

# 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. Preparatory 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. 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. Prerequisite: Credit or concurrent registration in CHEM 102 is required.

**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. All students enrolled in CHEM 104 should also enroll in CHEM 105.

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.

**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 150** First Semester Success in Chemistry credit: 1 Hour. (<https://courses.illinois.edu/schedule/terms/CHEM/150/>)

First year orientation course for Chemistry majors focused on helping students develop a sense of community, acquire the study tools and skills needed to succeed in college-level STEM courses, and identify resources to begin exploring career options. Discussions, group-based activities, short reflective writings, and attendance at campus events (career fairs) and workshops (developing a resume, getting started in research) are emphasized. Prerequisite: Concurrent enrollment in one of CHEM 101, CHEM 102, CHEM 202, or CHEM 222. Restricted to freshmen Chemistry (BS & BSLAS) majors only.

**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 232 Elementary Organic Chemistry I credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/232/>)

Presents structural and mechanistic chemistry with emphasis on applications of this material to closely related areas. For students in agricultural, nutritional and biological sciences, as well as premedical, pre dental, and preveterinary programs. One-term survey course; may be followed by CHEM 332. 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, pre dental, 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 236 Fundamental Organic Chem I 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-term 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.

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 232 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 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 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. 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/>)

Lecture and problems focusing on microscopic properties. CHEM 442 and CHEM 444 constitute a year-long study of chemical principles. CHEM 444 focuses 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 204 or CHEM 222; MATH 225, MATH 257, or MATH 415, and a minimal knowledge of differential equations, or equivalent; and PHYS 211, PHYS 212, and PHYS 214 or equivalent.

CHEM 445 Physical Principles Lab I credit: 2 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/445/>)

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 for or concurrent registration in CHEM 440, CHEM 442 or CHEM 472 (same as BIOC 446 or MCB 446) or consent of instructor.

CHEM 447 Physical Principles Lab II credit: 2 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/447/>)

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 452 Data Science for Chemistry and Engineering credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/452/>) Same as CHBE 413. See CHBE 413.

CHEM 460 Green Chemistry credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/460/>)

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. (<https://courses.illinois.edu/schedule/terms/CHEM/472/>)

Same as MCB 446 and BIOC 446. See BIOC 446.

CHEM 474 Drug Discovery & Development credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/474/>)

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 480 Polymer Chemistry credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/480/>)

Same as MSE 457. See MSE 457.

CHEM 482 Polymer Physics credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/482/>)

Same as MSE 458. See MSE 458.

CHEM 483 Solid State Structural Anlysis credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/483/>)

Lectures and laboratory on various aspects of X-ray diffraction studies of solids; topics include the properties of crystals, symmetry, diffraction techniques, data collection methods, and the determination and refinement of crystal structures. 4 undergraduate hours. 4 graduate hours. Prerequisite: CHEM 442 or consent of instructor.

CHEM 488 Surfaces and Colloids credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/488/>)

Same as MSE 480. See MSE 480.

CHEM 492 Special Topics in Chemistry credit: 1 to 3 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/492/>)

Open to advanced undergraduates and graduate students. Deals with subjects not ordinarily covered by regularly scheduled courses. 1 to 3 undergraduate hours. 1 to 3 graduate hours. Approved for letter and S/ U grading. Prerequisite: Credit or concurrent registration in any 400-level course in chemistry.

CHEM 494 Lab Safety Fundamentals credit: 1 Hour. (<https://courses.illinois.edu/schedule/terms/CHEM/494/>)

Same as MSE 492. See MSE 492.

CHEM 495 Teaching Secondary Chemistry credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/495/>)

Intended for undergraduates working toward certification to teach high school chemistry and graduate students working towards a Master's degree in the Teaching of Chemistry. Course aims to provide future teachers with hands-on experience in conducting laboratory experiments, demonstrations, and teaching strategies. 4 undergraduate hours. 4 graduate hours. Course does not count toward the eleven advanced hours in chemistry required in the specialized curriculum, nor does it apply to coursework required for the Ph.D. in Chemistry. Prerequisite: Undergraduate background in general chemistry and credit or concurrent enrollment in CI 403.

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/>)

Structure of the metal solution interface. Electrochemical and physical methods for probing metal/solution interface. Electroanalysis. Principles of electrochemical instrumentation for electroanalysis. Electrode materials. Electrochemical surface science and electrocatalysis. Prerequisite: General physics and chemistry equivalent to a major for a bachelor's degree.

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 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 equilibria, 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, phage 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. (<https://courses.illinois.edu/schedule/terms/CHEM/582/>)

Same as CHBE 551. See CHBE 551.

CHEM 584 Introduction to Materials Chem credit: 4 Hours. (<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. (<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. (<https://courses.illinois.edu/schedule/terms/CHEM/586/>)

Same as CHBE 553. See CHBE 553.

CHEM 588 Physical Methods Mat Chem credit: 4 Hours. (<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. (<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. (<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. (<https://courses.illinois.edu/schedule/terms/CHEM/592/>)

Assists first- and second-year graduate students in Chemistry as well as a selected few senior undergraduate Chemistry majors 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. 1 graduate hour. No professional credit. Approved for S/U grading only. Prerequisite: Intended for first and second-year graduate students in Chemistry. Some senior undergraduate Chemistry majors 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. (<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. 1 graduate hour. No professional credit. Approved for S/U grading only. Prerequisite: Restricted to third-year or later graduate students in Chemistry, normally in the spring semester after passing the preliminary examination. Exceptions may be made only after consulting with the Director of Graduate Studies.

CHEM 595 Graduate Chemistry Internship credit: 0 Hours. (<https://courses.illinois.edu/schedule/terms/CHEM/595/>)

Full-time practice of chemical science in an off-campus industrial setting or research laboratory environment. Summary report required. 0 graduate hours. No professional credit. Approved for S/U grading only. May be repeated. Prerequisite: Restricted to Chemistry major(s), or consent of instructor.

CHEM 599 Thesis Research credit: 0 to 16 Hours. (<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.