CHE 4360* Computational Quantum Chemistry and Electronic Structure Methods 3(3) Hands-on 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.

CHE 4430 Research Problems 1-6(3-18) Original investigation of an assigned problem in a fundamental branch of chemistry. May be repeated for a maximum of six credits. Includes Honors sections. Preq: Consent of instructor.

CHE 4440 Research Problems 1-6(3-18) Continuation of CH 4430. Original investigation of an assigned problem in a fundamental branch of chemistry. May be repeated for a maximum of six credits. Includes Honors sections. Preq: Consent of instructor.

CHE 4520 Chemistry Communication II 1(1) Non-credit laboratory to accompany CH 4500. Coreq: CH 4500.

CHE 4500 Chemistry Capstone 3(3) 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 4500.

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

CHE 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 4430/4440/graduate research or results of that work are appropriate. Preq: CH 1520.

CHE 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.

CHE 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. May 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, PV relations 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, PV 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 2300.

CHE 2990 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. May 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) Acquaints 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 departmental honors program.

CHE 3070 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 3071 Unit Operations Laboratory II 0(3) Non-credit laboratory to accompany CHE 3070. Coreq: CHE 3070.

CHE 3190 Engineering Materials 3(3) Introduction to the fundamental properties and behavior of engineering materials emphasizing polymers, metals, ceramics, and composite materials. Preq: CHE 2110. Preq or concurrent enrollment: CH 2220 and CHE 2200.

CHE 3210 Chemical Engineering Thermodynamics II 3(3) A 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(2) Non-credit laboratory to accompany CHE 3300. Coreq: CHE 3300.

CHE 3530 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 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. 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.
CHE 4070 Unit Operations Laboratory II 3(1)
Continuation of CHE 3070 with experiments primarily on the diffusional operations. Additional lecture material on report writing and general techniques for experimental measurements and analysis of data, including statistical design of experiments. Preq: CHE 3070 and CHE 3300. CHE 4071.

CHE 4071 Unit Operations Laboratory II Laboratory 0(6) Non-credit laboratory to accompany CHE 4070. Coreq: CHE 4070.

CHE 4120* Polymer Engineering 3(3) Design-oriented course in synthetic polymers. Topics include reactor design used in polymer production, effect of step versus addition kinetics on reactor design, epoxy curing reactions, polymer solubility, influence of polymerization and processing conditions on polymer crystallinity. Preq: CH 2240 and CH 3320.

CHE 4130 Polymer Composite Engineering 3(3) Presents fundamental concepts of polymeric composite materials. Main topics include classification of polymeric matrices; flow behavior and viscoelastic properties of fiber precursors and polymeric matrices; and physical and mechanical properties of composites. Preq: CH 2240; and CHE 4120 or MSE 4150.

CHE 4140 Green Engineering 3(3) Green chemisty engineering principles are applied to process and product design. Green engineering metrics are applied to quantify the sustainability, life cycle and environmental impact of chemical technologies, processes and products. Emphasis is placed on industrial sustainability, product innovation, risk assessment, policy and societal implications. Preq: CHE 2110 and MATH 1080.

CHE 4150 Alternative Energy 3(3) Addresses the technological, environmental, political, social and economic fundamentals associated with using alternative energy sources to meet global energy needs. Engineering analyses is used to evaluate several alternative energy technologies, including biomass, geothermal, hydropower, nuclear, solar and wind. Preq: CHE 2200 and CHE 2300.

CHE 4310 Chemical Process Design I 3(3) Steps in creating a chemical process design from original concept to successful completion and operation. Topics include process layout, equipment selection and sizing, safety and environmental evaluation, engineering economics, simulation, evaluation of alternatives, and optimization. Preq: CHE 3070 and CHE 3210 and CHE 3300. Preq or concurrent enrollment: CHE 4500.

CHE 4330 Process Design II 3(1) Continuation of CHE 4310. Principles of process development, design, and optimization are applied in a comprehensive problem carried from a general statement of the problem to detailed design and economic evaluations. Preq: CHE 3300 and CHE 4070 and CHE 4310 and CHE 4500. Coreq: CHE 4331.

CHE 4331 Process Design II Laboratory 0(6) Non-credit laboratory to accompany CHE 4330. Coreq: CHE 4330.

CHE 4430 Safety, Environmental and Professional Practice 1 2(2) Preparation of senior chemical engineering students for entry into the profession with an emphasis on process safety. Timely information is presented on career options for chemical engineers, professional practice, and a host of safety-related topics. Outside speakers are used frequently. To be taken Pass/No Pass only. Preq or concurrent enrollment: CHE 4310.

CHE 4440 Safety, Environmental and Professional Practice 1(1) Students work on safety modules available from SACHE that culminate in a safety certificate. Working in groups, students present and discuss topics related to ethics, safety, the environment, and current events. To be taken Pass/No Pass only. Preq: CHE 4430. Preq or concurrent enrollment: CHE 4330.

CHE 4450 Selected Topics in Chemical Engineering 3(3) Topics not covered in other courses, emphasizing current literature, research, and practice of chemical engineering. Topics vary from year to year. May be repeated, but only if different topics are covered. Preq: Consent of instructor.

CHE 4500* Chemical Reaction Engineering 3(3) Review of kinetics of chemical reactions and an introduction to the analysis and design of chemical reactors. Topics include homogeneous and heterogeneous reactions, batch and continuous flow reaction systems, catalysis, and design of industrial reactors. Preq: CHE 3210 and CHE 3300 and CH 3320.

CHE 4910 Special Projects in Chemical Engineering 1-3(1-3) Topics requested by students or offered by faculty as the need arises. Topics may include review of current research in an area, technological advances, and national engineering goals. May be repeated for a maximum of six credits, but only if different topics are covered. Includes Honors sections.

CHE 4950 Honors Research II 3(9) Individual research under the direction of a chemical engineering faculty member. Preq: CHE 3950.

CHE 4970 Honors Thesis 1(1) Preparation of honors thesis based on research conducted in CHE 3950 and CHE 4950. Preq: CHE 4950.

CHE 4990 Creative Inquiry - Chemical and Biomolecular Engineering I(1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. Arrangements with faculty members must be established prior to registration. Preq: Consent of faculty member(s).

CHIN 3050 Chinese Conversation and Composition I 3(3) Practice in the spoken language emphasizing vocabulary, word-combinations, pronunciation, and comprehension. Learning practical language skills and intercultural communication by studying various topics. Preq: CHIN 2020

CHIN 3060 Chinese Conversation and Composition II 3(3) Continuation of CHIN 3050. More practice in the spoken language emphasizing vocabulary, word combinations, pronunciation, and comprehension. Learning practical language skills and intercultural communication by studying various topics. Preq: CHIN 3050.

CHIN (PHIL) 3120 Philosophy in Ancient China 3(3) Study of the history of Chinese philosophy from fifth century BCE, including Confucianism, Daoism, Mohism, Legalism, Buddhism, Neo-Confucianism, and Neo-Confucianism. Examination of Chinese philosophers’ views and arguments on questions of life and death, history and society, education and personal cultivation. May be used to satisfy general modern language requirements. May also be offered as PHIL 3120.

CHIN (PHIL) 3130 Philosophy in Modern China 3(3) Study of the history of Chinese philosophy from the 19th century BCE, including Confucianism, Daoism, Mohism, Legalism, Buddhism, Neo-Daoism, and Neo-Confucianism. Examination of Chinese philosophers’ views and arguments on questions of life and death, history and society, education and personal cultivation. May not be used to satisfy general modern language requirements. May also be offered as PHIL 3130.