# CHEMISTRY - CHM

<table>
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<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Description</th>
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<tr>
<td>CHM 104</td>
<td>Energy, Environment, and Society</td>
<td>3</td>
<td>Designed to provide a better understanding of energy and our environment, including man’s interaction with his environment and the consequences facing society today. This course satisfies the goals and objectives of Field 6, Natural Sciences.</td>
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<td><strong>Fulfills College Core:</strong> (part of the Sustainability Core Pathway)</td>
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<tr>
<td>CHM 109</td>
<td>General Chemistry I with Review - Part I</td>
<td>3</td>
<td>General Chemistry I for science majors, Part I, three lectures and one recitation per week. This course reviews some mathematical concepts, emphasizes dimensional analysis, nomenclature, stoichiometry, solutions, basic chemical reactions, and thermochemistry. This course satisfies the goals and objectives of Field 6, Natural Sciences.</td>
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<td><strong>Fulfills College Core:</strong> Field 6 (Natural Sciences)</td>
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<tr>
<td>CHM 110</td>
<td>General Chemistry I with Review - Part II</td>
<td>3</td>
<td>General Chemistry I for science majors, Part II, three lectures, one laboratory, and one recitation per week. This course emphasizes atomic and molecular structure, periodic properties, gas laws, and states of matter. The CHM 109 and CHM 110 sequence is equivalent to CHM 111 and a free elective. Students completing the CHM 109 and CHM 110 sequence are eligible to take CHM 112 in the fall of their sophomore year or during the summer. A minimum grade of C- in CHM 110 is required for both CHM 112 (General Chemistry II) and CHM 227 (Organic Chemistry I). <strong>Prerequisite:</strong> minimum grade of C- in CHM 109. <strong>Corequisite:</strong> CHM 111L. <strong>Offered:</strong> every spring.</td>
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<tr>
<td>CHM 111</td>
<td>General Chemistry I</td>
<td>3</td>
<td>General Chemistry I for science majors, three lectures, three laboratory, and one recitation per week. This course is recommended for students with a very good background in mathematics and significant exposure to high school chemistry. The course emphasizes dimensional analysis, nomenclature, stoichiometry, solutions, basic chemical reactions, thermochemistry, atomic and molecular structure, periodic properties, gas laws, and states of matter. A minimum grade of C- in CHM 111 is a prerequisite for both CHM 112 (General Chemistry II) and CHM 227 (Organic Chemistry II). This course satisfies the goals and objectives of Field 6, Natural Sciences. <strong>Prerequisite:</strong> minimum score of 580 in MSAT or permission of instructor. <strong>Corequisite:</strong> CHM 111L. <strong>Fulfills College Core:</strong> Field 6 (Natural Sciences) <strong>Offered:</strong> every fall.</td>
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<td>CHM 111L</td>
<td>General Chemistry I Laboratory</td>
<td>1</td>
<td>One three-hour lab per week. <strong>Corequisite:</strong> CHM 110 or CHM 111. <strong>Offered:</strong> every fall.</td>
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<tr>
<td>CHM 112</td>
<td>General Chemistry II</td>
<td>3</td>
<td>General Chemistry II for science majors, three lectures, one laboratory, and one recitation per week. The course emphasizes properties of solutions, kinetics, chemical equilibrium concepts, calculations involving acid/base and precipitation equilibria, thermodynamics, electrochemistry, nuclear chemistry, and chemistry of the environment. A minimum grade of C in CHM 112 is required for all chemistry and biochemistry majors. This course satisfies the goals and objectives of Field 6, Natural Sciences. <strong>Prerequisite:</strong> minimum grade of C- in either CHM 110 or CHM 111. <strong>Corequisite:</strong> CHM 112L. <strong>Fulfills College Core:</strong> Field 6 (Natural Sciences) <strong>Offered:</strong> every fall &amp; spring.</td>
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<td>CHM 112L</td>
<td>General Chemistry II Laboratory</td>
<td>1</td>
<td>One three-hour lab per week. <strong>Prerequisite:</strong> minimum grade of C- in CHM 111L. <strong>Corequisite:</strong> CHM 112. <strong>Offered:</strong> every fall &amp; spring.</td>
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<tr>
<td>CHM 227</td>
<td>Organic Chemistry I</td>
<td>3</td>
<td>Fundamental treatment of organic chemistry. Bonding, structure, nomenclature, and stereochemistry of organic functional groups. Mechanisms and reactivity in substitution and elimination reactions. Three lectures and one recitation per week. <strong>Prerequisite:</strong> minimum grade of C- in either CHM 110 or CHM 111. <strong>Corequisite:</strong> CHM 227L. <strong>Offered:</strong> every fall.</td>
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<td>CHM 227L</td>
<td>Organic Chemistry I Laboratory</td>
<td>1</td>
<td>One four-hour lab per week. <strong>Prerequisite:</strong> minimum grade of C- in CHM 111L. <strong>Corequisite:</strong> CHM 227. <strong>Offered:</strong> every fall.</td>
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<tr>
<td>CHM 228</td>
<td>Organic Chemistry II</td>
<td>3</td>
<td>Continuation of organic chemistry. Includes chemistry and reaction mechanisms of unsaturated compounds, and oxygen and nitrogen-containing functional groups. Introduces the organic chemistry of carbohydrates, lipids and peptides. Laboratory expands on techniques for the synthesis, purification and investigation of the chemical properties of organic compounds. Three lectures, one laboratory, and one recitation per week. <strong>Prerequisite:</strong> minimum grade of C- in CHM 227. <strong>Corequisite:</strong> CHM 228L. <strong>Offered:</strong> every spring.</td>
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<td>CHM 228L</td>
<td>Organic Chemistry II Laboratory</td>
<td>1</td>
<td>One four-hour lab per week. <strong>Prerequisite:</strong> minimum grade of C- in CHM 227L. <strong>Corequisite:</strong> CHM 228. <strong>Offered:</strong> every spring.</td>
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<td>CHM 230</td>
<td>Analytical Chemistry</td>
<td>3</td>
<td>Principles and methodology of modern analytical chemistry presented with particular emphasis on statistical error analysis, solution equilibrium, and potentiometry. Three lectures, one laboratory, and one recitation per week. <strong>Prerequisite:</strong> minimum grade of C in CHM 112. <strong>Corequisite:</strong> CHM 230L. <strong>Offered:</strong> every spring.</td>
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<tr>
<td>CHM 230L</td>
<td>Analytical Chemistry Laboratory</td>
<td>1</td>
<td>One four-hour lab per week. <strong>Prerequisite:</strong> minimum grade of C- in CHM 112L. <strong>Corequisite:</strong> CHM 230. <strong>Offered:</strong> every spring.</td>
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CHM 232 Environmental Analytical Chemistry 3 Credits
Environmental applications of analytical chemistry. Sampling techniques and statistical analysis of data. Soil chemistry, aquatic chemistry and atmospheric chemistry. Trace analysis with electroanalytical, liquid and gas chromatography, atomic absorption spectroscopy and ion selective electrodes. Three lectures, one laboratory and one recitation per week.
Prerequisite: CHM 112. Corequisite: CHM 232L.
Offered: spring 2018.

CHM 232L Environmental Analytical Chemistry Laboratory 1 Credit
One four-hour lab per week.
Prerequisite: CHM 112L. Corequisite: CHM 232.
Offered: spring 2018.

CHM 244 Inorganic Chemistry 3 Credits
Electronic configuration of atoms, periodic classification of the elements, nature of chemical bonding, symmetry and application of group theory to molecular orbitals, structures and thermodynamics of solids, bonding in metals and semiconductors, acid/base concepts, electrochemistry, isomerism, bonding, reactions and spectroscopy of coordination compounds, and other aspects of modern inorganic chemistry. Three lectures and one recitation per week.
Prerequisite: minimum grade of C in CHM 112.
Offered: every fall.

CHM 301 Fundamental Physical Chemistry 3 Credits
Fundamental topics in thermodynamics, kinetics, and quantum chemistry. Three lectures and one recitation per week.
Prerequisite: minimum grade of C in CHM 112, successful completion of MAT 111 or MAT 110, and a year of physics (PHY 201 & PHY 202 or PHY 223 & PHY 224).
Offered: every fall.

CHM 301L Fundamental Physical Chemistry Laboratory 1 Credit
Selected experiments demonstrating principles of thermodynamics and chemical kinetics. One four-hour lab per week.
Prerequisite: minimum grade of C in CHM 230L & C in CHM 301 (or concurrent registration in CHM 301).
Fulfills College Core: Advanced Writing-Intensive
Offered: every fall.

CHM 302 Modern Physical Chemistry 3 Credits
Introduction to quantum chemistry with applications to the structure of atoms and molecules. Molecular spectroscopy. Three lectures and one recitation per week.
Prerequisite: minimum grade of C in CHM 112, successful completion of MAT 111 or MAT 110; MAT 112; and a year of physics (PHY 201 & PHY 202 or PHY 223 & PHY 224).
Offered: every fall.

CHM 302L Modern Physical Chemistry Laboratory 1 Credit
Selected spectroscopic experiments with applications to molecular structure. One four-hour lab per week.
Prerequisite: CHM 302 (or concurrent registration in CHM 302) & minimum grade of C in CHM 230L, CHM 301L, CHM 334L or CHM 430L.
Offered: every spring.

CHM 334 Spectrometric Analysis 3 Credits
Spectrometric methods for the elucidation of chemical structures. Includes nuclear magnetic resonance, infrared, ultraviolet and mass spectrometry. Emphasis on organic compounds. Three lectures and one laboratory per week.
Prerequisite: CHM 228.
Offered: every fall.

CHM 334L Spectrometric Analysis Lab 1 Credit
One four-hour lab per week.
Prerequisite: CHM 228L.
Offered: every fall.

CHM 338 Intermediate Organic Chemistry 3 Credits
Important basic concepts in organic chemistry are reviewed at a higher level than is possible in the introductory courses. New concepts are presented in the areas of reaction mechanisms, frontier molecular orbitals, physical organic chemistry, and in stereoelectronic effects.
Prerequisite: CHM 228.
Offered: fall 2019.

CHM 344 Metal Ions in Biological Systems 3 Credits
Chemical processes in biological systems, which include participation of metal ions, are covered. The course begins with the principles of coordination chemistry and structural biochemistry. The rest of the course is organized according to the functions performed by the metal centers: gene expression and signal transduction, digestion, bioenergetics and electron transfer, oxygen transport, liver functions and anticancer drugs.
Prerequisite: CHM 228.
Offered: occasionally in spring.

CHM 381 Scientific Literature and Communication 1 Credit
First of three student-faculty seminars for majors. Introduces scientific literature, technical writing and oral communication in chemistry and allied fields.
Prerequisite: CHM 228 & junior standing.
Offered: every fall.

CHM 401 Modern Synthetic Methods 3 Credits
Structure-reactivity relationships in organometallic chemistry and the application of organometallic compounds in organic synthesis, including industrial catalysis.
Prerequisite: CHM 228 & CHM 244.
Offered: occasionally in spring.

CHM 401L Modern Synthetic Methods Laboratory 1 Credit
Designed to illustrate some of the most important synthetic and physical techniques used by modern synthetic chemists.
Prerequisite: CHM 401 (or concurrent registration).
Offered: occasionally in spring.

CHM 402 Advanced Physical Chemistry 3 Credits
Introduction to statistical thermodynamics. Applications of group theory to chemical bonding and molecular spectroscopy. Angular momentum coupling in atomic and molecular spectroscopy. Three lectures per week.
Prerequisites: MAT 111 & MAT 112; CHM 244; CHM 302 (may be taken concurrently); and either PHY 201 & PHY 202 or PHY 223 & PHY 224.
Offered: Occasionally in spring.

CHM 420 Materials Chemistry 3 Credits
A survey of topics and applications in modern materials chemistry including solid state materials, semiconductors, polymers, nanomaterials, and introductions to mechanical properties, device fabrication, and structure-activity relationships.
Prerequisite: CHM 228 & CHM 244 (or concurrent registration in CHM 244). Corequisite: CHM 420L.
Offered: either spring or fall 2018 (please consult with department).
CHM 420L Materials Chemistry Laboratory  
This laboratory develops concepts introduced in the lecture component of Materials Chemistry, CHM420, including solid-state structure, mechanical properties, semiconductors, polymers, and nanomaterials. The lab meets for four hours per week.  
Prerequisite: CHM 228L (may be taken concurrently). Corequisite: CHM 420.  
Offered: either spring or fall 2018 (please consult with department).

CHM 430 Instrumental Analytical Chemistry  
3 Credits  
Advanced instrumental methods of analysis including spectroscopy, chromatography and various electrochemical techniques. Three lectures and one laboratory per week.  
Prerequisite: CHM 112 & CHM 228 (or concurrent registration in CHM 228).  
Offered: every spring.

CHM 430L Instrumental Analytical Chemistry Laboratory  
1 Credit  
One four-hour lab per week.  
Prerequisite: CHM 112L & CHM 228L (or concurrent registration in CHM 228L). Corequisite: CHM 430.  
Offered: every spring.

CHM 450 Research in Chemistry  
3 Credits  
Independent research under the direction of the chemistry faculty. Students are required to spend 9 hours per week conducting research. CHM 450 may be taken in place of a chemistry elective without lab. Research and consultation times to be arranged after approval of department chair.  
Prerequisite: permission of department chair.  
Offered: fall & spring.

CHM 451 Research in Chemistry  
4 Credits  
Independent research under the direction of the chemistry faculty. Students are required to spend 12 hours per week conducting research. CHM 451 may be taken in place of a chemistry elective with lab. Research and consultation times to be arranged after approval of department chair.  
Prerequisite: permission of department chair.  
Offered: fall & spring.

CHM 455 Medicinal Chemistry  
3 Credits  
Chemical principles are used to explain the interaction of drugs with biological targets. Strategies used in the design and development of medicines are discussed.  
Prerequisite: minimum grade of C- in both CHM 228 & BCH 301.  
Offered: spring 2019.

CHM 480 Communicating Concepts in Chemistry  
1 Credit  
Second of three student-faculty seminars for majors. Students give a 25-minute presentation on an advanced coursework topic. Emphasis is placed on the process and the mechanics of constructing a scientific talk.  
Prerequisite: CHM 228 & junior standing.  
Offered: every spring.

CHM 481 Communicating Research Literature  
1 Credit  
Third of three student-faculty seminars for majors. Students give a 45-minute presentation on a scientific work from the chemical literature. Emphasis is placed on constructing a narrative and gaining a working understanding of the scientific issues in the presented paper.  
Prerequisite: CHM 228, CHM 381, & junior standing.  
Fulfills College Core: Oral Communication  
Offered: every fall.

CHM 490 Chemistry Internship  
3 Credits  
Internships in chemical or biochemical industry under the direction of company and faculty supervisors.  
Prerequisite: permission of department chair & associate dean.  
Offered: fall & spring.

CHM 499 Independent Study  
3-4 Credits  
Independent study under the direction of the chemistry faculty. Independent studies require an application and approval by the associate dean.  
Prerequisite: permission of the instructor, department chair, & associate dean.  
Offered: fall & spring.