

CHEMICAL ENGINEERING

Department Website (https://www.sc.edu/study/colleges_schools/engineering_and_computing/departments/chemical_engineering/)

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Chemical engineers are involved in the design of materials and devices and in the design and operation of plants which manufacture a wide variety of chemicals, including plastics, textile fibers, fuels, and pharmaceuticals. The work of the chemical engineer can be highly diverse, ranging from research on pollution prevention to the marketing of new chemical products.

The department offers the Bachelor of Science in Engineering with a major in chemical engineering. The department, jointly with the Department of Mechanical Engineering, offers a major in biomedical engineering.

Accelerated B.S.E./M.E. Education Plan

The Accelerated B.S.E./M.E. Plan in Chemical Engineering allows students to complete both the B.S.E. degree and a Master of Engineering degree in chemical engineering in as few as five years. The use of dual credit-courses that can be used toward both degrees-enables acceleration of the program, reducing the total enrollment of the student by one semester.

Chemical engineering students may apply for approval of an accelerated education plan in the semester in which they will complete 90 hours of undergraduate course work. In addition, students must have a sufficient foundation in chemical engineering course work to enable them to take graduate-level courses. University and department regulations stipulate that applicants must have a minimum GPA of 3.40, both overall and in chemical engineering courses. Students may apply by submitting an accelerated education plan, an application for senior privilege, and a copy of a Graduate School application to the graduate director in chemical engineering. The dean of The Graduate School has final authority for approving accelerated education plans.

Only graduate-level courses (numbered 500 and above) may be used for dual credit. No more than nine credit hours may be used as dual credit. The graduate courses used for dual credit must be taken during the student's final undergraduate year. The student graduates with the B.S.E. degree after completing the B.S.E. degree requirements. At that time, the student is admitted to the graduate program with up to nine hours of graduate credit.

Programs

- Chemical Engineering, Minor (<https://academicbulletins.sc.edu/undergraduate/engineering-computing/chemical-engineering/chemical-engineering-minor/>)
- Chemical Engineering, B.S.E. (<https://academicbulletins.sc.edu/undergraduate/engineering-computing/chemical-engineering/chemical-engineering-bse/>)

Courses

ECHE 101 - Introduction to Chemical Engineering (2 Credits)

Introduction to engineering, with emphasis on chemical engineering. Problem-solving techniques, including the use of computer tools. Basic engineering design methods.

ECHE 202 - Exploring the Chemical Engineering Workplace (1 Credit)

Identification of career interests and active exploration of careers in chemical engineering.

Prerequisite or Corequisite: ECHE 300.

Graduation with Leadership Distinction: GLD: Professional and Civic Engagement Internships

ECHE 203 - Research in Chemical Engineering (1 Credit)

Introduction to research in Chemical Engineering, effective literature search, communication of results, lab safety, and research ethics.

Graduation with Leadership Distinction: GLD: Research

ECHE 300 - Chemical Process Principles (3 Credits)

Material and energy balances in the chemical process industry. Properties of gases, liquids, and solids. Two one-hour lectures and one three-hour laboratory period devoted to problem solving.

Prerequisites: MATH 141.

Prerequisite or Corequisite: CHEM 112 or CHEM 142.

ECHE 310 - Introductory Chemical Engineering Thermodynamics (3 Credits)

First law and second law of thermodynamics. Thermodynamic properties of single component systems. Analysis of power and refrigeration cycles.

Prerequisites: C or better in ECHE 300.

Prerequisite or Corequisite: MATH 241.

ECHE 311 - Chemical Engineering Thermodynamics (3 Credits)

Mass, energy, and entropy balance analysis of chemical engineering systems; evaluation of thermodynamic property changes of pure materials; solution thermodynamics of single-phase multicomponent systems; phase and chemical reaction equilibrium.

Prerequisites: C or better in ECHE 310, ENCP 290, CHEM 541, BMEN 290, EMCH 290 or PHYS 306.

ECHE 320 - Chemical Engineering Fluid Mechanics (3 Credits)

Fluid statics and dynamics with emphasis on chemical engineering applications.

Prerequisites: D or better in PHYS 211.

Prerequisite or Corequisite: D or better in MATH 241.

ECHE 321 - Heat-Flow Analysis (3 Credits)

Theory of heat transmission; mechanism, generation, distribution, and measurement; use of theory in practical equipment design.

Prerequisites: C or better in ECHE 320 or ENCP 360; C or better in MATH 242.

Prerequisite or Corequisite: D or better in ECHE 456.

ECHE 322 - Mass Transfer (3 Credits)

Molecular diffusion in fluids; diffusion in laminar and turbulent flow; momentum, transport analogies; interfacial mass transfer; design applications including humidification and absorption.

Prerequisites: D or better in ECHE 321.

ECHE 372 - Introduction to Materials (3 Credits)

Overview of the fundamental chemical aspects of materials; role of materials in applications in modern society by case studies of advances in new materials and processes.

Prerequisites: CHEM 112.

ECHE 389 - Special Topics in Chemical Engineering (3 Credits)

Course content varies and will be announced in the schedule of classes by title. May be repeated as topic varies.

ECHE 430 - Chemical Engineering Kinetics (3 Credits)

Concepts of chemical kinetics, batch and flow reactors, catalysts and reactor design.

Prerequisites: C or better in ECHE 311.

Prerequisite or Corequisite: D or better in ECHE 321 or BMEN 354.

ECHE 440 - Separation Process Design (3 Credits)

Design of stagewise chemical separation cascades; analysis of binary and ternary systems; multicomponent separations, plate and column specification procedures; distillation, crystallization, extraction, and leaching.

Prerequisites: C or better in ECHE 300.

Prerequisite or Corequisite: ECHE 311.

ECHE 442 - Adsorption Fundamentals and Processes (3 Credits)

Basic principles of adsorption and adsorption processes including adsorbents, thermodynamics, kinetics, fixed bed adsorption and cyclic adsorption processes.

ECHE 456 - Computational Methods for Engineering Applications (3 Credits)

Introduction to advanced computational tools for the analysis of chemical engineering systems. Initial and boundary value problems related to heat and mass transfer, reaction engineering, and parameter estimation.

Prerequisite or Corequisite: D or better in MATH 242.

ECHE 460 - Chemical Engineering Laboratory I (3 Credits)

Review of technical-report writing and presentation techniques; topics in heat transfer, fluid mechanics, and thermodynamics; verification of theoretical results and determination of design parameters. One lecture and six laboratory hours.

Prerequisite or Corequisite: ECHE 311, ECHE 321.

ECHE 461 - Chemical Engineering Laboratory II (3 Credits)

Continuation of ECHE 460; topics in mass transfer, kinetics, and process control.

Prerequisites: D or better in ECHE 460.

Prerequisite or Corequisite: D or better in ECHE 430 and ECHE 440.

ECHE 465 - Chemical-Process Analysis and Design I (3 Credits)

Economics of chemical engineering projects related to typical corporate goals and objectives; process-flowsheet development techniques; review of shortcut design techniques; selection of profitability criteria.

Prerequisite or Corequisite: D or better in ECHE 430 and ECHE 440.

ECHE 466 - Chemical-Process Analysis and Design II (3 Credits)

Continuation of ECHE 465; computer-aided design of chemical processes; written and oral presentation of a comprehensive design project.

Prerequisites: D or better in ECHE 430, ECHE 440, ECHE 465.

Prerequisite or Corequisite: ECHE 322, ECHE 567.

Graduation with Leadership Distinction: GLD: Professional and Civic Engagement Internships, GLD: Research

ECHE 497 - Thesis Preparation (1-3 Credits)

Completion of the thesis requirements for the departmental undergraduate research track. A maximum of three credits may be applied toward a degree.

Prerequisites: Three credit hours of ECHE 499, acceptance into the departmental undergraduate research track, and consent of instructor.

ECHE 498 - Topics in Chemical Engineering (1-3 Credits)

Reading and research on selected topics in chemical engineering. Course content varies and will be announced in the schedule of classes by title.

May be repeated two times as topics vary. Pass-Fail grading.

Prerequisites: upper division standing.

Graduation with Leadership Distinction: GLD: Research

ECHE 499 - Special Problems (1-3 Credits)

Individual investigation or studies of special topics. A maximum of six credits may be applied toward a degree. Advance approval of project proposal by advisor and instructor.

Graduation with Leadership Distinction: GLD: Professional and Civic Engagement Internships, GLD: Research

ECHE 520 - Chemical Engineering Fluid Mechanics (3 Credits)

Multi-phase pressure drop, phase contacting, flow through porous media, fluidization, mixing, and turbulence.

Prerequisites: D or better in ECHE 320 or ENCP 360.

ECHE 521 - Computational Fluid Dynamics for Engineering Applications (3 Credits)

Introduction to the use of computational fluid dynamics codes to analyze flow, heat, and mass transfer problems of practical engineering applications.

Prerequisites: D or better in ECHE 320, EMCH 360, ECIV 360, ENCP 360, or AESP 265.

ECHE 530 - Intermediate Chemical Engineering Kinetics (3 Credits)

Intermediate concepts of chemical kinetics, batch and flow reactors, catalysts and reactor design, including non-ideal systems.

Prerequisites: C or better in ECHE 311.

Prerequisite or Corequisite: D or better in ECHE 321.

ECHE 540 - Intermediate Separation Process Design (3 Credits)

Intermediate level design of stagewise chemical separation cascades; analysis of binary and ternary systems; multicomponent separations, plate and column specification procedures; distillation, crystallization, extraction, and leaching.

Prerequisites: C or better in ECHE 300.

Prerequisite or Corequisite: D or better in ECHE 311.

ECHE 550 - Chemical-Process Dynamics and Control (3 Credits)

Fundamental physical and chemical principles in mathematically modeling the dynamic response of chemical processes; feedforward and feedback control systems; design of control schemes for selected chemical processes.

Prerequisites: C or better in ECHE 300 and MATH 242; D or better in ECHE 456.

ECHE 567 - Process Safety, Health and Loss Prevention (3 Credits)

Reliability, availability, and fault-tree analyses, risk indices, hazard evaluation, vapor cloud modeling, toxicology, material safety classification and regulations, individual/corporate ethical responsibilities.

Prerequisite or Corequisite: D or better in ECHE 466.

ECHE 571 - Corrosion Engineering (3 Credits)

Basic principles of corrosion engineering developed from a chemical engineering approach to thermodynamics, kinetics, mass transfer, and potential theory.

Prerequisites: D or better in ECHE 311.

ECHE 572 - Polymer Processing (3 Credits)

Industrial polymers with emphasis on their characterization and on the modeling of the major polymer fabrication processes.

ECHE 573 - Next Energy (3 Credits)

An examination of energy technologies that will enable society to move from an economy based on fossil fuels to one based on sustainable energy.

ECHE 574 - Combustion (3 Credits)

Fundamental process and applications related to the broad field of combustion and energy generation including emissions control technologies.

Prerequisites: D or better in ECHE 430.

ECHE 575 - Engineering of Soft Materials (3 Credits)

Introductory overview of fundamental concepts in science and engineering of soft materials; the relation between microstructure and macroscopic behavior in a variety of soft matter systems; key applications in chemical and biomedical engineering.

Prerequisites: D or better in ECHE 320, ENCP 360, EMCH 360, or ECIV 360.

Cross-listed course: BMEN 575

ECHE 589 - Special Advanced Topics in Chemical Engineering (3 Credits)

Course content varies and will be announced in the schedule of classes by title. May be repeated as topic varies.