Chemistry and Biochemistry

Chemistry is an excellent foundation for any scientific, professional or business career, including but not limited to agricultural chemistry, analytical chemistry, biochemistry, chemical engineering, dentistry, ecology and environmental chemistry, forensic science, geochmistry, management and marketing, materials science, medicine, optometry and ophthalmology, patent law, pharmacology, physical chemistry, plastics and polymer chemistry, renewable energy, synthetic organic chemistry, toxicology or veterinary science. Undergraduate research experiences are readily available under the supervision of a faculty advisor. Students are encouraged to meet with an undergraduate advisor to design a curriculum focused on their career goals.

All Chemistry majors begin in the Comprehensive Chemistry specialization, which provides a rigorous program with advanced study in analytical, organic and physical chemistry for the professional chemist. After the freshman year, all students pursuing a Bachelor of Science degree in the College of Science have the option to continue in Comprehensive Chemistry or move into a more specialized specialization, which builds upon the foundation course work in analytical, biochemistry, inorganic, organic and physical chemistry.

Pre-professional students and those interested in biological chemistry may pursue the Biochemistry specialization with additional advanced courses in other life sciences. The Environmental Chemistry specialization complements advanced study in analytical and organic chemistry with in depth study of environmental chemistry and related fields of engineering, forestry, geology, plant biology and soil science. The Forensic Chemistry specialization gives students the opportunity to study the science required for investigative research in a crime lab. Although not required for graduate study or employment as a chemist, students are encouraged to pursue certification from the American Chemical Society, 1155 Sixteenth St. NW, Washington, D.C.

Future business leaders can earn a Bachelor of Arts degree in the College of Science. The Business specialization allows students to pursue a minor degree in Business and Administration and is ideal preparation for a career in the production, management, marketing and technology transfer aspects of the chemistry industry. Additional course work is recommended to prepare for a Masters in Business Administration.

All science majors require proficiency in mathematics, which is prerequisite for upper level course work in chemistry. Students are encouraged to enroll in the highest level of mathematics appropriate to their background within the first semester. All students are expected to show proficiency in chemistry prerequisites that are chemistry courses with a grade of C or better, or obtain consent of the instructor for enrollment in the subsequent chemistry course. For chemistry majors, a grade of C- or better is needed in every Chemistry Introductory course and in every Chemistry Foundation course to be eligible for graduation. A minimum grade point average of 2.0 in chemistry course work is needed in order for a student to receive a degree in chemistry. A student cannot repeat a course or its equivalent in which a grade of B or better was earned without the consent of the department.

Students wishing more detailed information should visit our website at chem.siu.edu or contact an undergraduate advisor at the Department of Chemistry and Biochemistry, Neckers Hall, Rm. 224 - Mail Code 4409, Southern Illinois University Carbondale, Carbondale, IL 62901.
# Bachelor of Science Degree in Chemistry

<table>
<thead>
<tr>
<th>Degree Requirements</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Core Curriculum Requirements ¹</td>
<td>39</td>
</tr>
<tr>
<td>College of Science Academic Requirements</td>
<td>6</td>
</tr>
<tr>
<td>Biological Sciences - (3 hours included in the UCC Life Sciences hrs, and 3 hours completed with CHEM 350) Mathematics – completed with major Physical Sciences – completed with major Supportive Skills - CS 201 or CS 202; ENGL 290 or ENGL 291 or ENGL 391; MATH 282 or MATH 483 ²</td>
<td>6</td>
</tr>
<tr>
<td>Chemistry Major Requirements ³</td>
<td>62-64</td>
</tr>
<tr>
<td>CHEM 200 or CHEM 200H, CHEM 201, CHEM 202 or CHEM 202H, CHEM 210 or CHEM 210H, CHEM 211, CHEM 212 or CHEM 212H (3 hours included in the UCC Physical Science hours)</td>
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</tr>
<tr>
<td>CHEM 330, CHEM 340, CHEM 341, CHEM 350, CHEM 351, CHEM 360, CHEM 361, CHEM 410, CHEM 411</td>
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<tr>
<td>MATH 150, MATH 250 (3 hours included in the UCC Mathematics hours)</td>
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<tr>
<td>MATH 221 or MATH 251 or MATH 305 or MATH 483</td>
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<tr>
<td>PHYS 205A, PHYS 255A, PHYS 205B, PHYS 255B</td>
<td>8</td>
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<td>One of the following specializations:</td>
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<tr>
<td>Biochemistry Specialization</td>
<td>16</td>
</tr>
<tr>
<td>CHEM 442, CHEM 443, CHEM 452, CHEM 453</td>
<td>10</td>
</tr>
<tr>
<td>Six hours from the following: BIOL 305, BIOL 306; CHEM 434, CHEM 444, CHEM 451 A/B in lieu of CHEM 350, CHEM 456, CHEM 460/CHEM 463; MICR 301, MICR 302, MICR 425, MICR 460; PHSL 310, PHSL 401A, PHSL 401B, PHSL 410A, PHSL 410B, PHSL 420A, PHSL 420B, PHSL 460; PLB 320, PLB 419, PLB 427; ZOOL 409, ZOOL 418</td>
<td>6</td>
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<tr>
<td>Comprehensive Chemistry</td>
<td>16</td>
</tr>
<tr>
<td>CHEM 434, CHEM 442, CHEM 443, CHEM 460, CHEM 461</td>
<td>13</td>
</tr>
<tr>
<td>Degree Requirements</td>
<td>Credit Hours</td>
</tr>
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<tr>
<td>One of the following: CHEM 431, CHEM 439, CHEM 444, CHEM 451 A&amp;B in lieu of CHEM 350, CHEM 452, CHEM 456, CHEM 468, CHEM 479</td>
<td>3</td>
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<tr>
<td>Environmental Chemistry Specialization</td>
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<tr>
<td>CHEM 431, CHEM 434, CHEM 442, CHEM 443</td>
<td>12</td>
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<tr>
<td>MATH 483 (included in math hours above)</td>
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<tr>
<td>At least 3 hours from the following: CE 310, CE 418; FOR 452/FOR 452L; GEOL 418, GEOL 421; ME 410, ME 416; MICR 423, MICR 425; CSEM 442, CSEM 446, CSEM 447/CSEM 448; PLB 427; ZOOL 411, ZOOL 432</td>
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<tr>
<td>Forensic Chemistry Specialization</td>
<td>15</td>
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<tr>
<td>CHEM 434, CHEM 439, CHEM 442, CHEM 443</td>
<td>12</td>
</tr>
<tr>
<td>MATH 483 (included in math hours above)</td>
<td></td>
</tr>
<tr>
<td>PHIL 104 or PHIL 340 (3 hours included in UCC humanities)</td>
<td></td>
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<tr>
<td>At least 3 hours from the following: BIOL 305; GEOL 310, GEOL 417; MICR 301, MICR 302, MICR 454, MICR 460; PHSL 310, PHSL 401A, PHSL 401B, PHSL 420A, PHSL 420B; PLB 330; ZOOL 409</td>
<td>3</td>
</tr>
<tr>
<td>American Chemical Society Certification</td>
<td>3</td>
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<tr>
<td>Certification by the ACS requires a minimum of 300 contact hours of undergraduate research over at least two semesters, including two credit hours of CHEM 396 or CHEM 496H; attending undergraduate seminar, CHEM 490; and completion of a comprehensive research report under the direction of a faculty advisor. A student can receive ACS Certification with any of the above specializations.</td>
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<tr>
<td>Chemistry Honors</td>
<td>6</td>
</tr>
<tr>
<td>Participation in Chemistry Honors requires completion of the ACS Certificate with 300 contact hours of undergraduate research, including two credit hours of CHEM 496H; attending undergraduate seminar, CHEM 490H; and completion of an honors thesis, CHEM 499H or UHON 499, under the direction of a faculty advisor. A faculty advisor approved proposal for an honors research project should be submitted one year prior to the expected completion of an honors thesis. A student can earn Chemistry Honors with any of the above specializations.</td>
<td></td>
</tr>
</tbody>
</table>
1 A total of nine hours of biological science, mathematics, and physical science course work are accounted for in the 39-hour University Core Curriculum requirement. An additional two hours of human health are accounted for if students choose PHSL 310 as part of the Biochemistry Specialization.

2 A total of three hours of biological sciences are completed with biological chemistry or biochemistry. CHEM 451A may substitute for CHEM 350, if a student continues with CHEM 451B. Prerequisite is MATH 106, MATH 111 or MATH 108 and MATH 109. The elective hours are decreased by three to six hours for students who place into a course lower than calculus. Three hours of supportive skills are accounted for in the College of Science requirement and elective hours may increase by two hours if students choose MATH 483.

3 Students must complete all of the additional courses listed under the specialization as well as any prerequisites not listed here for all additional courses. These courses may substitute for electives and may require more than 120 total credit hours if not chosen wisely and with guidance from advisors.

Bachelor of Arts Degree in Chemistry

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<thead>
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<td>6</td>
</tr>
<tr>
<td>Requirements for Major in Chemistry</td>
<td>62</td>
</tr>
<tr>
<td>CHEM 200 or CHEM 200H, CHEM 201, CHEM 202 or CHEM 202H, CHEM 210 or CHEM 210H, CHEM 211, CHEM 212 or CHEM 212H (3 hours included in the UCC Physical Science hrs)</td>
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<tr>
<td>MATH 150, MATH 250 (3 hours included in the UCC Mathematics hrs)</td>
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<tr>
<td>PHYS 205A, PHYS 255A, PHYS 205B, PHYS 255B</td>
<td>8</td>
</tr>
<tr>
<td>Business Specialization</td>
<td>21-22</td>
</tr>
<tr>
<td>Degree Requirements</td>
<td>Credit Hours</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
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<tr>
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<tr>
<td>ACCT 220, ACCT 230</td>
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<td>ECON 240</td>
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<tr>
<td>FIN 330</td>
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<tr>
<td>MKTG 304 or MGMT 318</td>
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<tr>
<td>Free Electives</td>
<td>7-10</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
</tr>
</tbody>
</table>

1 A total of nine hours of biological science, mathematics, and physical science course work are accounted for in the 41-hour University Core Curriculum requirement. An additional three hours of social science are accounted for if students take ECON 240 in the Business Specialization.

**Chemistry Minor**

The minor in chemistry requires a minimum of 20 semester hours of chemistry in formal course work including CHEM 200, CHEM 201, CHEM 210, CHEM 211 and three elective lecture courses at 300-level or above. At least one of the elective courses must include a lab component. All elective courses must be taken at SIU. A grade of C or better is needed in all elective courses to be eligible for a minor in chemistry. Microbiology majors may take MICR 425 in place of CHEM 350 to meet the requirements for a minor in chemistry.

**Forensic Science Minor**

Required courses for the Forensic Science Minor amount to 15 hours, including nine hours of required courses and six hours of electives (with no more than four of the minimum six hours of electives from a single discipline/department).

Required Courses: nine hours: ANTH 231, CCJ 201, CHEM 173.

Electives: (note, some have prerequisites) six hours: AH 313; ANTH 240A, ANTH 440B, ANTH 441D, ANTH 455A, ANTH 455H, ANTH 465 (Internship in Forensics - must be arranged individually); BIOL 305; CCJ 290, CCJ 310, CCJ 330, CCJ 408; CHEM 439; PHIL 104, PHIL 340; PHSL 301; PLB 300, PLB 330; POLS 334; PSYC 305, PSYC 431, PSYC 440; SOC 372.

**American Chemical Society Certificate**

The American Chemical Society (ACS) Certificate program prepares students for a career in the chemical industry or for further studies in graduate school. The certificate indicates that a student has completed the rigorous academic requirements for a degree in chemistry and has actively participated in undergraduate research under the direction of a faculty research advisor. Students should contact a faculty research advisor at least one year prior to graduation to apply for an undergraduate research position in their laboratory. Students will complete 300 hours of undergraduate research including two credit hours of CHEM 396 or CHEM 496H; attend undergraduate seminar, CHEM 490; and complete a comprehensive research report for submission to the department. An application to receive an ACS
Certificate must be submitted at least one month prior to graduation with verification by a faculty research advisor of completion of all requirements.

**Chemistry Honors Specialization**

All freshmen chemistry majors are strongly encouraged to enroll in CHEM 200H and to participate in the University Honors Program. The Chemistry Honors track includes completion of an ACS Certificate and an honors thesis under the supervision of a faculty research advisor. Applications for Chemistry Honors should be submitted at least one year prior to graduation and must include an honors research project proposal with a letter of support from a faculty research advisor. Acceptance and participation in an honors research project requires a 3.25 grade point average in all chemistry coursework. Students will complete 300 hours of undergraduate research including two credit hours of CHEM 496H; attend undergraduate seminar, CHEM 490H; complete an honors thesis, CHEM 499H; and present their thesis work as a seminar or poster presentation. The honors thesis and all chemistry honors courses may be included in the pursuit of an Honors Degree offered by the University Honors Program, which requires submission of an honors thesis project proposal to the Honors Program Director before the end of the junior year after approval from a faculty research advisor. The Honors Thesis course, University Honors 499, may substitute for CHEM 499H and requires submission of an honors thesis to the Honors Program Office and OpenSIUC.

**Multiple Specializations in Chemistry**

Students meeting the requirements for a Bachelor of Science degree in Chemistry may earn multiple specializations. All requirements for each specialization must be satisfied.

**Transfer Credit**

Credit for a course in chemistry successfully completed at another accredited institution will be accepted to meet major or minor requirements in chemistry at SIU, subject to the following conditions:

1. The course number must bear a departmental prefix clearly indicating the course is a chemistry (or biochemistry) course.
2. The course must have covered substantially the same material as a course currently offered at SIU to meet major requirements.
3. Any course used to meet major or minor requirements in chemistry must be explicitly approved by the Department of Chemistry and Biochemistry.

**Chemistry and Biochemistry Courses**

**CHEM106 - Chemistry and Society** 106-3 Chemistry and Society. (University Core Curriculum) [IAI Course: P1 903L] Exploration of the many implications that chemistry has upon modern society. Topics include air and water quality, global warming, acid rain, fossil, solar and nuclear fuels, nutrition and drugs. Three lectures per week except that every other week a three-hour lab is substituted for one of the lectures that week. Lab fee: $60.

**CHEM125 - Prep General Chemistry** 125-3 Preparatory General Chemistry. Preparation for general chemistry (CHEM 200). This course is designed to strengthen background knowledge and skills necessary for success in CHEM 200. Topics include unit conversions, periodic table, chemical formulas, chemical reactions, and stoichiometry, with a focus on mathematical problem solving, interpreting data from graphs and tables, and chemical reasoning.

**CHEM140A - Chemistry** 140A-4 Chemistry. (Advanced University Core Curriculum) [IAI Course: P1 902L] This is the first semester of a two-semester sequence of general, organic and biological chemistry designed to meet the needs of nursing, dental hygiene, physical therapy, other allied health programs,
agriculture, forestry and other majors with comparable requirements. This course is not applicable to a major in chemistry. CHEM 140A can serve as a preparation for CHEM 200 for students without a year of high school chemistry or for those who feel their background is inadequate. Three lectures and one three-hour laboratory per week. Pre- or Co-requisite: MATH 106, 108, 109, 110, 111, 125, 139, 140, 141 or 150. CHEM 140A satisfies University Core Curriculum Science Group I requirement in lieu of 106. Lab fee: $60.

CHEM140B - Chemistry 140B-4 Chemistry. This is the second semester of a two semester sequence of general, organic and biological chemistry designed to meet the needs of nursing, dental hygiene, physical therapy, other allied health programs, agriculture, forestry and other majors with comparable requirements. This course is not applicable to a major in chemistry. CHEM 140A can serve as a preparation for CHEM 200 for students without a year of high school chemistry or for those who feel their background is inadequate. Three lectures and one three-hour laboratory per week. Pre- or Co-require: MATH 106, 108, 109, 110, 111, 125, 139, 140, 141 or 150. CHEM 140A satisfies University Core Curriculum Science Group I requirement in lieu of 106. Lab fee: $60.

CHEM173 - Forensic Science 173-3 Introduction to Forensic Science. This course is designed to provide an introduction to forensic science and criminalistics and the techniques used in the modern forensic laboratory for the analysis of common types of physical evidence encountered at crime scenes. Topics include the recognition, identification, and evaluation of physical evidence such as DNA, hairs, fibers, drugs, blood, glass, soil, firearms, fingerprints, and documents. Three lectures per week. No prerequisite.

CHEM180 - Chemistry of Beer 180-2 The Chemistry of Beer and Brewing. The course covers the science and chemistry of beer and brewing. The history of beer and brewing will be introduced to follow the evolution of beer as a food and beverage, including how beer has impacted society and how brewing has been affected by society. The chemistry of the four basic ingredients of beer (water, malt, hops, and yeast) will be explored, as well as the chemistry of the brewing process. The various styles of beer will be introduced and discussed with respect to how the styles can be achieved based on the chemistry of the ingredients and process. Home brewing and commercial brewing will be compared. The course does not presume a background in chemistry and various chemical concepts will be introduced on an as needed basis.

CHEM181 - Chemistry of Beer Lab 181-1 The Chemistry of Beer and Brewing Lab. The laboratory complement to CHEM 180, The Chemistry of Beer and Brewing. The laboratory will cover various aspects of beer and brewing in a hands-on experiential environment. A major component will be guided tasting sessions of the various style categories of beer. Students will participate in brewing beer from base ingredients using various brewing techniques. Experiments conveying basic biology, chemistry and physical science concepts will be conducted. In addition, spectroscopic and chromatographic methods will be used to analyze flavor and ingredient components in beer. Special tours may also be arranged in regional breweries and hop yards. Lab fee: $90.

CHEM200 - Intro to Chemical Principles 200-3 Introduction to Chemical Principles. (Advanced University Core Curriculum course) [IAI Course: CHM 911] [IAI Course: P1 902] First-semester chemistry for students in science, pre-professional, engineering or technology programs. Atomic structure, molecular structure, bonding, solutions, stoichiometry, gases, liquids and solids. Three lectures per week. Students are required to attend a weekly one hour supervised computer workshop. Prerequisite: one year of high school chemistry or CHEM 140A or ACT Science score of at least 22; Prerequisite or Co-requisite: MATH 106, 108, 109, 111, 140 or 150; Concurrent enrollment in CHEM 201 and CHEM 202. With 201 satisfies University Core Curriculum Science Group I requirement in lieu of 106.

CHEM200H - Atoms and Molecules 200H-3 Chemistry of Atoms and Molecules. First semester of the accelerated chemistry course for chemistry majors and advanced students in science. Atoms, quantum theory, atomic structure, chemical bonds, molecular structure, and chemical reactions. Three lectures per week. Students are required to attend a weekly one hour supervised computer workshop. Prerequisite: declared Chemistry major or ACT Science score of at least 25; Prerequisite or Co-requisite: MATH 106, 108, 109, 111 or 150. Concurrent enrollment in CHEM 201 and CHEM 202H. With 201 satisfies University Core Curriculum Science Group I requirement in lieu of 106.

CHEM201 - General Chemistry Lab I 201-1 General Chemistry Laboratory I. (Advanced University Core Curriculum course) [IAI Course: P1 902L] [IAI Course: CHM 911] Synthesis and exploration of the
properties of compounds and elements. One three-hour laboratory per week. Prerequisite: completion of or concurrent enrollment in Chemistry 200. If Chemistry 200 is dropped, the laboratory course must also be dropped. With Chemistry 200 satisfies University Core Curriculum Science Group I requirement in lieu of 106. Lab fee: $60.


**CHEM205 - Atoms & Molecules CHEM Majors** 205-3 Atoms and Molecules for CHEM Majors.

Chemistry of Atoms and Molecules for CHEM Majors. First semester of the accelerated chemistry course for chemistry majors and advanced students in science. Atoms, quantum theory, atomic structure, chemical bonds, molecular structure, and chemical reactions. Three lectures per week. Students are required to attend a weekly one hour supervised computer workshop. Prerequisite: declared Chemistry major or ACT Science score of at least 25; Prerequisite or Co-requisite: MATH 106, 108, 109, 111 or 150. Concurrent enrollment in CHEM 201 and CHEM 207.

**CHEM205H - Atoms & Molecules Honors** 205H-3 Chemistry of Atoms and Molecules for Honors.

First semester of the accelerated chemistry course for chemistry majors and advanced students in science. Atoms, quantum theory, atomic structure, chemical bonds, molecular structure, and chemical reactions. Three lectures per week. Students are required to attend a weekly one hour supervised computer workshop. Prerequisite: declared Chemistry major or ACT Science score of at least 25; Prerequisite or Co-requisite: MATH 106, 108, 109, 111 or 150. Concurrent enrollment in CHEM 201 and CHEM 207H. With 201 satisfies University Core Curriculum Science Group I requirement in lieu of 106.

**CHEM207 - Atoms & Molecules Workshop** 207-1 Atoms and Molecules Workshop for CHEM Majors.

Supervised computer workshop meets one hour weekly for students in Chemistry of Atoms and Molecules. Concurrent enrollment in CHEM 205.

**CHEM207H - Atoms & Molecules Workshop Hon** 207H-1 Atoms and Molecules Workshop for Honors.

Supervised computer workshop meets one hour weekly for students in Chemistry of Atoms and Molecules. Concurrent enrollment in CHEM 205H.

**CHEM210 - General and Inorganic Chem** 210-3 General and Inorganic Chemistry. [IAI Code: CHM 912] Second semester chemistry for science, engineering or pre-professional majors. Rates of reaction, chemical equilibrium, acid-base equilibria, pH electrochemistry, transition metals, properties of inorganic compounds, nuclear chemistry and organic chemistry. Three lectures per week. Students are required to attend a weekly one hour supervised computer workshop. Prerequisite: MATH 106, 108, 109, 111, 140 or 150; C or better in CHEM 200, 201. Concurrent enrollment in CHEM 212.

**CHEM211 - General Chemistry Lab II** 211-1 General Chemistry Laboratory II. [IAI Code: CHM 912] Continued synthesis and exploration of properties of compounds and elements. Prerequisite: C or better in CHEM 200, 201; completion of or concurrent enrollment in CHEM 210. If CHEM 210 is dropped, CHEM 211 must also be dropped. Lab fee: $60.

**CHEM212 - General Chemistry Workshop** 212-1 General Chemistry Workshop. Supervised computer workshop meets one hour weekly for students in General and Inorganic Chemistry. Concurrent enrollment in CHEM 210.

**CHEM215 - Chemistry of Matter** 215-3 Chemistry of Matter for CHEM Majors.

Second semester of the accelerated chemistry course for chemistry majors and advanced students in science. Chemical properties of matter, kinetics, equilibrium, solution chemistry, thermodynamics, electrochemistry, nuclear chemistry and transition metals. Three lectures per week. Students are required to attend a weekly one hour supervised computer workshop. Prerequisite: MATH 106, 108, 109, 111 or 150 or concurrent enrollment; C or better in CHEM 205H or declared Chemistry major and A grade in CHEM 205; Concurrent enrollment in CHEM 211 and CHEM 217.

**CHEM215H - Chemistry of Matter for Honors** 215H-3 Chemistry of Matter for Honors.

Second semester of the accelerated chemistry course for chemistry majors and advanced students in science. Chemical properties of matter, kinetics, equilibrium, solution chemistry, thermodynamics, electrochemistry, nuclear chemistry and transition metals. Three lectures per week. Students are required
to attend a weekly one hour supervised computer workshop. Prerequisite or Co-requisite: MATH 106, 108, 109, 111 or 150; C or better in CHEM 205H or declared Chemistry major and a grade of C or better in CHEM 205; Concurrent enrollment in CHEM 211 and CHEM 217H.


CHEM296 - Introduction to Research 296-1 to 2 Introduction to Research. Introduction to research under the direction and supervision of a faculty advisor. Safety training is required. Special approval needed from the instructor.

CHEM311 - Intermediate Inorganic Chem 311-3 Intermediate Inorganic Chemistry. Foundational platform to understand the principles of inorganic chemistry and properties of inorganic compounds. The primary focus of this course will be on bonding and periodicity encompassing the broader aspect of trends in chemistry of elements. This course will cover acid-base and redox chemistry, and the chemistry of inorganic chain, ring cages and clusters. Prerequisites: CHEM 200 and CHEM 210 with grades of C or better.

CHEM330 - Quantitative Analysis 330-5 Quantitative Analysis. A one-semester course in analytical chemistry that emphasizes quantitation by wet-chemical methods and modern instrumentation. Topics include statistics, sampling, gravimetry, multiple chemical equilibria, titrimetry, potentiometry, voltammetry, spectrophotometry and chromatography. Three lectures and two laboratories per week. Ability to solve algebraic equations and use of logarithms essential. Prerequisite: MATH 109, 111, 150 or 250; C or better in CHEM 210, 211. Lab fee: $60.

CHEM339 - Intro to Organic Chemistry 339-3 Introduction to Organic Chemistry. An introduction to the chemistry of carbon-based compounds. Intended to introduce students to functional groups; their structure properties and reactivity. For students requiring only one semester of organic chemistry. Three lectures per week. Prerequisite: C or better in CHEM 210, 211. Recommended: concurrent enrollment in CHEM 341.

CHEM340 - Organic Chemistry I 340-3 Organic Chemistry I. The first part of a two semester introduction to organic chemistry. This course will introduce basic nomenclature, bonding, stereochemistry, reactivity and the spectroscopic methods common to organic chemistry. Three lectures per week. Prerequisite: C or better in CHEM 210, 211.

CHEM341 - Organic Chemistry Lab I 341-2 Organic Chemistry Laboratory I. An introductory lab course based upon a problem-solving approach to organic chemistry. Students will identify and derivatize unknowns using modern organic techniques. One one-hour lecture and one four-hour laboratory per week. Prerequisite: C or better in CHEM 210, 211; 339 or 340 taken concurrently. Lab fee: $60.

CHEM350 - Biological Chemistry 350-3 Introduction to Biological Chemistry. Fundamental concepts in Biological Chemistry include biomolecular structure, enzyme catalysis, metabolism and gene expression. Three lectures per week. Prerequisite: C or better in CHEM 210 and 339 or 340; C or better in one semester biological sciences course (not University Core Curriculum course). Offered spring semester only.

CHEM351 - Biochemistry Laboratory 351-2 Biochemistry Laboratory. A one semester biochemistry laboratory covering techniques and laboratory procedures; isolation, purification and characterization of amino acids, peptides, proteins, nucleic acids, lipids and cofactors; spectroscopic and chromatographic analysis of biomolecules; study of protein-ligand interactions; enzyme kinetics. One one-hour lecture and one four-hour laboratory per week. Prerequisites: CHEM 210, 211, 339 or 340, 341. Prerequisite or co-requisite: CHEM 350 or 451B. Offered spring semester. Lab fee: $60.

CHEM360 - Physical Chemistry 360-3 Classical Physical Chemistry. An introduction to chemical, statistical thermodynamics and kinetics. Prerequisite: Mathematics 250; C or better in CHEM 210,
330 or concurrent enrollment. Mathematics 221 or 305 is recommended as prerequisite or concurrent enrollment. Offered fall semester only.

CHEM361 - Physical Chem Lab I 361-1 Physical Chemistry Laboratory I. Experiments relating to topics covered in 360. Prerequisite: CHEM 360 or concurrent enrollment. One three-hour laboratory per week. Offered fall semester only. Lab fee: $60.

CHEM386A - Problem Solving Workshop 386A-1 Problem Solving Workshop. A two semester workshop sequence for chemistry majors. One two-hour workshop per week per semester. Introduction to problem solving strategies with examples and practice problems. Prerequisite: Chemistry 200. Restricted to chemistry major.

CHEM386B - Problem Solving Workshop 386B-1 Problem Solving Workshop. A two semester workshop sequence for chemistry majors. One two-hour workshop per week per semester. Advanced problem solving with general applications. Prerequisite: CHEM 386A.

CHEM396 - Undergraduate Research 396-1 to 2 Undergraduate Research. Research under the direction and supervision of a faculty advisor culminating in a written report. Safety training is required. Prerequisite: one semester of chemistry with laboratory experience. Special approval needed from the instructor.

CHEM410 - Inorganic Lab 410-2 Inorganic Synthesis and Characterization Laboratory. Introduction to synthesis techniques and characterization methods of inorganic compounds. One four-hour lab per week. Not for graduate credit. Prerequisite: completion of or concurrent enrollment in CHEM 411. Offered spring semester only. Lab fee: $60.

CHEM411 - Advanced Inorganic Chemistry 411-3 Advanced Inorganic Chemistry. Inorganic chemistry covering bonding and structure, polyatomic systems, coordination compounds, and the chemistry of elements. Three lectures per week. Prerequisites: CHEM 311, 360, and 361 with grades of C or better. Suggested MATH 221.

CHEM431 - Environmental Chemistry 431-3 Environmental Chemistry. Chemical principles applied to the environment and environmental problems. Chemical kinetics, thermodynamic and equilibrium concepts as they relate to the atmosphere, water and soil will be discussed to include current problems of pollutants, pollutant evaluation and pollutant remediation. Discussion of methods for the chemical analysis of environmental samples will also be included. Prerequisite: C or better in CHEM 330 and 340.

CHEM434 - Instrumental Analysis 434-2 to 4 Instrumental Analytical Chemistry. Theory and practice of instrumental measurements, including emission and absorption spectroscopic, capillary electrophoretic and chromatographic methods. Two lectures and two three-hour laboratories per week for four credits. Enrollment for two credit hours is restricted to graduate students in the Department of Chemistry and Biochemistry who are advised to take instrumental analysis. Prerequisite: C or better in CHEM 330. Offered fall semester only. Laboratory fee: $60.

CHEM439 - Forensic Chemistry 439-3 Forensic Chemistry. A one-semester course in the analysis of forensics samples. Topics include sample collection and preservation, chain of custody, data validation and reports, and analytical methods which may include (as time permits) chromatography, mass spectroscopy, fluorescence and absorbance spectroscopy, fingerprint identification, and scanning electron and light microscopy. One lecture and one six-hour laboratory meeting per week. Prerequisite: C or better in CHEM 330 and 434. Offered spring semester only. Lab fee: $60.

CHEM442 - Organic Chemistry II 442-3 Organic Chemistry II. This is a continuation of 340 emphasizing topics that were not covered in the first semester. Topics will include the chemistry of aromatic compounds, dienes and other carbon-carbon bond forming reactions. Advanced topics such as polymers and biomolecules may also be covered. Three lectures per week. Prerequisite: C or better in CHEM 340, 341; concurrent enrollment in 443 is recommended. Offered spring semester only.

CHEM443 - Organic Chemistry Lab II 443-2 Organic Chemistry Laboratory II. A second organic laboratory course based upon a synthetic approach. Students will learn modern synthetic organic chemistry techniques including modern spectroscopic techniques. One one-hour lecture and one four-
CHEM444 - Intermediate Organic Chem 444-3 Intermediate Organic Chemistry. A transitional course between introductory and graduate level chemistry. The chemistry of carbon compounds based upon a mechanistic approach will be discussed. Three lectures per week. Prerequisite: C or better in CHEM 340 and 442. Offered fall semester only.

CHEM451A - Biochemistry 451A-3 Biochemistry. (Same as BCHM 451A and MBMB 451A) First half of the 451 A,B two semester course. Must be taken in A,B sequence. Three lectures per week. Introduction to biomolecules, biochemical techniques, expression of genetic information, basic thermodynamics, ligand binding, aqueous solutions, protein structure, spectroscopy. Prerequisites: CHEM 340 and CHEM 342 or 442, or equivalents.

CHEM451B - Biochemistry 451B-3 Biochemistry. (Same as MBMB 451B and BCHM 451B) Second half of 451A,B two semester course. Must be taken in A,B sequence. Basic kinetics, enzyme kinetics, enzyme inhibitors, regulation of enzymes, oxidation-reduction, high energy bonds, transport across membranes, intermediary metabolism, hormonal control of metabolism. Prerequisites: MBMB 451A or BCHM 451A or CHEM 451A or equivalent.

CHEM452 - Advanced Biochemistry 452-3 Advanced Biological Chemistry. Advanced study of biological chemistry including the structure-function relationship in proteins, the mechanism of enzyme reactions and the biochemical basis of gene expression, signal transduction, nerve impulses, molecular motors and other physiological processes. For graduate students, this course may be taken to meet deficiencies in biochemical knowledge, but will not meet the formal coursework requirements for the master or doctoral level degrees. Prerequisite: C or better in CHEM 340, 341, 350.

CHEM453 - Advanced Biochemistry Lab 453-2 Advanced Biochemistry Laboratory. A one semester advanced biochemistry laboratory covering techniques and laboratory procedures for the isolation, purification and characterization of biomolecules. Two three-hour laboratories per week. Prerequisites: C or better in CHEM 350 and CHEM 351. Lab fee: $60.

CHEM456 - Biophysical Chemistry 456-3 Biophysical Chemistry. (Same as MBMB 456 and BCHM 456) A one-semester course in Biophysical Chemistry intended for biochemists and molecular biologists. Emphasis will be on solution thermodynamics, kinetics and spectroscopy applied to biological systems. Prerequisites: CHEM 340 and CHEM 342 or 442, MATH 141 or 150, MBMB 451A or BCHM 451A or CHEM 451A, or equivalents.

CHEM460 - Quantum Mechanics 460-3 Quantum Mechanics and Spectroscopy. An introduction to quantum mechanics and spectroscopy. Prerequisite: MATH 250; C or better in CHEM 360. MATH 221 or 305 is recommended as prerequisite or concurrent enrollment. Offered spring semester only.

CHEM463 - Physical Chem Lab II 463-1 Physical Chemistry Laboratory II. Experiments relating to topics covered in 460. Prerequisite: C or better in CHEM 460 or concurrent enrollment. One three-hour laboratory per week. Offered spring semester only. Lab fee: $60.

CHEM468 - Application Symmetry to Chem 468-3 Application of Symmetry to Chemistry. The concepts of symmetry elements, groups and character tables will be taught. Symmetry will be applied to molecules in order to simplify and characterize their wave functions and vibrational frequencies. Prerequisite: C or better in CHEM 460. Offered spring semester in odd years only.

CHEM479 - Materials Chemistry 479-3 Principles of Materials Chemistry. Introduction to fundamental concepts of materials chemistry. Synthesis, characterization, processing and applications of different materials including solids, polymers, ceramics and molecularly designed materials. Prerequisite: CHEM 360, 411 or concurrent enrollment. Offered fall semester in odd years only.

CHEM489 - Special Topics in Chemistry 489-1 to 3 Special Topics in Chemistry. Special approval needed from the instructor and chair.

CHEM490 - Undergraduate Seminar 490-1 Undergraduate Seminar. Current topics in chemistry covered through literature review, presentations, reports of ongoing research and discussions.
Prerequisite/Co-requisite: CHEM 296, CHEM 396 or CHEM 496. Special approval needed from the instructor.

**CHEM490H - Honors Seminar** 490H-1 Honors Seminar. Current topics in chemistry covered through literature review, presentations, reports of ongoing research and discussions. Pre/Co-requisite: CHEM 496H. Special approval needed from the instructor.

**CHEM496H - Honors Research** 496H-1 to 6 Honors Research. Independent research under the direction of a faculty advisor culminating in a written report. Safety training is required. Prerequisite: C or better in CHEM 330. Special approval needed from the instructor and a minimum 3.0 grade point average in all chemistry course work.

**CHEM499H - Honors Thesis** 499H-3 Honors Thesis. Preparation of a well-written honors thesis under the supervision of a faculty advisor based on an honors research project. The written thesis will be submitted to the faculty advisor and the department. A public presentation of the honors thesis research is required as a seminar or poster presentation. A proposal for honors research must be submitted to the department one year prior to completion of the honors thesis. Pre/Co-requisite: CHEM 496H.

### Chemistry and Biochemistry Faculty

- **Bancroft, Senetta F.**, Assistant Professor, Ph.D., University of Akron, 2014.
- **Deria, Pravas**, Assistant Professor, Ph.D., University of Pennsylvania, 2009.
- **Du, Zhihua**, Associate Professor, Ph.D., University of Texas, 1997.
- **Gagnon, Keith T.**, Assistant Professor, Ph.D., North Carolina State University, 2007.
- **Gao, Yong**, Associate Professor, Ph.D., University of Alberta, 1998.
- **Ge, Qingfeng**, Professor, Ph.D., Tiangin University, 1991.
- **Goodson, Boyd M.**, Professor, Ph.D., University of California, Berkeley, 1999.
- **Hinckley, Conrad C.**, Professor, Emeritus, Ph.D., University of Texas, 1964.
- **Kinsel, Gary R.**, Professor, Ph.D., University of Colorado-Boulder, 1989.
- **Kohli, Punit**, Professor, Michigan State University 2000.
- **Koropchak, John A.**, Professor, Emeritus, Ph.D., University of Georgia, 1980.
- **Koster, David F.**, Professor, Emeritus, Ph.D., Texas A & M University, 1965.
- **Moran, Sean D.**, Assistant Professor, Ph.D., Columbia University, 2008.
- **McCarroll, Matthew E.**, Professor, Ph.D., University of Idaho, 1998.
- **Plunkett, Kyle N.**, Associate Professor, Ph.D., University of Illinois, 2005.
- **Shamsi, Mohtashim H.**, Assistant Professor, Ph.D., University of Toronto, 2012.
- **Smith, Gerard V.**, Professor, Emeritus, Ph.D., University of Arkansas, 1959.
- **Suni, Ian I.**, Professor, Ph.D., Harvard University, 1992.
- **Trimble, Russell F.**, Professor, Emeritus, Ph.D., Massachusetts Institute of Technology, 1951.
- **Tyrrell, James**, Professor, Emeritus, Ph.D., University of Glasgow, 1963.
- **Wang, Lichang**, Professor and Chair, Ph.D., University of Copenhagen, 1993.

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**Catalog Year Statement:**
Students starting their collegiate training during the period of time covered by this catalog (see bottom of this page) are subject to the curricular requirements as specified herein. The requirements herein will extend for a seven calendar-year period from the date of entry for baccalaureate programs and three years for associate programs. Should the University change the course requirements contained herein subsequently, students are assured that necessary adjustments will be made so that no additional time is required of them.