

Table of Contents

Chemistry..... 1

Chemistry

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, chemical education, forensic science, geochemistry, 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 Agricultural, Life and Physical Sciences 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 major with additional advanced courses in other life sciences. The Chemical Education specialization prepares students for participation in the Teacher Education Program, which will qualify students for an Initial Professional Educator license endorsed for secondary education-Chemistry. 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 Agricultural, Life and Physical Sciences. 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 program.

Students wishing more detailed information should visit our website at chem.siu.edu or contact an undergraduate advisor at the School of Chemical and Biomolecular Sciences, Neckers Hall, Rm. 224 - Mail Code 4409, Southern Illinois University Carbondale, Carbondale, Illinois 62901.

Bachelor of Arts (B.A.) in Chemistry Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements ¹	39
Chemistry Major Requirements	68
Supportive Skills: CS 201 or CS 202; ENGL 290 or ENGL 291 or ENGL 391; MATH 282 or MATH 483	6
CHEM 200 or CHEM 205 or CHEM 205H, CHEM 201, CHEM 202, or CHEM 207 or CHEM 207H, CHEM 210 or CHEM 215 or CHEM 215H, CHEM 211, CHEM 212 or CHEM 217 or CHEM 217H (3 hours included in the UCC Physical Science hours)	7
CHEM 311, CHEM 330, CHEM 340, CHEM 341, CHEM 350, CHEM 351, CHEM 360, CHEM 361	22
MATH 150, MATH 250 (3 hours included in the UCC Mathematics hours)	5
PHYS 205A, PHYS 255A, PHYS 205B, PHYS 255B	8
Business Specialization	21-22
One of the following: CHEM 411, CHEM 431, CHEM 434, CHEM 442, CHEM 452, CHEM 460	3-4
ACCT 220, ACCT 230	6
ECON 240	3
FIN 330	3
MGMT 304 or MGMT 318	3
MKTG 304	3
Free Electives	7-10
Total	120

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 three hours of social science are accounted for if students take ECON 240 in the Business Specialization

Bachelor of Science (B.S.) in Chemistry Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements ¹	39
Chemistry Major Requirements ²	68-70
Supportive Skills - CS 201 or CS 202; ENGL 290 or ENGL 291 or ENGL 391; MATH 282 or MATH 483 ³	6
CHEM 200 or CHEM 205 or CHEM 205H, CHEM 201, CHEM 202 or CHEM 207 or CHEM 207H, CHEM 210 or CHEM 215 or CHEM 215H, CHEM 211, CHEM 212 or CHEM 217 or CHEM 217H (3 hours included in the UCC Physical Science hours)	7
CHEM 311, CHEM 330, CHEM 340, CHEM 341, CHEM 350, CHEM 351, CHEM 360, CHEM 361	22
MATH 150, MATH 250 (3 hours included in the UCC Mathematics hours)	5
MATH 221 or MATH 251 or MATH 305 or MATH 483	3-4
PHYS 205A, PHYS 255A, PHYS 205B, PHYS 255B	8
One of the following specializations: ⁴	
Comprehensive Chemistry Specialization	16
CHEM 434, CHEM 442, CHEM 443, CHEM 460, CHEM 463	13
One of the following: CHEM 411, CHEM 431, CHEM 439, CHEM 444, CHEM 451A & CHEM 451B in lieu of CHEM 350, CHEM 452, CHEM 456, CHEM 468, CHEM 479	3
Environmental Chemistry Specialization	15
CHEM 431, CHEM 434, CHEM 442, CHEM 443	12
MATH 483 (included in math hours above)	
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	3
Forensic Chemistry Specialization	17
CHEM 434, CHEM 439, CHEM 442, CHEM 443	12

Degree Requirements	Credit Hours
CHEM 396 (This research must involve problems of interest to forensic science or a formal internship at a forensic lab. The latter is subject to availability and approval from said lab.)	2
MATH 483 (included in math hours above)	
PHIL 104 or PHIL 340 (3 hours included in UCC humanities)	
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	3
American Chemical Society Certification	3
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, CHEM 496, 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.	
Chemistry Honors	6
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.	
General Electives	13-15
Total	120

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.

² 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.

³ 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.

⁴ While students may complete more than one specialization, only one will be reported on their transcript.

B.S. Chemistry - Chemical Education Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements ¹	41
Chemistry Major Requirements	90-91
Supportive Skills - CS 201 or CS 202; ENGL 290 or ENGL 291 or ENGL 391; MATH 282 or MATH 483 ²	6
CHEM 200 or CHEM 205 or CHEM 205H, CHEM 201, CHEM 202 or CHEM 207 or CHEM 207H, CHEM 210 or CHEM 215 or CHEM 215H, CHEM 211, CHEM 212 or CHEM 217 or CHEM 217H (3 hours included in the UCC Physical Science hours)	7
CHEM 311, CHEM 330, CHEM 340, CHEM 341, CHEM 350, CHEM 351, CHEM 360, CHEM 361 ³	18-19
MATH 150, MATH 250 (3 hours included in UCC Mathematics hours)	5
MATH 282 (hours included in supportive skills)	
PHYS 205A, PHYS 205B, PHYS 255A, PHYS 255B	
Specialization Requirements	44
CHEM 396, CHEM 442, CHEM 443	6
GEOL 121, GEOL 124	3
BIOL 202 (2 hours included in UCC Human Health), BIOL 211, BIOL 212 (3 hours included in UCC Life Sciences above)	5
PHIL 105, PHIL 307I (6 hours included in UCC Social Science)	
UCOL 101S (3 hours included in UCC/UNIV 101U)	
EDUC 211, EDUC 214, EDUC 301, EDUC 302, EDUC 303, EDUC 308, EDUC 313, EDUC 319, EDUC 401A (3 hours included in UCC Multicultural Diversity in the US and 3 hours in Social Science)	24
CI 360, CI 468	6
Fine Arts Elective (3 hours included in UCC/UNIV 101U)	

Degree Requirements	Credit Hours
Total	131-132

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 20 credit hours (BIOL 202, PHIL 307I, PHIL 105, PSYC 102, UNIV 101, EDUC 211, EDUC 214) are included as part of Chemical Education Specialization.

² Prerequisite is MATH 106, MATH 111 or MATH 108 and MATH 109.

³ CHEM 360 and CHEM 350 required, choose either CHEM 361 or CHEM 351.

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.

Chemistry Honors Specialization

All freshmen chemistry majors are strongly encouraged to enroll in CHEM 205H 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, UHON 499, may substitute for CHEM 499H and requires submission of an honors thesis to the Honors Program Office and Open SIU.

Chemistry Minor

The minor in chemistry requires a minimum of 20 credit 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 credit hours, including nine credit hours of required courses and six credit hours of electives (with no more than four of the minimum six credit hours of electives from a single discipline/program).

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

Electives: (note, some have prerequisites) six credit hours: ANTH 240A, ANTH 440B, ANTH 455A, ANTH 455H, ANTH 465 (Internship in Forensics - must be arranged individually); BIOL 305; CCJ 290, CCJ 310, 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 Certification

The American Chemical Society (ACS) Certificate 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, CHEM 496, or CHEM 496H; attend undergraduate seminar, CHEM 490; and complete a comprehensive research report for submission to the program. 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.

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 program 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 School of Chemical and Biomolecular Sciences.

Technology Fee

The College of Agricultural, Life, and Physical Sciences assesses undergraduate majors a technology fee of \$4.58 per credit hour up to 12 credit hours. The fee is charged Fall and Spring semester.

Chemistry Courses

CHEM106 - 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. Credit Hours: 3

CHEM125 - 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. Credit Hours: 3

CHEM140A - Chemistry (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. Credit Hours: 4

CHEM140B - 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-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. Credit Hours: 4

CHEM173 - 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. Credit Hours: 3

CHEM180 - 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. Credit Hours: 2

CHEM181 - 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. Credit Hours: 1

CHEM200 - Introduction to Chemical Principles (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. Credit Hours: 3

CHEM201 - General Chemistry Laboratory I (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. Credit Hours: 1

CHEM202 - Introductory Chemistry Workshop Supervised computer workshop meets one hour weekly for students in Introduction to Chemical Principles. Concurrent enrollment in CHEM 200. Credit Hours: 1

CHEM205 - Atoms and Molecules for CHEM Majors (University Core Curriculum) 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 CHEM/BCHM 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. Credit Hours: 3

CHEM205H - Chemistry of Atoms and Molecules for Honors (University Core Curriculum) 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. Credit Hours: 3

CHEM207 - Atoms and Molecules Workshop for CHEM Majors (University Core Curriculum) Supervised computer workshop meets one hour weekly for students in Chemistry of Atoms and Molecules. Concurrent enrollment in CHEM 205. Credit Hours: 1

CHEM207H - Atoms and Molecules Workshop for Honors (University Core Curriculum) Supervised computer workshop meets one hour weekly for students in Chemistry of Atoms and Molecules. Concurrent enrollment in CHEM 205H. Credit Hours: 1

CHEM210 - 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. Credit Hours: 3

CHEM211 - 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. Credit Hours: 1

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

CHEM215 - Chemistry of Matter for CHEM Majors (University Core Curriculum) 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 CHEM/BCHM major and a grade of C- or better in CHEM 205; Concurrent enrollment in CHEM 211 and CHEM 217. Credit Hours: 3

CHEM215H - Chemistry of Matter for Honors (University Core Curriculum) 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. Credit Hours: 3

CHEM217 - Chemistry of Matter Workshop for CHEM Majors (University Core Curriculum) Supervised computer workshop meets one hour weekly for students in Chemistry of Matter. Concurrent enrollment in CHEM 215. Credit Hours: 1

CHEM217H - Chemistry of Matter Workshop for Honors (University Core Curriculum) Supervised computer workshop meets one hour weekly for students in Chemistry of Matter. Concurrent enrollment in CHEM 215H. Credit Hours: 1

CHEM296 - 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. Credit Hours: 1-2

CHEM311 - 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. Credit Hours: 3

CHEM330 - 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. Credit Hours: 5

CHEM339 - 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. Credit Hours: 3

CHEM340 - 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. Credit Hours: 3

CHEM341 - 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. Credit Hours: 2

CHEM350 - 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. Credit Hours: 3

CHEM351 - 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. Credit Hours: 2

CHEM360 - 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. Credit Hours: 3

CHEM361 - 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. Credit Hours: 1

CHEM386A - 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. Credit Hours: 1

CHEM386B - 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. Credit Hours: 1

CHEM396 - 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. Credit Hours: 1-2

CHEM410 - 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. Credit Hours: 2

CHEM411 - 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. Credit Hours: 3

CHEM431 - 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. Credit Hours: 3

CHEM434 - 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 School of Chemical and Biomolecular Sciences who are advised to take instrumental analysis. Prerequisite: C- or better in CHEM 330. Offered fall semester only. Laboratory fee: \$60. Credit Hours: 2-4

CHEM439 - 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. Credit Hours: 3

CHEM442 - 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. Credit Hours: 3

CHEM443 - 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-hour laboratory per week. Prerequisite: C- or better in CHEM 340, 341, 442, or concurrent enrollment in 442. Offered spring semester only. Lab fee: \$60. Credit Hours: 2

CHEM444 - 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. Credit Hours: 3

CHEM451A - Biochemistry (Same as BCHM 451A and MBMB 451A) First half of the 451 A,B two semester course. Introduction to structure and function of biomolecules including nucleic acids, proteins, sugars, polysaccharides, lipids and membranes, biochemical techniques, expression of genetic information, signal transduction and transport through membranes. Prerequisites: CHEM 340 and CHEM 342 or 442, or equivalents with grades of C- or better. Credit Hours: 3

CHEM451B - Biochemistry (Same as BCHM 451B and MBMB 451B) Second half of 451A,B two semester course. Basic kinetics, enzyme kinetics, enzyme inhibitors, regulation of enzymes, oxidation-reduction, high energy bonds, carbohydrate metabolism, aerobic/anaerobic metabolism, lipid metabolism, nitrogen metabolism, hormonal control of metabolism. Prerequisite: MBMB 451A or BCHM 451A or CHEM 451A or equivalent with a grade of C- or better. Credit Hours: 3

CHEM452 - 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. Credit Hours: 3

CHEM453 - 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. Credit Hours: 2

CHEM456 - 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 442, MATH 141 or 150, MBMB 451A or BCHM 451A or CHEM 451A, or equivalents. Credit Hours: 3

CHEM460 - 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. Credit Hours: 3

CHEM463 - 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. Credit Hours: 1

CHEM468 - 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. Credit Hours: 3

CHEM479 - 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. Credit Hours: 3

CHEM489 - Special Topics in Chemistry Special approval needed from the instructor and director. Credit Hours: 1-3

CHEM490 - 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. Credit Hours: 1

CHEM490H - 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. Credit Hours: 1

CHEM496 - 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. Credit Hours: 1-6

CHEM496H - 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. Credit Hours: 1-6

CHEM499H - 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 program. 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 program one year prior to completion of the honors thesis. Pre/Co-requisite: CHEM 496H. Credit Hours: 3

Chemistry Faculty

Bancroft, Senetta, Associate Professor, Chemical Education, Ph.D., University of Akron, 2014; 2016. K-16 science educator professional development, teacher beliefs, attitudes, and values, equity and student persistence in STEM higher education.

Deria, Pravas, Associate Professor, Inorganic Chemistry, Ph.D., University of Pennsylvania, 2009; 2015. Physical inorganic chemistry, photophysical, photochemical, and electrochemical behaviors of porous molecular assemblies.

Du, Zhihua, Associate Professor, Biochemistry, Ph.D., University of Texas, 1997; 2009. Structural biology, biochemistry, biotechnology.

Gao, Yong, Professor, Organic Chemistry, Ph.D., University of Alberta, 1998; 2000. Polymer, redox flow battery, fuel cell, and clean energy.

Ge, Qingfeng, Professor, Distinguished Scholar, and Director, Physical Chemistry, Ph.D., Tianjin University, 1991; 2003. Catalysis for renewable energy and resources, CO₂ conversion and utilization, chemical kinetics, catalysis by metal oxides.

Goodson, Boyd, Professor, Distinguished Scholar, and Associate Dean, Physical Chemistry, Ph.D., University of California, Berkeley, 1999; 2002. Magnetic resonance and optical spectroscopies, NMR and MRI, lasers, hyperpolarization, contrast agents, biomedical imaging, catalysis, liquid crystals, technique development, nuclear physics and fundamental symmetries.

Kinsel, Gary, Professor, Analytical Chemistry, Ph.D., University of Colorado-Boulder, 1989; 2005. Applied mass spectrometry, ion-molecule reaction chemistry, fundamentals of matrix-assisted laser desorption/ionization MS.

Kohli, Punit, Professor and Interim IMAGE Director, Analytical Chemistry, Ph.D., Michigan State University, 2000; 2004. Fabrication and characterization of functional materials and devices for resource-limited countries.

McCarroll, Matthew, Professor and Fermentation Science Institute Director, Analytical Chemistry, Ph.D., University of Idaho, 1998; 2000. Analytical chemistry and fermentation science.

Moran, Sean, Assistant Professor, Biochemistry, Ph.D., Columbia University, 2008; 2014. Biophysical chemistry, biomolecular structure and dynamics, ultrafast spectroscopy.

Plunkett, Kyle, Professor, Organic Chemistry, Ph.D., University of Illinois, 2005; 2010. Organic electronic materials for renewable energy, polymer chemistry, supramolecular chemistry.

Prakash, Divya, Assistant Professor, Biochemistry, Ph.D., Auburn University, 2014. Biochemistry of anaerobic microbes, molecular biology, bioinorganic chemistry, spectroscopy, transient state kinetics.

Shamsi, Mohtashim, Associate Professor, Analytical Chemistry, Ph.D., University of Toronto, 2012; 2015. Electroanalysis, biosensing, and microfabrication of microdevices for biomedical applications.

Tucker, Sheryl A., Professor and Provost, Analytical Chemistry, Ph.D., University of North Texas, 1994; 2023.

Wang, Lichang, Professor, Physical Chemistry, Ph.D., University of Copenhagen, 1993; 2001. Solar energy harvesting using organic small molecules, fluorescence sensors, catalysis in fuel production and fuel cells, method development.

Emeriti Faculty

Bausch, Mark, Professor, Emeritus, Organic Chemistry, Ph.D., Northwestern, 1984; 1987.

Koropchak, John A., Professor, Emeritus, Analytical Chemistry, Ph.D., University of Georgia, 1980; 1984.

Koster, David F., Professor, Emeritus, Physical Chemistry, Ph.D., Texas A & M University, 1965; 1967.

Tyrrell, James, Professor, Emeritus, Physical Chemistry, Ph.D., University of Glasgow, 1963; 1967.

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