomenclature, dynamics, spectroscopy, and reactions of organic molecules.
Prerequisite: CHEM 113.
Registration Information: Credit allowed for only one of the following: CHEM 341, CHEM 245, and CHEM 345.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.
CHEM 343  Modern Organic Chemistry II  Credits: 3 (3-0-0)  
Course Description: Continued studies of reactions and mechanisms of organic molecules and biological chemistry.  
Prerequisite: CHEM 245 or CHEM 341 or CHEM 345.  
Registration Information: Credit not allowed for both CHEM 343 and CHEM 346.  
Terms Offered: Fall, Spring, Summer.  
Grade Mode: Traditional.  
Special Course Fee: No.

CHEM 344  Modern Organic Chemistry Laboratory  Credits: 2 (0-6-0)  
Course Description: Laboratory applications of modern organic chemistry.  
Prerequisites: CHEM 114 and CHEM 343, may be taken concurrently.  
Registration Information: Intended for science majors. Credit not allowed for both CHEM 344 and CHEM 246.  
Terms Offered: Fall, Spring, Summer.  
Grade Mode: Traditional.  
Special Course Fee: Yes.

CHEM 345  Organic Chemistry I  Credits: 4 (3-3-0)  
Course Description: Structure, nomenclature, dynamics, spectroscopy, reactions of organic molecules. Laboratory applications of principles presented in lecture.  
Prerequisites: CHEM 113 and CHEM 114.  
Registration Information: Chemistry majors only. Must register for lecture and laboratory. Students should plan to complete the sequence CHEM 345, CHEM 346. Credit allowed for only one of the following: CHEM 245, CHEM 341, and CHEM 345.  
Terms Offered: Fall.  
Grade Mode: Traditional.  
Special Course Fee: Yes.

CHEM 346  Organic Chemistry II  Credits: 4 (3-3-0)  
Course Description: Continue studies of reactions and mechanisms of organic molecules. Laboratory applications of principles presented in lecture.  
Prerequisite: CHEM 345.  
Registration Information: Chemistry majors only. Must register for lecture and laboratory. Students should plan to complete the sequence CHEM 345 and CHEM 346. Credit not allowed for both CHEM 343 and CHEM 346.  
Terms Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: Yes.

CHEM 380A2  Environmental Chemistry  Credits: 3 (3-0-0)  
Course Description: Fundamental environmental chemistry concepts, and sources and fates of chemical pollutants in aquatic, soil, and atmospheric environments.  
Prerequisites: (CHEM 113) and (CHEM 245 or CHEM 341 or CHEM 345).  
Terms Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.

CHEM 384  Supervised College Teaching  Credits: Var[1-3]  
Course Description:  
Prerequisite: CHEM 100 to 499 - at least 20 credits.  
Registration Information: Written consent of department chair. Maximum of 12 credits for any combination of CHEM 384, CHEM 487, CHEM 495, CHEM 498. A maximum of 10 combined credits for all 384 and 484 courses are counted towards graduation requirements.  
Terms Offered: Fall, Spring, Summer.  
Grade Mode: Instructor Option.  
Special Course Fee: No.

CHEM 431  Instrumental Analysis  Credits: 4 (3-3-0)  
Course Description: Instrumental methods of chemical analysis.  
Prerequisites: (CHEM 334) and (CBE 310, may be taken concurrently or CHEM 474, may be taken concurrently).  
Registration Information: Must register for lecture and laboratory.  
Terms Offered: Fall.  
Grade Mode: Traditional.  
Special Course Fee: Yes.

CHEM 433  Clinical Chemistry  Credits: 3 (2-3-0)  
Course Description: Principles and methodology of clinical chemistry. Laboratory experience in methodology and method development.  
Prerequisites: CHEM 334, and (CHEM 334).  
Registration Information: Must register for lecture and laboratory.  
Terms Offered: Spring (odd years).  
Grade Mode: Traditional.  
Special Course Fee: Yes.

CHEM 440  Advanced Organic Chemistry Laboratory  Credits: 2 (0-6-0)  
Course Description: Advanced techniques in organic synthesis, mechanisms of reactions, structure determination.  
Prerequisite: CHEM 344 or CHEM 346.  
Terms Offered: Fall.  
Grade Mode: Traditional.  
Special Course Fee: Yes.

CHEM 461  Inorganic Chemistry  Credits: 3 (3-0-0)  
Course Description: Concepts, models to explain structural, spectroscopic, magnetic, thermodynamic, and kinetic properties of inorganic compounds; symmetry, group theory.  
Prerequisites: (CHEM 261) and (CBE 310 or CHEM 474).  
Terms Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: Yes.

CHEM 462  Inorganic Chemistry Laboratory  Credits: 2 (0-6-0)  
Course Description: Synthetic techniques and instrumental methods in inorganic chemistry.  
Prerequisite: CHEM 461, may be taken concurrently.  
Terms Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.

CHEM 473  Foundations of Physical Chemistry  Credits: 4 (4-0-0)  
Course Description: Quantum chemistry; molecular structure and spectroscopy; equilibrium thermodynamics; kinetics.  
Prerequisites: (CHEM 113) and (MATH 161 or MATH 255) and (PH 122 or PH 142).  
Terms Offered: Spring.  
Grade Mode: Traditional.  
Special Course Fee: No.
CHEM 474  Physical Chemistry I  Credits: 3 (3-0-0)
Course Description: Quantum chemistry; applications to bonding, molecular structure, and spectroscopy.
Prerequisites: CHEM 113 and MATH 261 and PH 142.
Registration Information: Credit not allowed for both CHEM 473 and CHEM 474.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 475  Physical Chemistry Laboratory I  Credit: 1 (0-3-0)
Course Description: Physiochemical experiments; emphasis on quantum mechanics/spectroscopy; interpretation/presentation of data; formal lab reports.
Prerequisite: CBE 310, may be taken concurrently or CHEM 473, may be taken concurrently or CHEM 474, may be taken concurrently.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.

CHEM 476  Physical Chemistry II  Credits: 3 (3-0-0)
Course Description: Statistical thermodynamics; applications to phase and chemical equilibria; kinetics.
Prerequisite: CHEM 474.
Registration Information: Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 477  Physical Chemistry Laboratory II  Credit: 1 (0-3-0)
Course Description: Physiochemical experiments; emphasis on thermodynamics/statistical mechanics/kinetics; interpretation/presentation of data; formal lab reports.
Prerequisite: CHEM 475.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.

CHEM 487  Internship  Credits: Var[1-18]
Course Description: Supervised work experience in approved off-campus chemical laboratory setting. Consultation with faculty adviser/instructor.
Prerequisite: CHEM 476.
Registration Information: Maximum of 12 credits allowed for any combination of CHEM 384, CHEM 487, CHEM 495, and CHEM 498.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 495  Independent Study  Credits: Var[1-3]
Course Description: Satisfactory completion of course requires a written report, an oral presentation at a research group meeting, or a poster presentation.
Prerequisite: CHEM 100 to 499 - at least 9 credits.
Registration Information: Written consent of laboratory mentor and department chair. Maximum of 12 credits for any combination of CHEM 384, CHEM 487, CHEM 495, and CHEM 498.
Term Offered: Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 498  Research  Credits: Var[1-3]
Course Description: Supervised laboratory research in chemistry; written report consistent with ACS guidelines required.
Prerequisite: CHEM 100 to 499 - at least 20 credits.
Registration Information: Written consent of research mentor and department chair. Maximum of 12 credits for any combination of CHEM 384, CHEM 487, CHEM 495, and CHEM 498.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 511  Solid State Chemistry  Credits: 3 (3-0-0)
Course Description: Physical and descriptive chemistry of solids including characterization and synthetic methods.
Prerequisites: CHEM 461 and CHEM 476.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 515  Polymer Chemistry  Credits: 3 (3-0-0)
Course Description: Fundamentals of polymer chemistry: synthesis, characterization, physical properties.
Prerequisites: CHEM 346 and CHEM 476.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 517  Chemistry of Electronic Materials  Credits: 3 (3-0-0)
Course Description: Chemical aspects of preparation and processing of materials in electronic devices, “molecular electronics,” and nanostructured materials.
Prerequisite: CHEM 571, may be taken concurrently.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 521  Principles of Chemical Biology  Credits: 3 (3-0-0)
Also Offered As: BC 521.
Course Description: Principles of chemical biology. Chemical methods for understanding and controlling the structure and function of biopolymers.
Prerequisite: CHEM 245 or CHEM 343 or CHEM 346.
Registration Information: Credit not allowed for both CHEM 521 and BC 521.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Course Description</th>
<th>Prerequisites</th>
<th>Term Offered</th>
<th>Grade Mode</th>
<th>Special Course Fee</th>
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</thead>
<tbody>
<tr>
<td>CHEM 522</td>
<td>Methods of Chemical Biology</td>
<td>2</td>
<td>Approaches to quantitative chemical biology, visualization, study and characterization of macromolecules and macromolecular-dependent processes.</td>
<td>BC 351 with a minimum grade of B or BC 401 with a minimum grade of B.</td>
<td>Spring</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 530A</td>
<td>Advanced Topics in Chemical Analysis: Environmental Chemical Analysis</td>
<td>1</td>
<td>Fundamentals and applications of chemical separations.</td>
<td>CHEM 431, may be taken concurrently.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 530B</td>
<td>Advanced Topics in Chemical Analysis: Absorption and Emission Spectroscopy</td>
<td>1</td>
<td>Theory and methods of electrochemistry; applications of modern electrochemical techniques.</td>
<td>CHEM 431.</td>
<td>Spring (odd years).</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 530C</td>
<td>Advanced Topics in Chemical Analysis: Bioanalytical Chemistry</td>
<td>1</td>
<td>Determination of organic molecular structure by spectroscopic methods.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 530D</td>
<td>Advanced Topics in Chemical Analysis: Statistical Analysis in Analytical Chemistry</td>
<td>1</td>
<td>Structure including stereochemistry and conformational isomerism; reactivity and mechanisms in organic chemistry.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 530E</td>
<td>Advanced Topics in Chemical Analysis: Mass Spectrometry</td>
<td>1</td>
<td>Reactions and synthesis in organic chemistry.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 530F</td>
<td>Advanced Topics in Chemical Analysis: Analysis of Materials</td>
<td>1</td>
<td>Reactions and synthesis in organic chemistry.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 532</td>
<td>Advanced Chemical Analysis II</td>
<td>3</td>
<td>Determination of organic molecular structure by spectroscopic methods.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 533</td>
<td>Chemical Separations</td>
<td>3</td>
<td>Theory and methods of electrochemistry; applications of modern electrochemical techniques.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 537</td>
<td>Electrochemical Methods</td>
<td>3</td>
<td>Determination of organic molecular structure by spectroscopic methods.</td>
<td>CHEM 431.</td>
<td>Fall.</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 539A</td>
<td>Principles of NMR and MRI: Basic NMR Principles</td>
<td>1</td>
<td>Determination of organic molecular structure by spectroscopic methods.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 539B</td>
<td>Principles of NMR and MRI: NMR Diffusion Measurements-2D NMR and MRI</td>
<td>1</td>
<td>Determination of organic molecular structure by spectroscopic methods.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 539C</td>
<td>Principles of NMR and MRI: Advanced NMR and MRI Techniques</td>
<td>1</td>
<td>Determination of organic molecular structure by spectroscopic methods.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<td>CHEM 541</td>
<td>Organic Molecular Structure Determination</td>
<td>2</td>
<td>Structure including stereochemistry and conformational isomerism; reactivity and mechanisms in organic chemistry.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<tr>
<td>CHEM 543</td>
<td>Structure/Mechanisms in Organic Chemistry</td>
<td>3</td>
<td>Structure including stereochemistry and conformational isomerism; reactivity and mechanisms in organic chemistry.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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<td>CHEM 545</td>
<td>Synthetic Organic Chemistry I</td>
<td>3</td>
<td>Reactions and synthesis in organic chemistry.</td>
<td>CHEM 431.</td>
<td>Fall</td>
<td>Traditional</td>
<td>No.</td>
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</table>
CHEM 547  Physical Organic Chemistry  Credits: 3 (3-0-0)
Course Description: Mechanisms, theory, kinetics, and thermodynamics.
Prerequisite: CHEM 543.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 548  Organometallics in Synthesis  Credits: 2 (2-0-0)
Course Description: Fundamental aspects of organometallic chemistry applied to organic synthesis.
Prerequisite: CHEM 545.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 549  Synthetic Organic Chemistry II  Credits: 2 (2-0-0)
Course Description: Strategies for the total synthesis of natural products.
Prerequisite: CHEM 545.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 550A  Materials Chemistry: Hard Materials  Credit: 1 (1-0-0)
Course Description: Structure and bonding; crystallography, properties; synthesis; characterization of metals, semiconductors, and network solids.
Prerequisites: (CHEM 343 or CHEM 346) and (CHEM 461 and CHEM 476).
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 550B  Materials Chemistry: Soft Materials  Credit: 1 (1-0-0)
Course Description: Structure and bonding, mechanisms, properties, applications, synthesis, characterization of polymers, complex fluids, and biomaterials.
Prerequisites: (CHEM 343 or CHEM 346) and (CHEM 461 and CHEM 476).
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 550C  Materials Chemistry: Nanomaterials  Credit: 1 (1-0-0)
Course Description: Structure and bonding, synthesis, properties, characterization of carbon nanotubes, metal and semiconductor nanocrystals, and nanocomposites.
Prerequisites: (CHEM 343 or CHEM 346) and (CHEM 461 and CHEM 476).
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 551  Organometallic Chemistry  Credits: 3 (3-0-0)
Course Description: Descriptive and mechanistic organometallic chemistry applied to homogeneous catalysis and organic synthesis.
Prerequisite: CHEM 346.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 555  Chemistry of Sustainability  Credits: 3 (3-0-0)
Course Description: The central role of chemistry for achieving sustainability in key areas including chemicals and materials, energy, and environment.
Prerequisites: (BC 411 or CBE 310 or CHEM 476) and (CHEM 343 or CHEM 346).
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 560  Foundations of Inorganic Synthesis  Credit: 1 (1-0-0)
Course Description: Preparation for advanced studies in metal-mediated chemistry; essential aspects of inorganic structure, thermodynamics and reactivity.
Prerequisite: CHEM 461.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 561  Inorganic Synthesis  Credits: 2 (2-0-0)
Course Description: Chemistry of compounds of representative elements and transition metals.
Prerequisite: CHEM 560, may be taken concurrently.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 563A  Physical Methods in Inorganic Chemistry: Group Theory  Credit: 1 (1-0-0)
Course Description: Modern experimental methods in inorganic chemistry.
Prerequisite: CHEM 461.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 563B  Physical Methods in Inorganic Chemistry: Vibrational Spectroscopy  Credit: 1 (1-0-0)
Course Description: Modern experimental methods in inorganic chemistry.
Prerequisite: CHEM 461.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 563C  Physical Methods in Inorganic Chemistry: Electronic Structure and Magnetism  Credit: 1 (1-0-0)
Course Description: Modern experimental methods in inorganic chemistry.
Prerequisite: CHEM 461.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 563D  Physical Methods in Inorganic Chemistry: Magnetic Spectroscopies  Credit: 1 (1-0-0)
Course Description: Modern experimental methods in inorganic chemistry.
Prerequisite: CHEM 461.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.
CHEM 563E Physical Methods in Inorganic Chemistry: Advanced Nuclear Magnetic Resonance Spectroscopy Credit: 1 (1-0-0)
Course Description: Modern experimental methods in inorganic chemistry.
Prerequisite: CHEM 461.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 563F Physical Methods in Inorganic Chemistry: Other Structural Methods Credit: 1 (1-0-0)
Course Description: Modern experimental methods in inorganic chemistry.
Prerequisite: CHEM 461.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 565 Inorganic Mechanisms Credits: 3 (3-0-0)
Course Description: Fundamental tools, key principles, selected classic case histories of inorganic and organometallic mechanistic chemistry, emphasizing kinetic methods.
Prerequisite: CHEM 476.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 566 Bioinorganic Chemistry Credits: 3 (3-0-0)
Course Description: Biological-inorganic chemistry, including key principles, prototype systems, classic papers, and problems.
Prerequisite: CHEM 461.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 567 Crystallographic Computation Credit: 1 (1-0-0)
Course Description: Theory and practice of structural computations using single crystal X-ray diffraction data.
Prerequisite: CHEM 474 with a minimum grade of C-.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 569 Chemical Crystallography Credits: 3 (3-0-0)
Course Description: Theory and practice of determination of crystal and molecular structure by single crystal X-ray and neutron diffraction.
Prerequisite: CHEM 474.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 570 Chemical Bonding Credits: 3 (3-0-0)
Course Description: Electronic structure methods; chemical bonding models; intermolecular interactions.
Prerequisite: CBE 310 or CHEM 474.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 571A Quantum Chemistry: Foundations Credits: 2 (2-0-0)
Course Description: Simple systems; symmetry; approximate methods; time dependent methods; molecular structures.
Prerequisite: CBE 310 or CHEM 474.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 571B Quantum Chemistry: Electronic Structure Credit: 1 (1-0-0)
Course Description: Simple systems; symmetry; approximate methods; time dependent methods; molecular structures.
Prerequisite: CHEM 571A, may be taken concurrently.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 575 Fundamentals of Chemical Thermodynamics Credit: 1 (1-0-0)
Course Description: Fundamental thermodynamic concepts and some applications to chemical problems.
Prerequisite: CBE 310 or CHEM 476 or PH 361.
Registration Information: This is a partial-semester course.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 576 Statistical Mechanics Credits: 2 (2-0-0)
Course Description: Principles of statistical mechanics with applications to chemical systems.
Prerequisite: CHEM 575, may be taken concurrently.
Registration Information: This is a partial-semester course.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 577 Surface Chemistry Credits: 3 (3-0-0)
Course Description: Capillarity; interfacial thermodynamics, electrical aspects of surface chemistry, absorbed layers.
Prerequisite: CBE 310 or CHEM 476.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 578 Chemical Kinetics Credits: 3 (3-0-0)
Course Description: Elementary reactions, unimolecular reactions, reactions in solution, gas phase ion chemistry, photochemistry, and kinetic modeling.
Prerequisite: CBE 310 or CHEM 476.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 580A1 Responsible Conduct in Chemistry Research Credit: 1 (0-0-1)
Course Description: Moral reasoning in issues related to collection and dissemination of chemical data, publishing, grant writing, intellectual property issues.
Prerequisites: (CHEM 474) and (CHEM 495 or CHEM 498).
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 581A1 Science, Policy and Management of Environmental Issues Credits: 2 (2-0-0)
Course Description: The science, past and current policies, and management of four current environmental issues.
Prerequisite: ATS 350 or CHEM 474.
Registration Information: Credit not allowed for both CHEM 581A1 or ATS 581A1.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
CHEM 601 Responsible Conduct in Chemistry Research  Credit: 1 (1-0-0)
Course Description: Appropriate conduct in research, publishing, intellectual property decisions, job hunting, and negotiating; social responsibilities of scientists.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 641 Organic Reaction Mechanisms Credits: 2 (2-0-0)
Course Description: Organic reaction mechanisms, including using arrows to show electron movement; heterolytic, radical, and pericyclic reactions.
Prerequisite: CHEM 545.
Restriction: Must be a: Graduate, Professional.
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 651A Special Topics in Chemistry: Analytical Chemistry Credits: Var[1-4]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of instructor.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 651B Special Topics in Chemistry: Inorganic Chemistry Credits: Var[1-4]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of instructor.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 651C Special Topics in Chemistry: Organic Chemistry Credits: Var[1-4]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of instructor.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 651D Special Topics in Chemistry: Physical Chemistry Credits: Var[1-4]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of instructor.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 695 Independent Study Credits: Var[1-3]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 698 Research Credits: Var[1-9]
Course Description: Graduate research in chemistry for students who do not plan to write an M.S. thesis.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Graduate standing in chemistry.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 699 Thesis Credits: Var[1-15]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 702 Independent Research Proposal Credit: 1 (0-0-1)
Course Description: Preparation, submission, and defense of an independent research proposal; creative and original thinking about research problems in modern chemistry.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Admission to Ph.D. candidacy.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 751 Methods of Chemistry Laboratory Instruction Credit: 1 (1-0-0)
Course Description: Basic materials, methods, and skill development related to teaching undergraduate chemistry laboratory courses.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

CHEM 752 Advanced Chemical Instruction Credit: 1 (0-0-1)
Course Description: Advanced materials, methods, and presentation skills development related to teaching undergraduate chemistry courses.
Prerequisite: CHEM 571.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.
CHEM 773  Atomic and Molecular Spectroscopy  Credits: 3 (3-0-0)
Course Description: Time-dependent methods; multiphoton and nonlinear spectroscopy; fundamentals of rotational, vibrational, electronic and magnetic resonance spectroscopy.
Prerequisite: CHEM 571.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

CHEM 784  Supervised College Teaching  Credits: Var[1-2]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 793  Seminar  Credit: 1 (0-0-1)
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 795A  Independent Study: Inorganic Chemistry  Credits: Var[1-5]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 795B  Independent Study: Analytical Chemistry  Credits: Var[1-5]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 795C  Independent Study: Biological Chemistry  Credits: Var[1-5]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 795D  Independent Study: Physical Chemistry  Credits: Var[1-5]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.

CHEM 799  Dissertation  Credits: Var[1-15]
Course Description:
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Terms Offered: Fall, Spring, Summer.
Grade Mode: Instructor Option.
Special Course Fee: No.