

Chemical Engineering (CHE)

CHE 102 Introduction to Chemical Engineering 1 Hour

Introduction to chemical engineering, including problem solving and study skills. Opportunities and responsibilities of a career in chemical engineering.

CHE 103 Introduction to Undergraduate Research 1 Hour

Introduction to undergraduate research including the structure of academic research, how to access research resources on campus, and foundational skills to succeed in a research environment

CHE 210 Introduction to Computing 2 Hours

Computer programming focusing on basics of computing, high-level programming environments, and spreadsheets, with application to chemical engineering.

CHE 311 Engineering Sustainable Technologies 3 Hours

Flows of materials and energy in engineering environments at local, regional, and global scales, and the interaction of those anthropogenic flows with natural cycles of materials and energy. Discusses biogeochemical flows (grand cycles) and anthropogenic material flows at the national level, in industrial sectors, and for consumer products.

CHE 317 Introduction to Chemical Engineering Analysis 3 Hours

Principles and applications of material and energy balances in process analysis.

CHE 018C Peer Mentorship 0 Hours

Best practices for delivery of tutoring and/or grading for undergraduate chemical engineering majors.

CHE 319 Transport Phenomena 3 Hours

Basic study of momentum, energy, and mass transport. Includes viscous and turbulent flow, heat transfer, and mass diffusion.

CHE 119S, 219S, 319S, 419S, 519S, 619S, 719S, 819S, 919S Topics in Chemical Engineering 1-9 Hours

Used to record credit the student earns while enrolled at another institution in a program administered by the University's Study Abroad Office. Credit is recorded as assigned by the study abroad adviser in the McKetta Department of Chemical Engineering. University credit is awarded for work in an exchange program; it may be counted as coursework taken in residence. Transfer credit is awarded for work in an affiliated studies program.

CHE 322 Thermodynamics 3 Hours

Introductory course in thermodynamics with special reference to chemical process applications: basic laws, thermodynamic properties of single component systems, expansion and compression of fluids, heat engines, multicomponent systems, physical equilibrium, chemical equilibrium.

CHE 322M Molecular Thermodynamics 3 Hours

Statistical and molecular concepts, especially the role of the microscopic chemical potential.

CHE 323 Chemical Engineering for Micro- and Nanofabrication 3 Hours

Definition and description of the terminology and processes of microelectronics, including semiconductor facilities and chemical processes for integrated circuit manufacture, with an emphasis on unit processes; the major unit process, including thin-film metals and dielectrics deposition and etching, silicon oxidation and etching, ion implantation, diffusion, lithography, planarization, and process control; and an overview of promising nanopatterning and nanofabrication techniques, such as particle-beam imaging, nanoimprint, and near-field probe imaging, implantation, diffusion, lithography, planarization, and process control.

CHE 129S, 229S, 329S, 429S, 529S, 629S, 729S, 829S, 929S Topics in Chemical Engineering 1-9 Hours

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CHE 333T Engineering Communication 3 Hours

Advanced technical communication skills, with emphasis on writing strategies for technical documents, oral presentations, and visual aids.

CHE 337 Quantitative Analysis of Cellular and Molecular Biology 3 Hours

Analyzes biological systems from stoichiometric, thermodynamic, and kinetic perspectives. Case studies will illustrate how these principles are used to understand disease, control cellular behavior, and design protein-based therapeutics.

CHE 338 Biochemical Engineering 3 Hours

Introduction to basic biological processes including transcription, translation, protein/enzyme function, cellular energetics, protein secretion and modifications. Application of quantitative engineering principles to the analysis of biological processes, including thermodynamics, kinetics and stoichiometry.

CHE 339 Introduction to Biochemical Engineering 3 Hours

Microorganisms in chemical and biochemical syntheses; genetic manipulation of cells by classical and recombinant DNA techniques. Enzyme technology; design of bioreactors and microbial fermentations; separations of biological products.

CHE 339P Introduction to Biological Physics 3 Hours

Diffusion, dissipation, and driving forces in cellular processes. Locomotion of bacteria, basic modeling of biomolecular folding and binding events, osmotic flows, and self-assembly in cells.

CHE 339T Cell and Tissue Engineering 3 Hours

Introduction to biomedical research in tissue engineering. Includes case studies of tissues and organs of the body, physiology and biology of tissue, pathologies of tissue, current clinical treatments, the role of engineers in development of new technologies to diagnose and treat pathologies, quantitative cellular and molecular techniques, and applications of synthetic and natural biomaterials.

CHE 341 Design for Environment 3 Hours

Overview of environmental assessment tools for chemical processes and products, including life cycle and risk assessments. Overview of design tools for improving environmental performance of chemical processes, including unit operations and flowsheet analysis methods.

CHE 342 Chemical Engineering Economics and Business Analysis 3 Hours

Study of the economic decisions faced by chemical engineers. Discounted cash flow techniques. Personal finance, managerial economics, and other special topics.

CHE 343 Molecular Simulation of Materials 3 Hours

Introduction to basic molecular simulation techniques including molecular mechanics, molecular dynamics, and Monte Carlo method. Understanding of principles underlying these techniques, and how these techniques can be used to study the physical and chemical properties and behavior of materials at the molecular level. More advanced topics include molecular simulations in various ensembles (NVE, NVT, NPT, grand canonical), free energy computations, controlling dynamics, and association-bias Monte Carlo method. Elementary knowledge of physical chemistry, classical mechanics, and statistical thermodynamics is assumed.

CHE 344 Introduction to Therapeutics 3 Hours

CHE 346F Atmospheric Chemistry and Physics 3 Hours

Examine the sources of air pollutants and the chemical reactions and physical processes that affect them. Explore tropospheric chemistry and the microphysics, chemistry, and thermodynamics of atmospheric nanoparticles. Discuss aerosol transmission of viruses and mitigation of that transmission, as well as recent advances in understanding air pollution and its health effects.

CHE 348 Numerical Methods in Chemical Engineering and Problem Solving 3 Hours

Numerical solutions to algebraic and differential equations; numerical methods to integration, interpolation, and regression analysis, with application to chemical engineering.

CHE 349D Dynamics in Ecology and the Environment 3 Hours

Examine the Earth's natural processes, populations, and systems. Explore the Earth's dynamic systems and how they change with time in response to a variety of disturbances. Use mathematical models to aid in understanding these dynamic systems and to estimate the impact of manmade disturbances. Discuss current environmental and ecological problems.

CHE 350 Chemical Engineering Materials 3 Hours

Metallic, ceramic, polymeric, and composite materials. Crystal structures, phase diagrams, diffusion, and mechanical properties. Emphasis on structure-property-processing relationships.

CHE 253K Applied Statistics 2 Hours

Statistical methods such as data exploration and summary, least-squares fitting, probability and probability distributions, statistical inference and hypothesis testing, analysis of variance, design of experiments, statistical quality control, and use of professional statistical software.

CHE 253M Measurement, Control, and Data Analysis Laboratory 2 Hours

Laboratory safety; measurement and statistical analysis of transport process variables like temperature, pressure, and flow rate; computer data acquisition; feedback control; statistical process control and design of experiments; and production of professional-level lab reports.

CHE 354 Transport Processes 3 Hours

Design and analysis of heat exchangers, fluid-flow systems and equipment, and interphase-contact devices.

CHE 355 Introduction to Polymers 3 Hours

Synthesis, structural characterization, physical properties, and applications of polymers.

CHE 356 Optimization: Theory and Practice 3 Hours

Techniques of optimization, including formulation of optimization problems, one-dimensional search techniques, analytical methods, and n-dimensional search techniques; application of methods to process-industry problems.

CHE 357 Technology and Its Impact on the Environment 3 Hours

Study of sources and fates of environmental pollutants; environmental quality standards—their measurement and regulation; and pollution control design procedures.

CHE 359 Energy Technology and Policy 3 Hours

Technology and policy related to energy supply and demand, oil and gas production, coal utilization, hydrogen production, fuel cells, transportation, nuclear power, solar and wind energy, biomass utilization, energy conservation, and climate change.

CHE 360 Process Control 3 Hours

Analysis of process dynamics and methods for the design of automatic control systems for chemical process plants.

CHE 363 Separation Processes and Mass Transfer 3 Hours

Design and analysis of equilibrium and mass transfer based on separations such as absorption, chromatography, crystallization, distillation, extraction, and membrane-based processes.

CHE 264 Chemical Engineering Process and Projects Laboratory 2 Hours

Experimental studies of unit operations. Laboratory safety. Statistical data analysis. Written and oral reports.

CHE 364S Chemical Process Safety 3 Hours

Emphasizes quantitative engineering analysis based on the application of mass and energy balances, fluid mechanics of incompressible, compressible and two-phase fluids, heat transfer and conservation of energy, diffusion and dispersion under highly variable conditions, reaction kinetics, and process control. Subjects include various probabilistic and statistical methods to characterize accident and loss performance, techniques for process hazard analysis, risk assessment, and accident investigations.

CHE 372 Chemical Reactor Analysis and Design 3 Hours

Planning and design of commercial chemical and biochemical reaction systems for producing fuels, polymers, specialty and consumer products, pharmaceuticals, solid-state devices, and other products.

CHE 473K Process Design and Operations 4 Hours

Process design, economics, and safety; design projects representing a variety of industries and products.

CHE 376K Process Evaluation and Quality Control 3 Hours

Use of statistical techniques to evaluate, compare, and optimize processes. Design of experiments for improved product quality control.

CHE 077C Undergraduate Research Practicum 0 Hours

Discuss best practices for participation in research for undergraduate chemical engineering majors.

CHE 077D Undergraduate Research Practicum 0 Hours

Discuss best practices for participation in research for undergraduate chemical engineering majors.

CHE 177K, 277K, 377K Undergraduate Research Project 1-3 Hours

Recommended for students considering graduate study. Topic to be selected in conjunction with individual chemical engineering faculty member, with approval by the department chair. A final written report is required.

CHE 177L, 277L, 377L Undergraduate Research Project 1-3 Hours

Subject matter to be selected in conjunction with individual chemical engineering faculty member, with approval by the department chair. A final written report is required.

CHE 179, 279, 379, 479 Topics in Chemical Engineering 1-4 Hours

Special topics of current interest.

CHE 179.2, 279.2, 379.2, 479.2 Nanomaterials Chemistry and Engineering 1-4 Hours

CHE 179.3, 279.3, 379.3, 479.3 Greenhouse Gas Control Technology 1-4 Hours

CHE 179.43, 279.43, 379.43, 479.43 Entrepreneurship 1-4 Hours

CHE 179.6, 279.6, 379.6, 479.6 Materials Physics 1-4 Hours

CHE 179.64, 279.64, 379.64, 479.64 From Data to Decisions 1-4 Hours

CHE 179.8, 279.8, 379.8, 479.8 Advanced Nanotechnology and Innovation for Beginners 1-4 Hours

CHE 679H Undergraduate Honors Thesis 6 Hours

Research performed during two consecutive semesters under the supervision of a chemical engineering faculty member; topics are selected jointly by the student and the faculty member with approval by the department chair. The student makes two oral presentations and writes a thesis.

CHE 079I Undergraduate Research Internship 0 Hours
Participate in an internship or career experience program.

CHE 180C Laboratory Safety 1 Hour
Safe laboratory practice. Training in use of fire extinguishers and first aid. Case studies of laboratory accidents.

CHE 080D Research and Achievements Seminar 0 Hours
Seminar series covering recent research and technical achievements in Chemical Engineering.

CHE 381N Fluid Flow and Heat Transfer 3 Hours
Advanced treatment of fluid flow and heat transfer problems in chemical engineering.

CHE 381P Advanced Analysis for Chemical Engineers 3 Hours
Applications of mathematical methods to chemical engineering problems, with emphasis on differential equations, linear analysis and matrices, and real analysis and complex variables.

CHE 381Q Quantitative Analysis of Cellular and Molecular Biology 3 Hours
Analyzes biological systems from stoichiometric, thermodynamic, and kinetic perspectives. Case studies illustrate how these principles are used to understand disease, control cellular behavior, and design protein-based therapeutics.

CHE 384E Electrochemistry and Electrochemical Engineering 3 Hours
Fundamental principles of electrochemistry combined with mass transfer including applications in analytical chemistry as well as industrial electrochemistry.

CHE 384K Chemical Kinetics and Surface Chemistry 3 Hours
Application of chemical reaction kinetics to the prediction and determination of reaction rates and reaction selectivity.

CHE 384S Current and Emerging Trends in Chemical Engineering Research 3 Hours
Overview of current and emerging trends in chemical engineering research with frequent guest presentations by leading scholarly and industrial researchers in the discipline.

CHE 384T Topics in Chemical Engineering 3 Hours

CHE 185, 285, 385, 685, 985 Research 1,2,3,6,9 Hours

CHE 085C Research 0 Hours

CHE 385M Surface Phenomena 3 Hours
Liquid/fluid interfaces including equilibrium and nonequilibrium phenomena. Topics covered include capillarity, thermodynamics, surface rheology, and streaming potentials.

CHE 385P Optimization: Theory and Practice 3 Hours
Techniques of optimization, including formulation of optimization problems, one-dimensional search techniques, analytical methods, and n-dimensional search techniques; application of methods to process-industry problems.

CHE 386K Theory of X-Ray Diffraction 3 Hours
Application of basic diffraction theory to polycrystalline and single crystal materials.

CHE 386L Laboratory Experiments in X-Ray Diffraction 3 Hours
Application of X-ray diffraction techniques to the examination of polycrystalline and single crystal materials.

CHE 387K Advanced Thermodynamics 3 Hours
Applications of thermodynamics to chemical engineering processes.

CHE 387M Mass Transfer 3 Hours
Advanced treatment of diffusional mass transfer operations in chemical engineering.

CHE 388K Separations Processes 3 Hours
Advanced treatment of modern chemical engineering separations processes.

CHE 391 Elements of Modern Control Theory 3 Hours
Introduction to fundamentals of dynamic optimization and system theory; applications to engineering processes.

CHE 391J Reaction Kinetics 3 Hours

CHE 391M Mathematical Modeling of Engineered Systems 3 Hours
Introduction to fundamentals of dynamic system modeling and associated numerical solution methods with applications to engineering systems.

CHE 391S Molecular Simulation of Materials 3 Hours
Introduction to basic molecular simulation techniques including molecular mechanics, molecular dynamics, and Monte Carlo method. Understanding of principles underlying these techniques, and how these techniques can be used to study the physical and chemical properties and behavior of materials at the molecular level. More advanced subjects include molecular simulations in various ensembles (NVE, NVT, NPT, grand canonical), free energy computations, controlling dynamics, and association-bias Monte Carlo method. Elementary knowledge of physical chemistry, classical mechanics, and statistical thermodynamics is assumed.

CHE 392 Polymer Science 3 Hours
Details of polymerization mechanisms; structure-property relationships, fundamentals of processing, and characterization of high polymers.

CHE 392P Introduction to Polymer Materials Science 3 Hours
Synthesis, structural characterization, physical properties, and applications of polymers.

CHE 395C Chemical Processes for Microelectronics 3 Hours
Introduction to the chemical processes and the manufacturing operations used in microelectronics device fabrication.

CHE 395E Polymer Science and Engineering Laboratory 3 Hours
Training in the preparation and instrumental characterization of polymers, blends, and compounds.

CHE 395G Chemical Engineering Economics and Business Analysis 3 Hours
Study of the economic decisions faced by chemical engineers. Discounted cash flow techniques. Personal finance, managerial economics, and other special topics.

CHE 395J Product and Process Development 3 Hours
Product and process innovation in the process industries; screening criteria; needs-requirements research; evaluation.

CHE 395K Design for Environment 3 Hours
Overview of environmental assessment tools for chemical processes and products, including life cycle and risk assessments. Overview of design tools for improving environmental performance of chemical processes, including unit operations and flow sheet analysis methods.

CHE 397M Graduate Research Internship 3 Hours
Research associated with enrollment in the Graduate Research Internship Program (GRIP).

CHE 698 Thesis 6 Hours

CHE 398R Master's Report 3 Hours
Preparation of a report to fulfill the requirement for the master's degree under the report option.

CHE 398T Supervised Teaching in Chemical Engineering 3 Hours
Teaching under the close supervision of the instructor for one to four semesters; weekly group meetings; individual consultation; reports.

CHE 399W, 499W, 599W, 699W, 999W Dissertation 3,4,5,6,9 Hours