CE 4870 Senior Honors Project 1-3(3) Studies or laboratory investigations on special topics in civil engineering which are of interest to individual students and faculty members. Arranged on a project basis for a maximum of individual student effort under faculty guidance. May be repeated for a maximum of three credits. Preq: Senior standing in Civil Engineering Senior Departmental Honors Program.

CE 4880 Honors Research I 2-3(2-3) Individual research under the direction of a Civil Engineering faculty member. Preq: CE 3890.

CE 4890 Honors Research II 3(3) Individual research under the direction of a Civil Engineering faculty member. Preq: CE 4880.

CE 4890 Special Projects 1-3(3) Studies or laboratory investigations on special topics in civil engineering which are of interest to individual students and staff members. Arranged on a project basis with a maximum of individual student effort and a minimum of staff guidance. May be repeated for a maximum of three credits. Preq: Senior standing.

CE 4910* Selected Topics in Civil Engineering 1-3(1-3) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits. Preq: Consent of faculty member/mentor.

CHEMISTRY


CH 1010 General Chemistry 4(3) Introduction to the elementary concepts of chemistry through classroom and laboratory experience. Emphasizes chemical reactions and the use of symbolic representation, the mole concept and its applications and molecular structure. Includes Honors sections. Credit toward a degree will be given for only one of CH 1010 and CH 1050. Coreq: CMPT score of 60 or higher; or CH 1040 or MATH 1050; or MATH 1010 or MATH 1020 or MATH 1030 with a C or better; or preq or concurrent enrollment: MATH 1040 or MATH 1060 or MATH 1070 or MATH 2080 or MATH 2080 or STAT 2300. Coreq: CH 1011.

CH 1011 General Chemistry Laboratory 0(3) Non-credit laboratory to accompany CH 1010. Coreq: CH 1010.

CH 1020 General Chemistry 4(3) Continuation of CH 1010, treating solutions, rates of reactions, chemical equilibrium, electrochemistry, chemistry of selected elements, and an introduction to organic chemistry. Credit toward a degree will be given for only one of CH 1020 or CH 1050. Includes Honors sections. Preq: CH 1010 with a C or better. Coreq: CH 1021.

CH 1021 General Chemistry Laboratory 0(3) Non-credit laboratory to accompany CH 1020. Coreq: CH 1020.

CH 1040 Concepts in Chemistry 2(2) Covers chemical ideas and mathematical skills as applied to important topics including the particulate nature of matter, visualization of chemical behavior, and application of mathematical principles to describe chemical systems. Students who have received credit for any other chemistry course will not be allowed to enroll in or receive credit for CH 1040. To be taken Pass/No Pass only.

CH 1050 Chemistry in Context I 4(3) The chemistry of societal issues, including air quality, global warming, acid rain, and alternative energy sources is discussed in the context of their impact on society. May not be taken as a prerequisite for organic chemistry. Credit toward a degree will be given for only one of CH 1010 or CH 1050. Coreq: CH 1051.

CH 1051 Chemistry in Context I Laboratory 0(3) Non-credit laboratory to accompany CH 1050. Coreq: CH 1050.

CH 1060 Chemistry in Context II 4(3) Continuation of CH 1050. Topics include the chemistry of nuclear energy, new energy sources, nutrition, medicines, new materials, and genetic engineering. May not be taken as a prerequisite for organic chemistry. Credit toward a degree will be given for only one of CH 1020 or CH 1060. Preq: CH 1010 or CH 1050. Coreq: CH 1061.

CH 1061 Chemistry in Context II Laboratory 0(3) Non-credit laboratory to accompany CH 1060. Coreq: CH 1060.

CH 1410 Chemistry Orientation 1(1) Lectures, discussions, and demonstrations devoted to health and safety in chemistry laboratories; use of the chemical literature; and career planning. Preq or concurrent enrollment: CH 1010.

CH 1520 Chemistry Communication 3(3) Methods for scientific communication, including oral, written, and electronic formats. Service-learning projects engage participants with community needs pertaining to chemistry issues.

CH 1990 Creative Inquiry-Chemistry I 1-4(1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

CH 2010 Survey of Organic Chemistry 3(3) Introduction to organic chemistry emphasizing nomenclature, classes of organic compounds, and chemistry of functional groups. For students needing a one-semester course in organic chemistry. Credit toward a degree will be given for only one of CH 2100 or CH 2230. Preq: CH 1020.

CH 2020 Survey of Organic Chemistry Laboratory 1(3) Laboratory emphasizing standard techniques of organic laboratory analysis with the synthesis and characterization of organic molecules discussed in CH 2100. Credit will be given for only one of CH 2100 or CH 2270. Preq: CH 2020. Preq or concurrent enrollment: CH 2100.

CH 2050 Introduction to Inorganic Chemistry 3(3) One semester treatment which emphasizes the properties and reactions of the more common chemical elements. Preq: CH 1020.

CH 2230 Organic Chemistry 3(3) Introductory course in the principles of organic chemistry and the derivation of these principles from a study of the properties, preparations, and interrelationships of the important classes of organic compounds. Credit toward a degree will be given for only one of CH 2100 or CH 2230. Preq: CH 2020.

CH 2240 Organic Chemistry Laboratory 3(3) Continuation of CH 2230. Preq: CH 2230.

CH 2270 Organic Chemistry Laboratory 1(3) Synthesis and properties of typical examples of the classes of organic compounds. Credit toward a degree will be given for only one of CH 2230 or CH 2270. Preq or concurrent enrollment: CH 2230.
CH 2280 Organic Chemistry Laboratory 1(3)  
Continuation of CH 2270. Preq: CH 2270. Preq or concurrent enrollment: CH 2240.

CH 2290 Organic Chemistry Laboratory 1(3)  
One-semester laboratory for Chemical Engineering students. Credit toward a degree will be given for only one of CH 2270 or CH 2290. Preq: CH 2230.

CH 2990 Creative Inquiry–Chemistry II 1-4(1-4)  
In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

CH 3130 Quantitative Analysis 3(3)  
Fundamental principles of volumetric, gravimetric, and certain elementary instrumental chemical analyses. Preq or concurrent enrollment: CH 3150 or CH 3170.

CH 3150 Quantitative Analysis Laboratory 2 (6)  
Laboratory techniques of volumetric, gravimetric, and elementary instrumental chemical analyses. Credit toward a degree will be given for only one of CH 3150 or CH 3170. Preq or concurrent enrollment: CH 3130.

CH 3170 Quantitative Analysis Laboratory 1(3)  
Standard techniques of analytical chemistry: gravimetric, volumetric, and instrumental. Credit toward a degree will be given for only one of CH 3150 or CH 3170. Preq or concurrent enrollment: CH 3130.

CH 3300 Introduction to Physical Chemistry 3(3)  
One-semester treatment of physical chemistry emphasizing topics that are especially useful in the life sciences, agriculture, and medicine: chemical thermodynamics, equilibrium, solutions, kinetics, electrochemistry, macromolecules, and surface phenomena. Credit toward a degree will be given for only one of CH 3300 or CH 3310. Preq: MATH 1060.

CH 3310 Physical Chemistry 3(3)  
Includes the gaseous state, thermodynamics, chemical equilibrium, and atomic and molecular structure, from both experimental and theoretical points of view. Credit toward a degree will be given for only one of CH 3300 or CH 3310. Preq: MATH 2060 and PHYS 2210.

CH 3320 Physical Chemistry 3(3)  
Continuation of CH 3310, including chemical kinetics, liquid and solid state, phase equilibria, solutions, electrochemistry and surfaces. Includes Honors sections. Preq: CH 3310 or CHE 2200.

CH 3390 Physical Chemistry Laboratory 1(3)  
Experiments are selected to be of maximum value to Chemistry and Chemical Engineering majors. Preq or concurrent enrollment: CH 3310 or CHE 2200.

CH 3400 Physical Chemistry Laboratory 1(3)  
Continuation of CH 3390. Preq or concurrent enrollment: CH 3320.

CH 3410 Introduction to Research 1(1)  
Students are introduced to a variety of skills and topics related to the pursuit of independent research. The course addresses choosing a research topic, planning a research project, discovering and organizing prior work, keeping research records, laboratory safety and ethics in scientific research. Preq: CH 1020 and ENGL 1030.

CH 3600 Chemical Biology 3(3)  
Introduction to the chemical foundations of biological phenomena, focusing on bioorganic, biophysical, bioinorganic, and bioanalytical chemistry principles. Preq: CH 2010 or CH 2230.

CH 3990 Creative Inquiry–Chemistry III 1-4(1-4)  
In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

CH 4010* Organic Chemistry 3(3)  
Organometallic compounds are useful in applications ranging from largescale industrial reactions to antibiotics, and this versatility arises from the chemically unique metalcarbonyl bond. Course begins with fundamental coordination chemistry, then progresses through ligand substitution, oxidative addition/reductive elimination, catalytic transformations and polymerization reactions. Includes honors sections. Preq: CH 2230.

CH 4020* Inorganic Chemistry 3(3)  
Basic principles of inorganic chemistry are discussed with special emphasis on atomic structure, chemical bonding, solid state, coordination chemistry, organometallic chemistry, and acid-base theories. The chemistry of certain selected elements is treated. Includes Honors sections. Preq: CH 3310 and CH 3320.

CH 4030 Advanced Synthetic Techniques 2 (6)  
Introduction to advanced laboratory techniques in synthesis and characterization of inorganic and organic compounds. Laboratory sessions consist of a set of eight experiments in modern fields of chemistry, including superconductivity, buckminsterfullerene, bioorganic chemistry, medicinal chemistry, asymmetric synthesis, and polymer chemistry. Preq: CH 2050 or CH 4020; and CH 2270; and CH 2280; and CH 3400 or CH 4120.

CH 4040* Bioinorganic Chemistry 3(3)  
Covers fundamentals of bioinorganic chemistry with review of necessary inorganic and biochemical concepts. Topics include metal uptake, transport, and storage in biological systems; functions of metals in proteins; metal ion interactions with nucleic acids; physical methods used in bioinorganic chemistry; heavy element toxicity, radiopharmaceuticals and other metalloids. Includes Honors sections. Preq: BCH M 3010 or CH 2050.

CH 4110* Instrumental Analysis 3(3)  
Principles of operation and application of modern chemical instrumentation in the field of analytical chemistry. Topics include basic electronics, statistics, optical, mass, magnetic resonance, electron and x-ray spectroscopies, radiochemistry, and separation science. Preq: CH 3310. Preq or concurrent enrollment: CH 3320.

CH 4120 Instrumental Analysis Laboratory 2 (5)  
Reinforces principles of chemical instrumentation described in CH 4110 by practical, hands-on experience. Aspects of sample preparation, standardization, data acquisition and interpretation, and report formulation procedures common in chemical analyses are considered for a range of modern instrumental methods. Preq or concurrent enrollment: CH 4110.

CH 4130 Chemistry of Aqueous Systems 3(3)  
Study of chemical equilibria in aqueous systems, especially natural waters; acids and bases, dissolved C02, precipitation and dissolution, oxidation-reduction, adsorption, etc. Includes Honors sections. Preq: CH 1020 or 1060.

CH 4140* Bioanalytical Chemistry 3(3)  
Survey of selected areas of importance in bioanalytical chemistry. Fundamental principles, advanced topics, and applications of analytical measurements of biomolecules, bioassays, immunosassys, separations, mass spectrometry, method validation, macromolecular crystallography, microscopy, and imaging. Preq: CH 3310 and CH 4110.

CH 4210 Advanced Organic Chemistry 3(3)  

CH 4250* Medicinal Chemistry 3(3)  
Survey of the pharmaceutical drug discovery process. Covers discovery of candidate compounds, bioassay methods, and associated regulatory and commercial issues. Case studies are selected from the current literature. Preq: CH 2240.

CH 4270* Organic Spectroscopy 3(2)  
Survey of modern spectroscopic techniques used in the determination of molecular structure. Emphasizes the interpretation of spectra: nuclear magnetic resonance, ultraviolet, infrared, mass spectroscopy, optical rotatory dispersion, and circular dichroism. Includes Honors sections. Students are expected to have completed one year each of organic chemistry and physical chemistry. Coreq: CH 4271.

CH 4271* Organic Spectroscopy Laboratory 0(3)  
Non-credit laboratory to accompany CH 4270. Coreq: CH 4270.

CH 4350* Atomic and Molecular Structure 3(3)  
Introduction to quantum theory and its application to atomic and molecular systems. Topics include harmonic oscillator, hydrogen atom, atomic and molecular orbital methods, vector model of the atom, atomic spectroscopy, and molecular spectroscopy. Includes Honors sections. Preq: CH 3320.
CH 4360* Computational Quantum Chemistry and Electronic Structure Methods 3(3) An introduction to electronic structure calculations. Topics include types of quantum mechanical calculations, the theory behind ab initio and density functional theory methods, basis sets and basis set effects. Emphasis is placed on understanding the results of calculations and relating them to basic chemical principles. Preq: CH 3320.

CH 4430 Research Problems 1-6(3-18) Original investigation of an assigned problem in a fundamental branch of chemistry. Work must be carried out under the supervision of a member of the staff. May be repeated for a maximum of six credits. Includes Honors sections. Preq: Consent of instructor.

CH 4440 Research Problems 1-6(3-18) Continuation of CH 4430. Original investigation of an assigned problem in a fundamental branch of chemistry. Work must be carried out under the supervision of a member of the staff. May be repeated for a maximum of six credits. Includes Honors sections. Preq: Consent of instructor.

CH 4500 Chemistry Capstone 3(1) Students undertake capstone projects in a team format. Projects necessitate the use of electronic and print resources, demonstrate expertise with a specific instrument or experimental technique, require strong collaboration within a team setting, and produce a peer-reviewed oral and written report. Preq: Senior standing. Coreq: CH 4501.

CH 4501 Chemistry Capstone Laboratory 0(6) Non-credit laboratory to accompany CH 4500. Coreq.: 4500.

CH 4510* Frontiers in Polymer Chemistry 3(3) Survey of selected areas of current research in polymer science with particular emphasis on polymer synthesis. Although a text is required for review and reference, course is primarily literature based and focused on areas of high impact to multidisciplined technology. Preq: CH 4430/444 undergraduates research or results of that work are appropriate. Preq: CH 1520.

CH 4520 Chemistry Communication II 1(1) Methods for scientific communication, including oral, written, and electronic formats. Student presentations focus on current chemical literature topics pertinent to their CH 4430/444 undergraduate research or results of that work are appropriate. Preq: CH 1520.

CH 4710* Teaching Chemistry 3(3) Study of topics in chemistry addressed in the context of constructivist methodologies. Also considers laboratory work and management, laboratory safety, and the use of technology in the chemistry classroom. Preq: Any 3000-level chemistry course. Students who have not completed a 3000-level chemistry course but have high school teaching experience may request an override from the instructor.

CH 4990 Creative Inquiry-Chemistry IV 1-4(14) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

CHE 1300 Introduction to Chemical Engineering 3(3) Tools and methods for analyzing engineering problems with applications in chemical and biochemical processes, including development of process flow diagrams, numerical methods, graphing, and applied statistics. Problem-solving and computer skills are developed in the lecture and laboratory activities. Preq: CH 1010 and ENGR 1060, each with a C or better. Preq or concurrent enrollment: MATH 1060 or MATH 1070; and PHYS 1220.

CHE 1990 Creative Inquiry-Chemical and Biomolecular Engineering I 4(4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. To be taken Pass/No Pass only. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

CHE 2110 Mass and Energy Balances 4(3) Introduction to fundamental concepts of chemical engineering, including mass and energy balances, PVT relationships for gases and vapors, and elementary phase equilibria; problem-solving and computer skills are developed in lab. Preq: CH 1020 and MATH 1080 and PHYS 1220 and CHE 1300. Coreq: CHE 2111.

CHE 2111 Mass and Energy Balances Laboratory 0(2) Non-credit laboratory to accompany CHE 2110. Coreq: CHE 2110.

CHE 2200 Chemical Engineering Thermodynamics I 3(3) Topics include first and second laws of thermodynamics, ideal gases, PVT properties of real fluids, energy balances with chemical reactions, and thermodynamic properties of real fluids. Preq: CHE 2110 and MATH 2060.

CHE 2300 Fluids/Heat Transfer 4(3) General principles of chemical engineering and study of fluid flow, fluid transportation, and heat transmission. Special emphasis is placed on theory and its practical application to design. Preq: CHE 2110. Preq or concurrent enrollment: CHE 2200 and MATH 2060. Coreq: CHE 2301.

CHE 2301 Fluids/Heat Transfer Laboratory 0(2) Non-credit laboratory to accompany CHE 2300. Coreq: CHE 2301.

CHE 2990 Creative Inquiry-Chemical and Biomolecular Engineering 1-4(14) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. To be taken Pass/No Pass only. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

CHE 3000 Honors Seminar 1(1) A capstone experience for students enrolled in the Departmental Honors Program with current research issues in the profession. This assists the student in preparing a research proposal for the Senior Thesis. To be taken Pass/No Pass only. Preq: CHE 2200 and CHE 2300; and admission to the departmental honors program.

CHE 3071 Unit Operations Laboratory I 3(2) Laboratory work in the unit operations of fluid flow, heat transfer, and evaporation. Stress is on the relation between theory and experimental results and the statistical interpretation of those results and on report preparation and presentation. Preq: CHE 2200 and CHE 2300. Coreq: CHE 3071.

CHE 3101 Unit Operations Laboratory II 3(2) Laboratory work in the unit operations of fluid flow, heat transfer, and evaporation. Stress is on the relation between theory and experimental results and the statistical interpretation of those results and on report preparation and presentation. Preq: CHE 2200 and CHE 2300. Coreq: CHE 3101.


CHE 3210 Chemical Engineering Thermodynamics II 3(3) Continuation of CHE 2200. Topics include thermodynamics of power cycles and refrigeration/liquefaction, thermodynamic properties of homogeneous mixtures, phase equilibria, and chemical reaction equilibria. Preq: CHE 2200 and MATH 2080.

CHE 3300 Mass Transfer and Separation Processes 4(3) Study of mass transport fundamentals and application of these fundamentals to separation technologies, with emphasis on gas absorption, stripping, distillation, and liquid-liquid extraction. Preq: CHE 2300. Preq or concurrent enrollment: CHE 3210. Coreq: CHE 3301.

CHE 3301 Mass Transfer and Separation Processes Laboratory 0(3) Non-credit laboratory to accompany CHE 3300. Coreq: CHE 3300.

CHE 3350 Process Dynamics and Control 3(3) Mathematical analysis of the dynamic response of process systems. Basic automatic control theory and design of control systems for process applications. Preq: CHE 2300 and MATH 2080. Preq or concurrent enrollment: CHE 3300.

CHE 3950 Honors Research I 3 (9) Individual research under the direction of a Chemical Engineering faculty member. Preq: CHE 3000.

CHE 3990 Creative Inquiry-Chemical and Biomolecular Engineering 1-4(14) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

CHE 4010* Transport Phenomena 3(3) Mathematical analysis of single and multidimensional steady-state and transient problems in momentum, energy, and mass transfer. Both the similarities and differences in these mechanisms are stressed. Preq: CHE 3300 and MATH 2080.