CHEM - CHEMISTRY

CHEM Class Schedule (https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/CHEM/)

Courses

CHEM 101  Introductory Chemistry  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/101/)
Introduction to the basic concepts and language of chemistry; lectures, discussions, and lab. Preparation for chemistry course for students who require additional background before enrolling in CHEM 102. This course has been approved for graduation credit for all students in the College of LAS. Students in other colleges should check with their college office. Additional fees may apply. See Class Schedule. Prerequisite: 2.5 years of high school mathematics, or credit or concurrent registration in MATH 112.
This course satisfies the General Education Criteria for:
Nat Sci Tech - Phys Sciences

CHEM 102  General Chemistry I  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/102/)
For students who have some prior knowledge of chemistry. Principles governing atomic structure, bonding, states of matter, stoichiometry, and chemical equilibrium. Credit is not given for both CHEM 102 and CHEM 202. CHEM 102 and CHEM 103 are approved for General Education credit only as a sequence. Both courses must be completed to receive Natural Science and Technology credit. Prerequisite: Credit in or exemption from MATH 112; one year of high school chemistry or equivalent. All students enrolled in CHEM 102 should also enroll in CHEM 103.
This course satisfies the General Education Criteria for:
Nat Sci Tech - Phys Sciences

CHEM 103  General Chemistry Lab I  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/103/)
Laboratory studies to accompany CHEM 102. Additional fees may apply. See Class Schedule. Credit is not given for both CHEM 103 and CHEM 203. CHEM 102 and CHEM 103 are approved for General Education credit only as a sequence. Both courses must be completed to receive Natural Science and Technology credit. Prerequisite: Credit or concurrent registration in CHEM 102 is required.
This course satisfies the General Education Criteria for:
Nat Sci Tech - Phys Sciences

CHEM 104  General Chemistry II  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/104/)
Lecture and discussions. Chemistry of materials, including organic and biological substances, chemical energetics and equilibrium, chemical kinetics, and electrochemistry. Credit is not given for both CHEM 104 and CHEM 204. Prerequisite: CHEM 102 or CHEM 202 or advanced placement credit for one semester of college-level chemistry.
This course satisfies the General Education Criteria for:
Nat Sci Tech - Phys Sciences

CHEM 105  General Chemistry Lab II  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/105/)
Laboratory studies to accompany CHEM 104. Additional fees may apply. See Class Schedule. Credit is not given for both CHEM 105 and CHEM 205. Prerequisite: CHEM 102 and CHEM 103; credit or concurrent registration in CHEM 104 is required.
This course satisfies the General Education Criteria for:
Nat Sci Tech - Phys Sciences

CHEM 108  Chemistry, Everyday Phenomena  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/108/)
Laboratory-based work in which students will evaluate products (such as antacids), synthesize materials (such as soap), and gain a better understanding of forensic chemistry. Additional fees may apply. See Class Schedule. Credit in CHEM 108 does not count toward Chemistry requirements for students in the Specialized Curriculum in Chemistry, the Science and Letters Chemistry major, the Chemistry Teaching Option, or the Chemistry minor; however the course may be taken by students in any of these groups for general education hours. Prerequisite: Credit or concurrent registration in MATH 112.
This course satisfies the General Education Criteria for:
Nat Sci Tech - Phys Sciences

CHEM 123  Teaching Elementary & Middle School Chemistry  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/123/)
Inquiry-based, hands-on study of chemistry for prospective elementary and middle school teachers. Next Generation Science Standards are emphasized. Credit is not given toward the hours of chemistry required for chemistry and related majors. Prerequisite: Preference given to students in Elementary Education.

CHEM 150  First Semester Success in Chemistry  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/150/)
The first in a set of two courses for first-year students in Chemistry majors. It focuses on helping students to develop a sense of community in Chemistry, acquire the study tools and skills needed to succeed in college-level STEM courses, and identify resources to begin exploring career options. The course emphasizes discussion, group-based activities, short reflective writings, and attendance at campus events (career fairs) and workshops (developing a resume, getting started in research). Prerequisite: Concurrent enrollment in one of CHEM 101, CHEM 102, CHEM 202, or CHEM 222. Restricted to freshmen Chemistry (BS & BSLAS) majors only.

CHEM 152  College Success in Chemistry  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/152/)
The second in a set of two courses designed for Chemistry majors at the freshman level. The course strengthens the link between the Chemistry curriculum and students' interests and individual needs by: (1) Using students' interests as the starting and focal points to guide the content of the course, (2) Creating a supportive and communicative learning environment by using peer mentoring and the structure of a scientific research group as cornerstones in the curricular design, and (3) Emphasizing individual experiences and anticipating the needs of the students by helping them plan their course curricula, developing academic and research skills, while encouraging them to engage in authentic scientific research as undergraduates. Students will participate in a series of programs and activities, including guest lectures from alumni and professors, and skill lectures on reading and assessing scientific literature, oral presentations, scientific writing, career planning and networking, and finding a research group and carrying out effective undergraduate research. Students will be assigned to an undergraduate peer mentor and will attend group meetings, literature reviews, and special topics debates on science and public policy. CHEM 152 is a required course for BS chemistry majors and an optional course for BSLAS chemistry majors. Prerequisite: CHEM 150. Restricted to Specialized Chemistry (BS) and Chemistry (BSLAS) majors only; for first-year students only (except transfer students).

Information listed in this catalog is current as of 07/2021
CHEM 197 Individual Study Freshman credit: 1 to 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/197/)
Individual study of problems related to chemistry or research not necessarily leading to a senior thesis. May be repeated in separate terms to a maximum of 4 hours. A maximum of 2 hours may be used toward the major. A maximum of 18 hours of CHEM 197, CHEM 297, CHEM 397, CHEM 497 and/or CHEM 499 may be used toward the degree. Prerequisite: Chemistry faculty approval required to register.

CHEM 199 Undergraduate Open Seminar credit: 0 to 5 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/199/)
Approved for letter and S/U grading. May be repeated.

CHEM 202 Accelerated Chemistry I credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/202/)
Lectures and discussions. Beginning chemistry course for students in the chemical sciences and others with strong high school chemistry and mathematics preparation. Chemical calculations, structure, bonding and equilibrium. Credit is not given for both CHEM 202 and CHEM 102. Prerequisite: Credit or concurrent registration in MATH 220 or MATH 221; concurrent registration in CHEM 203.
This course satisfies the General Education Criteria for: Nat Sci Tech - Phys Sciences

CHEM 203 Accelerated Chemistry Lab I credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/203/)
Companion laboratory course to CHEM 202. Comprehensive skills-oriented approach to learning laboratory technique and safety. Additional fees may apply. See Class Schedule. Students may receive no more than two credit hours for both this course and CHEM 103. Prerequisite: Concurrent registration or credit in CHEM 202 or consent of instructor.

CHEM 204 Accelerated Chemistry II credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/204/)
Continuation of CHEM 202. Lectures and discussions. Emphasizes chemical thermodynamics, equilibrium, chemical kinetics, and coordination chemistry. Prerequisite: CHEM 202 and/or CHEM 203 and concurrent registration in CHEM 205, or consent of instructor.
This course satisfies the General Education Criteria for: Nat Sci Tech - Phys Sciences

CHEM 205 Accelerated Chemistry Lab II credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/205/)
Laboratory and discussion. Includes experiments in qualitative analysis, inorganic synthesis, and kinetics as well as an individual project. Additional fees may apply. See Class Schedule. Credit is not given for both CHEM 205 and CHEM 223. Prerequisite: Concurrent registration in CHEM 204 or consent of department.

CHEM 222 Quantitative Analysis Lecture credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/222/)
Fundamentals of quantitative analysis, chemical equilibrium and kinetics. This lecture course is intended to accompany CHEM 223. Students with credit in CHEM 222 can receive credit for CHEM 203. Prerequisite: CHEM 104 and CHEM 105 or equivalent.

CHEM 223 Quantitative Analysis Lab credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/223/)
Laboratory course covers the fundamentals of quantitative analysis, equilibrium and kinetics. Additional fees may apply. See Class Schedule. Credit is not given for both CHEM 223 and CHEM 205. Prerequisite: Credit or concurrent registration in CHEM 222.

CHEM 226 Fundamental Organic Chem I credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/226/)
Detailed study of fundamental organic chemistry. Chemical structures, and mechanisms of organic reactions. Reliable elementary organic chemistry. throne to more advanced organic chemistry courses. Prerequisite: MATH 220 or MATH 221.

CHEM 227 Laboratory Methods credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/227/)
Laboratory methods in analytical chemistry. Introduction to elemental analysis, titrimetry, gravimetric analysis, and polarimetry. Analysis of organic and inorganic compounds. Prerequisite: CHEM 226 or consent of instructor.

CHEM 228 Historical and Theoretical Perspectives credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/228/)
Historical and theoretical perspectives of the history of analytical chemistry, including analytical techniques and their applications. Prerequisite: CHEM 227.

CHEM 229 Techniques of Modern Analytical Chemistry credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/229/)
Introduction to modern analytical chemistry, including spectroscopic techniques, instrumental analysis, and bioanalytical chemistry. Prerequisite: CHEM 227.

CHEM 232 Elementary Organic Chemistry I credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/232/)
Prepares students for the separation, isolation and purification of organic compounds. For students in agricultural science, dairy technology, nutrition, dietetics, premedical, predental, and preveterinary programs. One-term survey course; may be followed by CHEM 232. Credit is not given for both CHEM 232 and CHEM 236. 3 hours of credit is an option for those not registered in a discussion-recitation section. 4 hours of credit requires registration in a discussion-recitation section and a live lecture or an online section. Prerequisite: CHEM 104 and CHEM 105, or CHEM 204.

CHEM 233 Elementary Organic Chem Lab I credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/233/)
Basic laboratory techniques in organic chemistry are presented with emphasis on the separation, isolation, and purification of organic compounds. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, predental, and preveterinary programs. Additional fees may apply. See Class Schedule. Credit is not given for both CHEM 233 and CHEM 237. Prerequisite: Credit or concurrent registration in CHEM 232.

CHEM 235 Instrumental Methods of Analysis credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/235/)
Introduction to instrumental methods of analysis, including spectroscopy, chromatography, and mass spectrometry. Prerequisite: CHEM 228 or consent of instructor.

CHEM 236 Fundamental Organic Chem II credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/236/)
Fundamental structural, synthetic, and mechanistic organic chemistry is presented. For students whose major is chemistry or for those in the specialized curricula in chemistry or chemical engineering. The first term of a two-semester integrated sequence (to be followed by CHEM 436). This lecture course is intended to accompany CHEM 237. Credit is not given for both CHEM 236 and CHEM 232. Prerequisite: Completion of CHEM 104 with a B- or higher, or completion of CHEM 204, or completion of CHEM 222 and 223.

CHEM 237 Structure and Synthesis credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/237/)
Laboratory course introduces synthesis and the basic techniques for the separation, isolation and purification of organic and inorganic compounds. Additional fees may apply. See Class Schedule. Credit is not given for both CHEM 237 and CHEM 233. Prerequisite: Credit or concurrent registration in CHEM 236.

CHEM 293 Cooperative Education Practice credit: 0 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/293/)
Off-campus cooperative practice of chemistry or chemical engineering in industrial or governmental facilities. Each chemistry or chemical engineering student participating in cooperative education must register for CHEM 293 for each off-campus term. Same as CHBE 202. Approved for S/U grading only. Prerequisite: Acceptance into the School of Chemical Sciences Cooperative Education Program.

CHEM 295 Chemistry Internship credit: 0 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/295/)
Full-time practice of chemical science in an off-campus industrial setting or research laboratory environment. Summary report required. Approved for S/U grading only. May be repeated. Prerequisite: Completion of freshman year or equivalent, or consent of Director of Cooperative Education in Chemistry.

Information listed in this catalog is current as of 07/2021
CHEM 297 Individual Study Sophomore  credit: 1 to 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/297/)
Individual study of problems related to chemistry or research not necessarily leading to a senior thesis. May be repeated in separate terms. A maximum of 6 hours may be used toward the major. A maximum of 18 hours of CHEM 197, CHEM 297, CHEM 397, CHEM 497 and/or CHEM 499 may be used toward the degree. Prerequisite: Chemistry faculty approval required to register.

CHEM 312 Inorganic Chemistry  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/312/)
Basic chemical bonding in molecules, introduction to symmetry, chemistry of the main group elements, coordination chemistry of the transition elements, organometallic chemistry, solid state chemistry, bioinorganic chemistry, chemistry of the lanthanide and actinide elements. Prerequisite: CHEM 232 or CHEM 236.

CHEM 315 Instrumental Chem Systems Lab  credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/315/)
Laboratory course emphasizes the application of modern instrumental techniques for characterizing the kinetic behavior and equilibrium properties of chemical systems. Prerequisite: Either CHEM 237 or both CHEM 223 and CHEM 233.

CHEM 317 Inorganic Chemistry Lab  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/317/)
Emphasizes modern techniques for the synthesis, purification, and characterization of inorganic and organometallic compounds. There are three components to the course: lectures on laboratory methodology and reporting, laboratory experiments, and report writing. The final third of the course is dedicated to special individualized projects. Additional fees may apply. See Class Schedule. Prerequisite: CHEM 312; completion of campus Composition I general education requirement. This course satisfies the General Education Criteria for: Advanced Composition

CHEM 332 Elementary Organic Chem II  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/332/)
Continuation of CHEM 223 focuses on advanced organic chemistry synthesis, mechanisms, and history, and its applications to peptide and protein sciences, carbohydrate chemistry, and DNA structure, repair and enzymatic processes. Credit is not given for both CHEM 332 and CHEM 436. This course should not be taken by students who have completed CHEM 236. Prerequisite: CHEM 232 and CHEM 233.

CHEM 360 Chemistry of the Environment  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/360/)
Study of the chemistry of the atmosphere, the chemistry of soil and minerals in the Earth's crust, chemistry of natural waters, agricultural chemicals and organic pollutants, and topics related to energy use. Prerequisite: One year of general chemistry (CHEM 102-105 or CHEM 202-205) and one semester of organic chemistry (CHEM 232 or CHEM 236). The organic chemistry class may be taken concurrently with CHEM 360.

CHEM 397 Individual Study Junior  credit: 1 to 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/397/)
Individual study of problems related to chemistry or research not necessarily leading to a senior thesis. May be repeated in separate terms. A maximum of 6 hours may be used toward the major. A maximum of 18 hours of CHEM 197, CHEM 297, CHEM 397, CHEM 497 and/or CHEM 499 may be used toward the degree. Prerequisite: Chemistry faculty approval required to register.

CHEM 420 Instrumental Characterization  credit: 2 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/420/)
Lecture course covers the fundamentals of instrumental characterization including: nuclear magnetic resonance spectroscopy, potentiometry, voltammetry, atomic and molecular spectroscopy, mass spectrometry, and gas and liquid chromatography. 2 undergraduate hours. 2 graduate hours. Prerequisite: CHEM 440; or credit or concurrent registration in CHEM 442; or consent of the instructor.

CHEM 435 Fundamental Organic Chem I  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/435/)
Course is the second term of a two-term integrated sequence and should be taken the term following enrollment in CHEM 236. 3 undergraduate hours. 3 graduate hours. Credit is not given for both CHEM 435 and CHEM 332. Prerequisite: CHEM 236 and CHEM 237; or CHEM 232 and CHEM 233 with consent of instructor.

CHEM 436 Fundamental Organic Chem II  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/436/)
Course is the second term of a two-term integrated sequence and should be taken the term following enrollment in CHEM 236. 3 undergraduate hours. 3 graduate hours. Credit is not given for both CHEM 436 and CHEM 332. Prerequisite: CHEM 236 and CHEM 237; or CHEM 232 and CHEM 233 with consent of instructor.

CHEM 437 Organic Chemistry Lab  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/437/)
Laboratory experiments in organic chemistry with emphasis on synthesis, purification and spectroscopic identification of organic compounds. Additional fees may apply. See Class Schedule. 3 undergraduate hours. 3 graduate hours. Prerequisite: CHEM 233 or CHEM 237 and credit or concurrent registration in CHEM 332 or CHEM 436. This course satisfies the General Education Criteria for: Advanced Composition

CHEM 438 Advanced Organic Chemistry  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/438/)
Advanced topics in structure, synthesis and reactions of organic chemistry. Lecture only course. 3 undergraduate hours. 3 graduate hours. Prerequisite: CHEM 332 or CHEM 436.

CHEM 440 Physical Chemistry Principles  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/440/)
One-term course in physical chemistry emphasizing topics most important to students in the biological and agricultural sciences. Not open to students in the specialized curricula in chemistry and chemical engineering. Laboratory experience in this area provided by CHEM 315 to be taken preferably after CHEM 440. Same as BIOC 440. 4 undergraduate hours. 4 graduate hours. Prerequisite: Completion of either CHEM 104 or CHEM 204, completion of either PHYS 102 or 212, and completion of MATH 241 or equivalent calculus including partial derivatives.

CHEM 442 Physical Chemistry I  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/442/)
Lectures and problems focusing on microscopic properties. CHEM 442 and CHEM 444 constitute a year-long study of chemical principles. CHEM 442 focuses on quantum chemistry, atomic and molecular structure, spectroscopy and dynamics. 4 undergraduate hours. 4 graduate hours. Credit is not given for both CHEM 442 and PHYS 485. Prerequisite: CHEM 204 or CHEM 222; MATH 225, 257, or 415, and a minimal knowledge of differential equations, or equivalent; and PHYS 211, PHYS 212, and PHYS 214 or equivalent.

CHEM 444 Physical Chemistry II  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/444/)
Continuation of CHEM 442, focusing on thermodynamics, statistical mechanics and kinetics from single molecules to the bulk, in gases and in the condensed phase. 4 undergraduate hours. 4 graduate hours. Credit is not given for CHEM 444 and MSE 401 or PHYS 427. Prerequisite: CHEM 442.
CHEM 445  Physical Principles Lab I  credit: 2 Hours.  
Laboratory course featuring experiments of interest to chemists and biochemists. Examples of experiments may include, but are not limited to, electron paramagnetic resonance (EPR) spectroscopy; Fourier-transform infrared (FT-IR) spectroscopy; X-ray diffraction; differential scanning calorimetry (DSC); 1D and 2D Fourier-transform nuclear magnetic resonance (FT-NMR) spectroscopy; and computational quantum chemistry (QM). This course provides hands-on experience with instrumental and computational techniques that are frequently used in both industrial and academic research and will be of interest to students proposing to carry out work in any area of chemistry and in related disciplines. 2 undergraduate hours. 2 graduate hours. Prerequisite: Credit or concurrent registration in CHEM 440, CHEM 442 or CHEM 472 (same as BIOL 446 or MCB 446) or consent of instructor.

CHEM 447  Physical Principles Lab II  credit: 2 Hours.  
Laboratory course featuring experiments of interest to chemists and biochemists. Examples of experiments may include, but are not limited to, molecular mechanics/molecular dynamics (MM/MD) simulations of proteins; Raman spectroscopy; low-energy electron diffraction (LEED); bomb calorimetry; nuclear magnetic resonance imaging (MRI), and enzyme kinetics and inhibition. This course provides hands-on experience with instrumental and computational techniques that are frequently used in both industrial and academic research and will be of interest to students proposing to carry out work in any area of chemistry and in related disciplines. 2 undergraduate hours. 2 graduate hours. Prerequisite: Credit for or concurrent registration in CHEM 440 or CHEM 442 or consent of instructor.

CHEM 450  Astrochemistry  credit: 4 Hours.  
Covers the foundations of astrochemistry, a young field at the intersection between chemistry and astronomy. Topics to be discussed include the interstellar medium, atomic and molecular physics, interstellar chemistry, molecular astronomy, and unresolved enigmas in the field. Same as ASTR 450. 4 undergraduate hours. 4 graduate hours. Prerequisite: CHEM 442 and CHEM 444, or PHYS 427 and PHYS 486, or equivalent experience in quantum mechanics, thermodynamics, and statistical mechanics.

CHEM 451  Astrochemistry Laboratory  credit: 3 or 4 Hours.  
An active, hands-on introduction to observational astrochemistry, laboratory astrochemistry and theoretical astrochemistry. Activities will include astronomical observations of interstellar molecules at the Observatory, spectroscopy of molecules in the laboratory, quantum chemical calculations and simulations of molecular spectra, and modeling of interstellar chemistry. Same as ASTR 451. 3 or 4 undergraduate hours. 3 or 4 graduate hours. Prerequisite: CHEM 450.

CHEM 460  Green Chemistry  credit: 3 or 4 Hours.  
This course seeks to reduce the environmental consequences of the chemical industry. It includes modifying engineering practices, the development of new catalytic processes, modification of existing chemical processes, and bioremediation. 3 undergraduate hours. 4 graduate hours. Prerequisite: CHEM 312, CHEM 332, CHEM 360, or consent of instructor.

CHEM 472  Physical Biochemistry  credit: 3 Hours.  
Same as MCB 446 and BIOL 446. See BIOL 446.

CHEM 474  Drug Discovery & Development  credit: 3 Hours.  
Lecture course on fundamentals of drug discovery and development. Topics include case studies of top-selling, mechanistically diverse drugs, chemistry of drug contraindications, structural biology of drug targets, mechanisms of drug resistance, and drug metabolism and toxicity. 3 undergraduate hours. 3 graduate hours. Prerequisite: CHEM 332 or CHEM 436; and MCB 354 or MCB 450, or consent of instructor.
CHEM 497  Individual Study Senior  credit: 1 to 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/497/)
Individual study of problems related to chemistry or research not necessarily leading to a senior thesis. Course Information:1 to 3 undergraduate hours. No graduate credit. May be repeated in separate terms. A maximum of 6 hours may be used toward the major. A maximum of 18 hours of CHEM 197, CHEM 297, CHEM 397, CHEM 497 and/or CHEM 499 may be used toward the degree. Prerequisite: Chemistry faculty approval required to register.

CHEM 499  Senior Thesis  credit: 2 to 6 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/499/)
Research with thesis, under the direction of a senior staff member in chemistry. Normally the student takes two terms of CHEM 499 in the senior year. 2 to 6 undergraduate hours. No graduate credit. May be repeated up to 10 hours in separate terms. CHEM 499 is recommended for all those who plan to do research and graduate study and it is a prerequisite for graduation with distinction in chemistry. In the term preceding their initial enrollment, those interested in taking the course should consult with their advisers and with the graduate adviser for the area of interest in which they plan to work. A maximum of 10 hours may be counted toward graduation and a thesis must be presented for credit to be received.

CHEM 512  Advanced Inorganic Chemistry  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/512/)
Descriptive chemistry of the main group and transition elements, reactions and reaction mechanisms of inorganic systems, and electronic structure of inorganic molecules and solids. Prerequisite: CHEM 312 or approval of instructor.

CHEM 515  Inorganic Chemistry Seminar  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/515/)
Required of all Chemistry graduate students whose area is inorganic chemistry. Prerequisite: Enrollment is allowed only by second-year graduate students who are presenting their Ph.D. literature seminar during that semester. Undergraduate students are not eligible to enroll in this course.

CHEM 516  Physical Inorganic Chemistry  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/516/)
Includes group theory and use of physical methods to provide information about the geometry, electronic structures, and reactivity of inorganic compounds in solution; emphasizes NMR and ESR. Prerequisite: CHEM 444.

CHEM 517  Advanced Inorganic Chem Lab  credit: 1 to 3 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/517/)
Specialized laboratory techniques; more difficult inorganic syntheses. Prerequisite: Credit or concurrent registration in one of the lecture courses in inorganic chemistry in the 500 series.

CHEM 518  Topics in Inorganic Chemistry  credit: 2 to 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/518/)
Advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as organometallic chemistry, advanced ligand field theory and molecular orbital theory of inorganic compounds, kinetics and mechanisms of inorganic reactions, etc. May be repeated. Prerequisite: CHEM 516 or consent of instructor.

CHEM 520  Advanced Analytical Chemistry  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/520/)
Treatment of the basic issues of importance in modern analytical chemistry. Topics include basic chemical and measurement concepts, measurement instrumentation and techniques, and principles, tools, and applications in spectroscopy, electrochemistry, separations, sensors, mass spectroscopy and surface characterization. Prerequisite: CHEM 315, CHEM 420, and CHEM 444.

CHEM 522  Experimental Spectroscopy  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/522/)
Principles and applications of spectroscopic measurements and instrumentation. Atomic and molecular absorption, emission, fluorescence, and scattering, emphasizing physical interpretation of experimental data. Prerequisite: General physics and chemistry equivalent to a major in physical sciences for a bachelor's degree.

CHEM 524  Electrochemical Methods  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/524/)

CHEM 525  Analytical Chemistry Seminar  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/525/)
Required of all Chemistry graduate students whose area is analytical chemistry. Prerequisite: Enrollment is allowed only by second-year graduate students who are presenting their Ph.D. literature seminar during that semester. Undergraduate students are not eligible to enroll in this course.

CHEM 530  Structure and Spectroscopy  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/530/)
Advanced survey of structure determination in organic chemistry with emphasis on NMR, IR, UV and mass spectroscopy. Prerequisite: CHEM 332 or CHEM 436.

CHEM 532  Physical Organic Chemistry  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/532/)
Advanced survey of physical organic chemistry. The emphasis is on structure and bonding in organic compounds; scope of reaction mechanisms, including reactive intermediates and how these mechanisms and intermediates are studied; and writing reasonable organic reaction mechanisms. Prerequisite: CHEM 332 or CHEM 436 and one year of physical chemistry.

CHEM 534  Advanced Organic Synthesis  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/534/)
Advanced survey of organic chemistry with emphasis on synthesis of organic compounds. Course content includes survey of important synthetic reactions, construction of fundamental subunits and illustrations of strategy and synthetic analysis. Prerequisite: CHEM 332 or CHEM 436.

CHEM 535  Organic Chemistry Seminar  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/535/)
Required of all Chemistry graduate students whose area is organic chemistry. Prerequisite: Enrollment is allowed only by second-year graduate students who are presenting their Ph.D. literature seminar during that semester. Undergraduate students are not eligible to enroll in this course.
CHEM 536  Organic Chemistry Research  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/536/)
Lecture course on research techniques in organic chemistry. Approved for letter and S/U grading. Prerequisite: Consent of instructor.

CHEM 538  Topics in Organic Chemistry  credit: 2 to 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/538/)
Advanced course dealing with subject matter not ordinarily covered by regularly scheduled courses, such as natural product synthesis and biosynthesis, organic photochemistry, chemistry of special families of organic compounds, etc. May be repeated. Prerequisite: CHEM 532 and CHEM 534, both of which may be taken concurrently.

CHEM 540  Quantum Mechanics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/540/)
The sequence, CHEM 540 and CHEM 542, is designed to give seniors and graduate students a unified treatment of quantum mechanics and spectroscopy on an advanced level. CHEM 540 covers the principles of formalism of quantum mechanics, as well as the solution of the Schrodinger equation for models and simple chemical systems. Prerequisite: CHEM 442 or equivalent.

CHEM 542  Quantum Mech and Spectroscopy  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/542/)
Continuation of CHEM 540. Focusing on molecular spectroscopy, nonlinear spectroscopy, kinetics and application of quantum mechanics to dissipative systems. Prerequisite: CHEM 540.

CHEM 544  Statistical Thermodynamics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/544/)
Fundamentals of thermodynamics and statistical mechanics, covering equilibrium, thermodynamic transforms, phase transitions, ensembles and non-equilibrium statistical mechanics, from single molecules to complex biological systems. Prerequisite: CHEM 442 and CHEM 444, or equivalent.

CHEM 545  Physical Chemistry Seminar  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/545/)
Required of all Chemistry graduate students whose area is physical chemistry. Prerequisite: Enrollment is allowed only by second-year graduate students who are presenting their Ph.D. literature seminar during that semester. Undergraduate students are not eligible to enroll in this course.

CHEM 546  Advanced Statistical Mechanics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/546/)
Fundamentals of equilibrium statistical mechanics with selected applications to interacting classical fluids: dense gases, solutions, liquids, plasmas, and ionic solutions; introduction to nonequilibrium statistical mechanics and linear response theory. Prerequisite: CHEM 540 and CHEM 544, or equivalent, or consent of instructor.

CHEM 548  Molecular Electronic Structure  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/548/)
Theoretical basis of the electronic structure of atoms and molecules; molecular orbital concepts and self-consistent field theory; angular momentum and the full rotation group; electron correlation effects; and applications to electronic spectroscopy of organic molecules, detailed descriptions of chemical reactions, and molecular properties. Prerequisite: CHEM 540.

CHEM 550  Advanced Quantum Dynamics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/550/)
The quantum mechanical and semi-classical description of time-dependent processes, including discussions of the time-dependent Schrodinger equation, approximations, interaction of matter with radiation, wave packets, elastic and inelastic scattering, and relaxation phenomena. Prerequisite: Concurrent registration in CHEM 540 or consent of instructor.

CHEM 570  Concepts in Chemical Biology  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/570/)
An overview of the concepts and methods utilized in research at the interface of chemistry and biology, and their application to contemporary problems in biological chemistry. Specific topics covered include, but are not limited to, chemical genetics, bioconjugation reactions, combinatorial chemistry, high-throughput screening, identifying biological targets of small-molecule compounds, combinatorial biosynthesis, sequence-specific DNA-binding compounds, activity-based protein profiling, anti-cancer agents, targeted therapeutics, phase display, and yeast-hybrid systems. Prerequisite: One year (two semesters) of undergraduate organic chemistry is required. One semester of undergraduate biochemistry or molecular biology is preferred.

CHEM 571  Chemical Biology Laboratory  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/571/)
Laboratory course in advanced state-of-the-art experimental techniques used to investigate problems at the interface of chemistry and biology. Specific topics include, but are not limited to, solid-phase peptide synthesis, native chemical ligation and expressed protein ligation, protein expression and analysis, enzyme kinetics and inhibition, high-throughput screening, various methods for examining biomolecular interactions, radiolabeling, mammalian cell biology, fluorescence microscopy, and flow cytometry. Prerequisite: One year (two semesters) of undergraduate organic chemistry is required. One semester of undergraduate biochemistry or molecular biology is preferred.

CHEM 572  Enzyme Reaction Mechanisms  credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/572/)
Introduction to the catalytic strategies used by enzymes for accelerating chemical reactions using a combination of kinetics, enzymology, and structural information. Application of gene databases to infer evolutionary relationships among catalytic mechanisms. Same as MCB 553. Prerequisite: Two semesters of undergraduate organic chemistry (CHEM 232 or CHEM 236 and CHEM 332 or CHEM 436) or consent of instructor.

CHEM 575  Chemical Biology Seminar  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/CHEM/575/)
Required of all Chemistry graduate students whose area is chemical biology. Prerequisite: Enrollment is allowed only by second-year graduate students who are presenting their Ph.D. literature seminar during that semester. Undergraduate students are not eligible to enroll in this course.

CHEM 576  Computational Chemical Biology  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/CHEM/576/)
Hands-on introduction to the simulation of biological molecules and bioinformatics. Topics included the principles of molecular modeling, molecular dynamics and monte carlo simulations, structure prediction in the context of structural and functional genomics, and the assembly of integrated biological systems. Course counts towards the CSE option. Same as BIOP 576 and CSE 576. 4 graduate hours. No professional credit. Prerequisite: One semester of undergraduate biochemistry and statistical thermodynamics or consent of instructor. Recommended: proficiency in Matlab and CS 101 or equivalent.
CHEM 582 Chemical Kinetics & Catalysis  credit: 4 Hours. ([courses.illinois.edu/schedule/terms/CHEM/582/](https://courses.illinois.edu/schedule/terms/CHEM/582/))  
Same as CHBE 551. See CHBE 551.

CHEM 584 Introduction to Materials Chem  credit: 4 Hours. ([courses.illinois.edu/schedule/terms/CHEM/584/](https://courses.illinois.edu/schedule/terms/CHEM/584/))  
Processing of ceramics, metals, polymers, and semiconductors, both traditional and advanced, and their mechanical, electrical, magnetic, optical and thermal properties.

CHEM 585 Materials Chemistry Seminar  credit: 1 Hour. ([courses.illinois.edu/schedule/terms/CHEM/585/](https://courses.illinois.edu/schedule/terms/CHEM/585/))  
Required of all Chemistry graduate students whose area is materials chemistry. Prerequisite: Enrollment is allowed only by second-year graduate students who are presenting their Ph.D. literature seminar during that semester. Undergraduate students are not eligible to enroll in this course.

CHEM 586 Surface Chemistry  credit: 4 Hours. ([courses.illinois.edu/schedule/terms/CHEM/586/](https://courses.illinois.edu/schedule/terms/CHEM/586/))  
Same as CHBE 553. See CHBE 553.

CHEM 588 Physical Methods Mat Chem  credit: 4 Hours. ([courses.illinois.edu/schedule/terms/CHEM/588/](https://courses.illinois.edu/schedule/terms/CHEM/588/))  
Includes physical techniques for characterization in materials chemistry, including thermal analysis, electron microscopy, microprobe analysis and electron spectroscopies, adsorption and surface area measurements, and X-ray powder diffraction.

CHEM 590 Special Topics in Chemistry  credit: 1 to 4 Hours. ([courses.illinois.edu/schedule/terms/CHEM/590/](https://courses.illinois.edu/schedule/terms/CHEM/590/))  
Designed for students majoring or minoring in chemistry who wish to undertake individual studies of a non-research nature under the direction of a faculty member of the department. Approved for both letter and S/U grading. Prerequisite: Consent of instructor and written approval of department head. Staff for the course is the same as for CHEM 599.

CHEM 591 Introductory Professional Development for Chemists  credit: 1 Hour. ([courses.illinois.edu/schedule/terms/CHEM/591/](https://courses.illinois.edu/schedule/terms/CHEM/591/))  
Covers topics to prepare Chemistry graduate students for all aspects of graduate culture. The topics include how to be an effective TA, cultural competence and awareness that enable effective professional interactions with diverse scientists, understanding ethics in research, and becoming savvy in non-technical skills essential to graduate school success such as program management, conflict resolution, time management, and understanding resources available for acute or chronic mental health challenges. This course also sets the departmental expectations for appropriate professional conduct. This course is required for all Chemistry graduate students in the Fall of their first year. 1 graduate hour. No professional credit. Approved for S/U grading only. Prerequisite: Restricted to first-year graduate students in Chemistry.

CHEM 592 Preparing Graduate Fellowships  credit: 1 Hour. ([courses.illinois.edu/schedule/terms/CHEM/592/](https://courses.illinois.edu/schedule/terms/CHEM/592/))  
This course assists first- and second-year graduate students as well as a selected few senior undergraduate students in their efforts to obtain external grants and fellowships. Using the National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) as an example, the course provides the students with general information and guidance about preparing grant applications. Each student will prepare a complete application package, which can be submitted to the NSF GRFP at the end of the course, although such submission is optional. Approved for S/U grading only. Prerequisite: For first- and second-year graduate students in Chemistry. Some senior undergraduate students who have high GPA and research experience in faculty laboratories may enroll with the instructor's approval.

CHEM 593 Advanced Professional Development for Chemists  credit: 1 Hour. ([courses.illinois.edu/schedule/terms/CHEM/593/](https://courses.illinois.edu/schedule/terms/CHEM/593/))  
Follows up on CHEM 591 and covers advanced non-technical topics to prepare graduate students for their last years of graduate study as well as their careers beyond graduate school. Topics include professional development plans, resilience in graduate school, mental health, professional behavior in a diverse work environment, recognizing strengths and weaknesses, all forms of harassment, and implicit bias. This course also continues setting the departmental expectations for appropriate professional conduct. The course is required for all Chemistry graduate students in the Spring of their third year. 1 graduate hour. No professional credit. Approved for S/U grading only. Credit does not count towards the required 20 hours of course credit required for obtaining a Ph.D. in Chemistry. Credit does not count towards earning 32 hours of course credit for the Master of Science in Chemistry without Thesis option, or the 20 hours of course credit for the Master of Science in Chemistry with Thesis option. Prerequisite: Restricted to third-year graduate students in Chemistry.

CHEM 599 Thesis Research  credit: 0 to 16 Hours. ([courses.illinois.edu/schedule/terms/CHEM/599/](https://courses.illinois.edu/schedule/terms/CHEM/599/))  
Candidates for the master's degree who elect research are required to present a thesis. A thesis is always required of students working toward the degree of Doctor of Philosophy. Not all candidates for thesis work necessarily are accepted. Any student whose major is in a department other than chemistry or chemical engineering must receive permission from the head of the Department of Chemistry to register in this course. Approved for S/U grading only. May be repeated in separate terms. During Summer terms, this course can only be taken for 0 to 8 hours.