

Course Catalog - Fall 2008

Chemistry

101 **Introductory Chemistry** credit: 3 hours.

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. Prerequisite: 2.5 years of high school mathematics, or credit or concurrent registration in MATH 012.

This course satisfies the General Education Criteria for a Physical Sciences course.

102 **General Chemistry I** credit: 3 hours.

For students who have some prior knowledge of chemistry. Principles governing atomic structure, bonding, states of matter, stoichiometry, and chemical equilibrium; descriptive chemistry of the elements and coordination compounds. Students may not receive credit for both CHEM 102 and CHEM 202. Prerequisite: Credit in or exemption from MATH 012; one year of high school chemistry or equivalent.

This course satisfies the General Education Criteria for a Physical Sciences course.

103 **General Chemistry Lab I** credit: 1 hours.

Laboratory studies to accompany CHEM 102. Prerequisite: Credit or concurrent registration in CHEM 102 is required.

This course satisfies the General Education Criteria for a Physical Sciences course.

104 **General Chemistry II** credit: 3 hours.

Lecture and discussions. Section A, B and C (Biological Version): Chemistry of organic and biochemical systems, chemical energetics and equilibrium, chemical kinetics, and reaction mechanisms. Section D (Engineering Version): Chemistry of materials, including organic and biological substances, chemical energetics and equilibrium, chemical kinetics, and solids and crystals. Students may not receive credit 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 a Physical Sciences course.

105 **General Chemistry Lab II** credit: 1 hours.

Laboratory studies to accompany CHEM 104. Prerequisite: CHEM 102 and CHEM 103; credit or concurrent registration in CHEM 104 is required.

This course satisfies the General Education Criteria for a Physical Sciences course.

108 **Chemistry, Everyday Phenomena** credit: 3 hours.

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. 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 012 or MATH 016.

This course satisfies the General Education Criteria for a Physical Sciences course.

199 **Undergraduate Open Seminar** credit: 1 to 5 hours.

Approved for both letter and S/U grading. May be repeated.

202 **Accelerated Chemistry I** credit: 3 hours.

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. Students may not receive credit for both CHEM 102 and CHEM 202. Prerequisite: Admission by U of I placement test or consent of adviser; credit or concurrent registration in MATH 220 or MATH 221; concurrent registration in CHEM 203.

This course satisfies the General Education Criteria for a Physical Sciences course.

203 **Accelerated Chemistry Lab I** credit: 2 hours.

Companion laboratory course to CHEM 202. Comprehensive skills-oriented approach to learning laboratory technique and safety. 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.

204 **Accelerated Chemistry II** credit: 3 hours.

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 a Physical Sciences course.

205 **Accelerated Chemistry Lab II** credit: 2 hours.

Laboratory and discussion. Includes experiments in qualitative analysis, inorganic synthesis, and kinetics as well as an individual project. Students may not receive credit for both CHEM 205 and CHEM 223. Prerequisite: Concurrent registration in CHEM 204 or consent of department.

222 **Quantitative Analysis Lecture** credit: 2 hours.

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 but not for CHEM 121. Prerequisite: CHEM 104 and CHEM 105 or equivalent.

223 **Quantitative Analysis Lab** credit: 1 hours.

Laboratory course covers the fundamentals of quantitative analysis, equilibrium and kinetics. Students may not receive credit for both CHEM 223 and CHEM 205. Prerequisite: Credit or concurrent registration in CHEM 222.

232 **Elementary Organic Chemistry I** credit: 3 hours.

Presents elementary structural and synthetic 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. Students may not receive credit for both CHEM 232 and CHEM 236. Prerequisite: CHEM 104 and CHEM 105, or CHEM 204.

233 **Elementary Organic Chem Lab I** credit: 2 hours.

Basic laboratory techniques in organic chemistry are presented with emphasis on experiments of interest to closely related areas. For students in agricultural science, dairy technology, food technology, nutrition, dietetics, premedical, pre dental, and preveterinary programs. Students may not receive credit for both CHEM 233 and CHEM 237. Prerequisite: Credit or concurrent registration in CHEM 232.

236 **Fundamental Organic Chem I** credit: 4 hours.

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. Students may not receive credit for both CHEM 236 and CHEM 232. Prerequisite: CHEM 204, CHEM 121 or CHEM 222 through CHEM 223.

237 **Structure and Synthesis** credit: 2 hours.

Laboratory course introduces synthesis and the basic techniques for the separation, isolation and purification of organic and inorganic compounds. Students may not receive credit for both CHEM 237 and CHEM 233. Prerequisite: Credit or concurrent registration in CHEM 236.

291 **Cooperative Education Planning** credit: 0 hours.

On-campus planning and discussion of cooperative work-study education programs in industry and government. Each chemistry or chemical engineering student participating in the cooperative education program must register for CHEM 291/CHBE 201 or CHBE 202 each term (CHBE 201 if on-campus, CHBE 202 if off-campus). Same as CHBE 201. Approved for S/U grading only. Prerequisite: Acceptance into the School of Chemical Sciences Cooperative Education Program.

293 **Cooperative Education Practice** credit: 0 hours.

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.

295 **Chemistry Internship** credit: 0 hours.

Full-time practice of chemical science in an off-campus industrial setting or research laboratory environment. Summary report required. May be repeated. Approved for S/U grading only. Prerequisite: Completion of freshman year or equivalent, or consent of Director of Cooperative Education in Chemistry.

312 **Inorganic Chemistry** credit: 3 hours.

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.

315 **Instrumental Chem Systems Lab** credit: 2 hours.

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. Class Section Information: Students must register for one lab and one quiz section.

317 **Inorganic Chemistry Lab** credit: 3 hours.

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. Prerequisite: CHEM 315, or credit or concurrent registration in CHEM 312, or equivalent; completion of campus Composition I general education requirement.

This course satisfies the General Education Criteria for a Advanced Composition course.

332 **Elementary Organic Chem II** credit: 3 hours.

Second course; lectures covering topics in organic chemistry with special applications to the life sciences. This course should not be taken by students who have completed CHEM 236. Students may not receive credit for both CHEM 332 and CHEM 436. Prerequisite: CHEM 232 and CHEM 233.

360 **Chemistry of the Environment** credit: 3 hours.

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 231 or CHEM 236). The organic chemistry class may be taken concurrently with CHEM 360.

420 **Instrumental Characterization** credit: 2 hours.

Lecture course covers the fundamentals of instrumental characterization including: nuclear magnetic resonance spectroscopy, potentiometry, voltammetry, atomic and molecular spectroscopy, mass spectrometry, activation analysis, electron and x-ray spectroscopy, and gas and liquid chromatography. Prerequisite: CHEM 440; or credit or concurrent registration in CHEM 442; or consent of the instructor.

423 **Electronic Circuits I** credit: 0 to 5 hours.

Same as PHYS 404. See PHYS 404.

436 **Fundamental Organic Chem II** credit: 3 hours.

Course is the second term of a two-term integrated sequence and should be taken the term following enrollment in CHEM 236. Students may not receive credit for both CHEM 436 and CHEM 332. Prerequisite: CHEM 236 and CHEM 237; students who have completed CHEM 232 and CHEM 233 may be enrolled with consent of instructor.

437 **Organic Chemistry Lab** credit: 3 hours.

Laboratory experiments in organic chemistry with emphasis on synthesis. Prerequisite: CHEM 233 or CHEM 237

and credit or concurrent registration in CHEM 332 or CHEM 436.

438 **Advanced Organic Chemistry** credit: 3 hours.

Third course, lectures. Topics in structure, synthesis and reactions of organic chemistry. Prerequisite: CHEM 332 or CHEM 436.

440 **Physical Chemistry Principles** credit: 4 hours.

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. Prerequisite: CHEM 222 and CHEM 232, or equivalent; PHYS 102; and MATH 241 or equivalent calculus including partial derivatives.

442 **Physical Chemistry I** credit: 4 hours.

Lectures and problems focusing on microscopic properties. CHEM 442 and CHEM 444 constitute a year-long study of chemical principles covering topics such as quantum chemistry, atomic and molecular structure and spectra, statistical thermodynamics, properties and thermodynamics of materials in gases, solids, and liquids, and chemical kinetics and equilibria. Credit is not given for both CHEM 442 and PHYS 427. Prerequisite: CHEM 204, CHEM 121, or CHEM 222; MATH 225 or MATH 415, and a minimal knowledge of differential equations, or equivalent; and PHYS 211, PHYS 212, and PHYS 214 or equivalent.

444 **Physical Chemistry II** credit: 4 hours.

Continuation of CHEM 442, focusing on bulk properties. Credit is not given for both CHEM 444 and PHYS 427. Prerequisite: CHEM 442.

445 **Physical Principles Lab I** credit: 2 hours.

Laboratory course features experiments concerning the fundamental physical nature of chemical phenomena. Typical experiments include magnetic resonance and thermochemistry. Prerequisite: CHEM 315, and credit or concurrent registration in CHEM 444; or consent of instructor.

447 **Physical Principles Lab II** credit: 2 hours.

Laboratory course features advanced experiments concerning the fundamental physical nature of chemical phenomena. This course is a continuation of CHEM 445. Typical experiments include dielectric constants of liquids and low-energy electron diffraction from surfaces. Prerequisite: CHEM 445 or consent of instructor.

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. Prerequisite: CHEM 442 and CHEM 444, or PHYS 427 and PHYS 486, or equivalent experience in quantum mechanics, thermodynamics, and statistical mechanics.

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.

470 **Computational Chemical Biology** credit: 3 or 4 hours.

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 470. Prerequisite: One semester of undergraduate biology and organic chemistry and statistical thermodynamics or consent of instructor. Recommended: proficiency in Matlab and CS 101 or equivalent.

472 **Physical Biochemistry** credit: 3 hours.

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

480 **Polymer Chemistry** credit: 3 or 4 hours.
Same as MSE 457. See MSE 457.

482 **Polymer Physical Chemistry** credit: 3 or 4 hours.
Same as MSE 458. See MSE 458.

483 **Solid State Structural Anlys** credit: 4 hours.
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. Prerequisite: CHEM 442 or consent of instructor.

484 **Thermodynamics of Materials** credit: 4 hours.
Same as MSE 401. See MSE 401.

488 **Surfaces and Colloids** credit: 3 or 4 hours.
Same as MSE 480. See MSE 480.

492 **Special Topics in Chemistry** credit: 1 to 3 hours.
Open to advanced undergraduates and graduate students. Deals with subjects not ordinarily covered by regularly scheduled courses. Prerequisite: Credit or concurrent registration in any 400-level course in chemistry.

494 **Lab Safety Fundamentals** credit: 1 hours.
Same as MSE 492. See MSE 492.

495 **Teaching Secondary Chemistry** credit: 4 hours.
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 conduction laboratory experiments, demonstrations, and teaching strategies. 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.

499 **Senior Thesis** credit: 2 to 6 hours.
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. CHEM 499 is recommended for all those who plan to do research and graduate study, and it or BIOC 492 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. No graduate credit.

512 **Advanced Inorganic Chemistry** credit: 4 hours.
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.

515 **Inorganic Chemistry Seminar** credit: 1 hours.
Required of all graduate students whose major is inorganic chemistry.

516 **Physical Inorganic Chemistry** credit: 4 hours.
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.

517 **Advanced Inorganic Chem Lab** credit: 1 to 3 hours.

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.

518 **Topics in Inorganic Chemistry** credit: 2 to 4 hours.

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.

520 **Advanced Analytical Chemistry** credit: 3 hours.

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.

521 **Advanced Analytical Chem Lab** credit: 1 hours.

Graduate-level laboratory course in chemical analysis meant to be taken concurrently with CHEM 520. Experiments in atomic and molecular spectroscopy, electrochemistry, and molecular separations cover areas relevant to modern chemical analysis with similar emphasis on sample manipulation, instrumentation and data analysis. Prerequisite: CHEM 315, CHEM 420, CHEM 442, and CHEM 444, or preparation in chemistry and physics equivalent to a major in the natural sciences or engineering at the bachelor's degree level.

522 **Experimental Spectroscopy** credit: 4 hours.

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.

524 **Electrochemical Methods** credit: 4 hours.

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.

525 **Analytical Chemistry Seminar** credit: 1 hours.

Required of all graduate students whose major is analytical chemistry.

526 **Topics in Analytical Chemistry** credit: 2 hours.

Recent advances in measurement science and the application of analytical chemistry to other sciences; designed to acquaint students with techniques and applications not covered in other courses. May be repeated. Prerequisite: Consent of instructor.

530 **Structure and Spectroscopy** credit: 4 hours.

Advanced survey of organic chemistry with emphasis on structure and spectroscopy. Prerequisite: CHEM 332 or CHEM 436.

532 **Physical Organic Chemistry** credit: 4 hours.

Advanced survey of organic chemistry with emphasis on reaction mechanisms and concepts of physical organic chemistry. Prerequisite: CHEM 332 or CHEM 436 and one year of physical chemistry.

534 **Advanced Organic Synthesis** credit: 4 hours.

Advanced survey of organic chemistry with emphasis on synthesis. Prerequisite: CHEM 332 or CHEM 436.

535 **Organic Chemistry Seminar** credit: 2 hours.

Current literature in organic chemistry. Prerequisite: Consent of instructor.

536 **Organic Chemistry Research** credit: 1 hours.

Lecture course on research techniques in organic chemistry. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

538 **Topics in Organic Chemistry** credit: 2 to 4 hours.

Advanced course dealing with a subject 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, one of which may be taken concurrently.

540 **Quantum Mechanics** credit: 4 hours.

The sequence, CHEM 540 and CHEM 542, is designed to give seniors and graduate students a unified treatment of physical chemistry on an advanced level; topics include the electronic structure and spectra of atoms, principles of wave mechanics, experimental and theoretical aspects of the chemical bond in diatomic and polyatomic molecules, statistical thermodynamics, and chemical kinetics. Prerequisite: CHEM 444 or equivalent.

542 **Quantum Mech and Spectroscopy** credit: 4 hours.

Continuation of CHEM 540. Prerequisite: CHEM 540.

544 **Statistical Thermodynamics** credit: 4 hours.

Fundamentals of classical thermodynamics with emphasis on equilibrium and stability criteria; an introduction to equilibrium statistical mechanics with discussion of several ensembles and applications to ideal systems of interest to chemists; and introduction to nonequilibrium thermodynamics. Prerequisite: CHEM 442 and CHEM 444, or equivalent.

545 **Physical Chemistry Seminar** credit: 1 or 2 hours.

Required of all graduate students whose major is physical chemistry. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

546 **Advanced Statistical Mechanics** credit: 4 hours.

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.

548 **Molecular Electronic Structure** credit: 4 hours.

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.

550 **Advanced Quantum Dynamics** credit: 4 hours.

The quantum mechanical 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.

554 **Topics in Physical Chemistry** credit: 2 or 4 hours.

Advanced course dealing with a subject not ordinarily covered by regularly scheduled courses, such as molecular spectroscopy, statistical mechanics, radiation and hot-atom chemistry, molecular quantum mechanics, radio-frequency spectroscopy, advanced experimental methods, kinetics of irreversible processes and cooperative phenomena, etc. May be repeated. Prerequisite: Consent of instructor.

570 **Special Topics Chem Biol** credit: 2 hours.

Advanced tutorials on special topics in Chemical Biology, including biomolecular synthesis and folding, biospectroscopy techniques, and computational biology. Emphasizes the development of presentation skills. Approved for both letter and S/U grading. Prerequisite: Enrollment in the Chemistry Graduate Program or consent of instructor.

572 **Enzyme Reaction Mechanisms** credit: 3 or 4 hours.

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.

573 **Isotopically Labeled Compounds** credit: 0 to 4 hours.

Variable credit course consisting of 2 parts: First half is a practical study of the most commonly used radioisotopes, including procedures for their safe handling; Last half of course covers the synthesis and analysis of isotopically labeled compounds using both radioisotopes and stable isotopes. Course credit is 2 hours (for the first half only) or 4 hours (for the entire course). Prerequisite: CHEM 436.

574 **Genomics, Proteomics, Bioinfo** credit: 3 or 4 hours.

Survey of contemporary methods, applications, and implications of postgenomic biology, including genome sequencing, global RNA analysis, and proteomics. Same as MCB 554. Prerequisite: One year of undergraduate organic chemistry and one semester of biochemistry, or consent of instructor.

575 **Chemical Biology Seminar** credit: 1 hours.

Required of all graduate students whose major is Chemical Biology. Prerequisite: Consent of instructor.

576 **Topics in Biophysical Chem** credit: 4 hours.

Topics of importance in research in biophysical chemistry are discussed with emphasis on physical background and current applications; topics may be chosen from among the following: NMR and ESR spectra of biological macromolecules; x-ray diffraction studies of macromolecules; kinetics and statistical mechanics of helix coil transitions; physical approaches to the refolding and assembly of multi-subunit proteins; fluorescence spectroscopic studies on macromolecules; and light scattering from macromolecules in solution. Same as BIOP 540 and MCB 556. Prerequisite: CHEM 444 or equivalent, or CHEM 472.

578 **Combinatorial Chemistry** credit: 4 hours.

All aspects of combinatorial chemistry, the synthesis of multiple compounds in a rapid fashion, will be covered. Examples of combinatorial biology will also be discussed. Prerequisite: Chemistry graduate students or two semesters of undergraduate organic chemistry.

582 **Chemical Kinetics & Catalysis** credit: 4 hours.

Same as CHBE 551. See CHBE 551.

584 **Introduction to Materials Chem** credit: 4 hours.

Processing of ceramics, metals, polymers, and semiconductors, both traditional and advanced, and their mechanical, electrical, magnetic, optical and thermal properties.

585 **Materials Chemistry Seminar** credit: 1 hours.

Required of all Chemistry graduate students whose major area is Materials Chemistry.

586 **Surface Chemistry** credit: 4 hours.

Same as CHBE 553. See CHBE 553.

588 **Physical Methods Mat Chem** credit: 4 hours.

Physical Methods for Materials Chemistry. 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.

590 **Special Topics in Chemistry** credit: 1 to 4 hours.

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.

599 **Thesis Research** credit: 0 to 16 hours.

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.