Chemical and Biochemical Engineering Courses (CBE)

This is a list of all chemical and biochemical engineering courses. For more information, see Chemical and Biochemical Engineering.

CBE:0000 Chemical Engineering Internship/Co-op 0 s.h. Chemical engineering students participating in the Cooperative Education Program register for this course during work assignment periods; registration provides a record of participation in the program on the student's permanent record. Requirements: admission to Cooperative Education Program.

CBE:1000 CBE Departmental Seminar 1 s.h. Introduction to the profession and the department; presentations by guest speakers, visits to laboratories and industries.

CBE:1180 First-Year Seminar 1 s.h. Small discussion class taught by a faculty member; topics chosen by instructor; may include outside activities (e.g., films, lectures, performances, readings, visits to research facilities, field trips). Requirements: first- or second-semester standing.

CBE:2030 Energy and Society 3 s.h. History of energy development and use throughout the world; how energy has affected the development of human societies; societal impact of engineering advances; current state of energy consumption worldwide, including distribution of energy sources, global variations in consumption, advantages and disadvantages of current energy sources; role of fossil fuel consumption in global climate change; potential scenarios for the future of energy.

CBE:2040 Environment, Energy, and Climate Change 3 s.h. Traditional concerns (e.g., pollution and conservation of energy resources) with clear, scientific explanations; Earth's dynamic processes and response to natural and human-induced stresses; link between energy and climate; reasons why we need to support reducing emissions and build a clean and sustainable environment.

CBE:2050 Severe and Unusual Weather 3 s.h. Basic weather concepts behind severe weather phenomena and essential safety information; how weather events cause billions of dollars in damage and thousands of casualties; winter storms can impact half of the nation, paralyzing the transportation network with icy roads and wind driven snow; tornadoes can strike within minutes tearing apart homes; hurricanes can destroy entire communities with strong winds, heavy rain, and deadly storm surge; how understanding severe weather and knowing what to do before, during, and after an event can significantly reduce injury, deaths, and property damage. Same as CEE:2050.

CBE:2105 Process Calculations 3 s.h. Fundamental principles of chemical process analysis, including material and energy balances for single-unit and multiple-unit processes, analysis of reactive and nonreactive systems, introduction to equations of state, thermodynamics of multiphase systems. Prerequisites: MATH:1550.

CBE:3000 Professional Seminar: Chemical Engineering 1 s.h. Professional aspects of chemical engineering presented through lectures and discussions by guest speakers, field trips, films, panel discussions. Prerequisites: CBE:2105. Requirements: sophomore standing.

CBE:3105 Chemical Engineering Thermodynamics 3 s.h. Applications of thermodynamic principles to chemical and physical processes; prediction of material properties; phase and chemical equilibria applied to mixtures and reacting systems. Prerequisites: ENGR:2130. Corequisites: CBE:2105.


CBE:3117 Separations 3 s.h. Solution of industrial problems including design of distillation, extraction, absorption, adsorption, drying, membrane processes, and mechanical separations. Prerequisites: CBE:2105 and CBE:3105. Corequisites: CBE:3113.

CBE:3120 Chemical Reaction Engineering 3 s.h. Application of chemical reaction kinetics to design of chemical reactors: batch reactors, mixed flow reactors, plug flow reactors; reversible and irreversible single reactions; parallel, series, and mixed reactions; temperature and pressure effects on reactor design; heterogeneous catalysis; transport in porous catalysts. Prerequisites: MATH:2560. Corequisites: CBE:3105. Recommendations: CBE:3113.


CBE:3150 Thermodynamics/Transport Laboratory 3 s.h. Error analysis, propagation of errors, experimental design, data collection techniques, report writing, oral presentations, laboratory safety; laboratory investigations of thermodynamics, fluid flow, heat transfer, fluid rheology. Prerequisites: CBE:3105 and CBE:3113. Recommendations: statistics course.
CBE:3155 Chemical Reaction Engineering/Separations Laboratory 3 s.h.

CBE:3160 Engineering Analysis of Alternative Energy Systems 3 s.h.
Engineering and sustainability analyses of conventional and emerging energy technologies; alternative energy sources, including biomass, wind, solar, geothermal; alternative energy carriers (transportation fuels), including varied biofuels, hydrogen, natural gas, ammonia. Prerequisites: ENGR:2130.

CBE:3205 Introduction to Biochemical Engineering 3 s.h.

CBE:3415 Statistical and Computational Analysis of Weather and Climate Data 3 s.h.
Statistical and computational (Python programming) analysis of weather and climate data, univariate and multivariate statistics, hypothesis testing, statistical forecasting, forecast verification, time-series analysis, principal component analysis, trend analysis, and cluster analysis. Requirements: senior or graduate standing.

CBE:3998 Individual Investigations: Chemical Engineering arr.
Individual projects for chemical engineering undergraduate students, such as laboratory study, engineering design project, analysis and simulation of an engineering system, computer software development, research.

CBE:4105 Process Dynamics and Control in Design 3 s.h.
Theory and application of process dynamics to the design of chemical process control systems; mathematical models of unit operations, transfer functions, feedback and feed-forward control, stability, instrumentation, digital control systems; computer methods, including simulation and commercial software use; laboratory focus on process analysis and design. Prerequisites: MATH:2560 and CBE:2105 and (CBE:3109 or CBE:3110). Corequisites: CBE:3120.

CBE:4109 Chemical Engineering Process Design I 2 s.h.
Engineering economics of process evaluation, including time value of money and bases for cost estimation; preliminary design of chemical process plants using computer-aided engineering. Prerequisites: (CBE:3110 and CBE:3115) or (CBE:3109 and CBE:3113 and CBE:3117). Corequisites: CBE:3120 and CBE:3125.

CBE:4110 Chemical Engineering Process Design II 3 s.h.
Capstone chemical engineering course; design and optimization of chemical process plants; application of process calculations, thermodynamics, kinetics, process synthesis, energy efficiency in separations, heat-exchanger network synthesis, physical property estimation, safety, computer-aided design, unit operations theory, process control, and economics. Prerequisites: CBE:4109. Recommendations: CBE:4105 and CBE:3205.

Microscopy methods for research; all aspects of research, from sample preparation to imaging to data analysis; when to use a particular microscopy procedure; theory, operation, and application of scanning electron microscopy, scanning probe microscopy, laser scanning microscopy, X-ray microanalysis. Requirements: a physical science course. Same as ACB:4156, EES:4156.

CBE:4195 Senior Enriching Activities Seminar 0 s.h.
Aspects of chemical engineering education, including multidisciplinary team skills, understanding the impact of engineering practice locally and globally. Corequisites: CBE:4110. Requirements: completion of enriching activity.

CBE:4410 Sustainable Systems 3 s.h.
New and emerging concepts in sustainable systems design and assessment. Same as CEE:4107.

CBE:4420 Environmental Chemistry 3 s.h.
Principles of general, physical, organic chemistry applied in water and air systems; emphasis on qualitative and quantitative understanding of chemical kinetics and equilibrium; acid-base reactions, complex formation, precipitation, dissolution, and oxidation-reduction reactions; organic nomenclature. Prerequisites: CHEM:1120. Same as CEE:4150.

CBE:4459 Air Pollution Control Technology 3 s.h.
Sources, environmental and health impacts, regulations, modeling of air pollution; processes and alternative strategies for control; global climate considerations. Same as CEE:4159, IGPI:4159.

CBE:5000 Seminar in Chemical and Biochemical Engineering 1 s.h.
Presentation and discussion of recent advances and research in chemical and biochemical engineering by guest lecturers, faculty, students. Requirements: graduate standing.

CBE:5100 Graduate Professional Development Seminar 1 s.h.
Seminar participants work with a faculty member to select and attend eight hours of approved seminars and professional development trainings at the University of Iowa; final meeting of participants is held to share notable seminars; typical seminar series include College of Engineering lectures, departmental and research center graduate seminars, the CBE professional seminar series, offerings of the Center for Teaching and Learning. Requirements: CBE masters standing.

CBE:5104 Introduction to Literature Review and Technical Writing 3 s.h.
Review of technical literature, how to contribute to it; produce and present orally a peer-reviewed-journal-quality review article; brainstorming, group writing, research ethics, plagiarism. Recommendations: nonthesis track graduate standing.

CBE:5105 Introduction to Literature Review and Proposal Writing 3 s.h.
Tools for reviewing literature, skills for critical reading of publications, training in successful proposal writing; experience drafting a proposal that can be used as a starting point for the Ph.D. comprehensive.
CBE:5110 Intermediate Thermodynamics 3 s.h.
Fundamental principles of thermodynamics as applied to phase equilibrium; properties of fluids, first and second law, variable composition systems, behavior of real fluids, mathematical techniques for solution thermodynamics. Requirements: CBE:3105 or ME:3040 or graduate standing. Same as ME:5210.

CBE:5115 Transport Phenomena I 3 s.h.
Unified treatment of momentum, mass, energy transport in chemical engineering problems; use of vector and tensor notations in expressing equations of continuity, motion, energy.

CBE:5140 Mathematical Methods in Engineering 3 s.h.

CBE:5199 Contemporary Topics: Chemical and Biochemical Engineering arr.
Research techniques for graduate students in chemical and biochemical engineering.

CBE:5210 Bioseparations 3 s.h.
Unit operations used to isolate and purify biologically derived chemicals, including flocculation, filtration, centrifugation, extraction, adsorption, chromatography, precipitation, crystallization, electrophoresis and cell disruption for intracellular product recovery.

CBE:5250 Introduction to Biocatalysis 3 s.h.
Applications of biological catalysis in varied industries; potential of biological catalysis to address future challenges in science and engineering.

CBE:5300 Drug Delivery Devices 3 s.h.
Why drug delivery devices are needed and how they are regulated; review of several clinical device categories (inhalation, transdermal, implantable) and preclinical technologies on the horizon.

CBE:5310 Polymer Science and Technology 3 s.h.
Uses, properties of industrially important polymeric materials; polymer chemistry, polymer structure, characterization, polymer processing. Prerequisites: CHEM:2220 or CHEM:2240. Corequisites: CBE:3120.

CBE:5315 Polymer Chemistry 3 s.h.
Monomer reactivity and polymerization reactions; step, radical, ionic, and ring-opening polymerizations. Prerequisites: CHEM:2220.

CBE:5390 Photopolymerization Topics 1 s.h.
Seminars presented by faculty members, research assistants, students.

CBE:5405 Green Chemical and Energy Technologies 3 s.h.
Strategies for pollution prevention for chemical processes studied at macroscale (industrial sector), mesoscale (unit operations), and microscale (molecular level); case studies. Prerequisites: CBE:2105.

CBE:5412 Atmospheric Modeling 3 s.h.
Model equations and approaches for atmospheric dynamics and chemistry; numerical methods for radiative, chemical, and aerosol rates; parameterization of subgrid-scale processes; model evaluation and inverse modeling.

CBE:5415 Satellite Image Processing and Remote Sensing of Atmosphere 3 s.h.
Introduction to principles of atmospheric radiation and techniques for satellite image processing; hands-on experience with data calibration, image registration and enhancement, noise filtering and (supervised and unsupervised) multi-spectral classification of satellite imageries; various satellite sensors used for monitoring of different atmospheric processes and constituents. Same as IGPI:5415.

CBE:5417 Physical Meteorology and Atmospheric Radiative Transfer 3 s.h.
Physical processes for weather and climate including radiative transfer, cloud and precipitation formation, and atmospheric electricity; theory of scattering by atmospheric particles (e.g., clouds, aerosols, molecules), atmospheric radiative transfer equations, and numerical techniques and tools to solve these equations. Requirements: senior or graduate standing. Same as IGPI:5417.

CBE:5425 Atmospheric Chemistry and Physics 3 s.h.
Principal chemical and physical processes affecting atmospheric trace gas and pollutant cycles; emphasis on atmospheric photochemistry, aerosol science, major sources, and removal processes. Corequisites: CBE:3120. Same as CEE:5115.

CBE:5875 Perspectives in Biocatalysis 1-3 s.h.
Applied enzymology, protein design, structure-activity relationships, biosensor technology, microbial transformations, biodegradation of environmental pollutants. Requirements: graduate standing in a participating department supported by the Predoctoral Training Program in Biotechnology. Same as BIOC:5875, CEE:5875, CHEM:5875, MICR:5875, PHAR:5875.

CBE:5998 Individual Investigations: Chemical and Biochemical Engineering arr.
Individual projects for chemical and biochemical engineering graduate students; may include laboratory study, engineering design project, analysis and simulation of an engineering system, computer software development, research. Requirements: graduate standing.

CBE:5999 M.S. Thesis Research: Chemical and Biochemical Engineering arr.
Experimental and/or analytical investigation of an approved topic for partial fulfillment of requirements for M.S. with thesis in chemical and biochemical engineering. Requirements: graduate standing.

CBE:6145 Diffusive Transport 3 s.h.
Diffusive transport of heat, mass, and momentum; phenomenological laws and analogies; analytical and numerical solution techniques; inverse heat conduction; multiphase and multicomponent systems. Prerequisites: ME:5145. Same as ME:6245.

CBE:6415 Advanced Satellite and Remote Sensing of Atmosphere 3 s.h.
Cloud masking and retrieval of cloud properties from satellites, aerosol detection and retrievals, Earth radiation energy budget, land and/or ocean remote sensing, microwave remote sensing, wind retrieval, multi-sensor intercomparison and validation, optimization and inversion theory; hands-on projects.
CBE:6435 Advanced Atmospheric Radiative Transfer
3 s.h.
Theory of scattering by atmospheric particles (e.g., clouds, aerosols, molecules), atmospheric radiative transfer equations, and techniques to solve these equations for solar and terrestrial radiation; numerical experiments with Mie scattering, T-matrix calculation, and radiative transfer models.

CBE:7999 Research: Chemical and Biochemical Engineering Ph.D. Dissertation arr.
Experimental and/or analytical investigation of an approved topic for Ph.D. in chemical and biochemical engineering.