Chemical Engineering

Department Website (http://www.che.sc.edu/)

Melissa A. Moss, Chair

The Department of Chemical Engineering offers research-oriented graduate study programs leading to the Master of Science and Doctor of Philosophy degrees in chemical engineering, as well as a program for professional development culminating in the Master of Engineering degree in chemical engineering. In addition, the department collaborates with the Department of Mechanical Engineering to offer Master of Science and Doctor of Philosophy degrees in biomedical engineering. Degree requirements for biomedical engineering are listed under the college offerings.

Advanced course work in chemical engineering has three objectives: to give students a solid foundation in core concepts at the graduate level, to prepare students for independent research in a field of specialization, and to expose students to a broad range of knowledge in chemical engineering and allied disciplines. The M.S. and Ph.D. programs emphasize independent research leading to the submission of a thesis or dissertation and publication of results in peer-reviewed technical journals. Students in the M.E. program may, at their option, propose a program of independent study, supervised by a faculty member, that may replace up to six hours of lecture courses.

In all cases, students should prepare and receive approval of a formal program of study that lists the specific courses to be used for their degree. In addition, proposals for independent study as a part of the M.E. degree program must be reviewed and approved by the faculty of the department before the work is initiated. Programs of study and plans for independent study and research should be developed in collaboration with the graduate director or the student’s research advisor.

Graduates from the Department of Chemical Engineering readily find entry-level employment in engineering research, development, management, marketing, sales, production, and design. Recent graduates have assumed positions in industry, government service, and academe.

Fields of Specialization

The research interests of the faculty span all of the traditional core areas of chemical engineering and extend into many frontiers. Ongoing research may be found in fluid mechanics, heat and mass transfer, separations, kinetics and reactor design, process control, and process design. Building upon this traditional core, the department has developed more specialized research strengths in electrochemical and corrosion engineering, advanced materials, environmentally conscious manufacturing, and molecular simulations. A complete description of the current research interests of the faculty may be found in the department’s brochure or on its Web page, located at http://www.che.sc.edu.

Accelerated B.S.E./Master’s Education Plans

The accelerated B.S.E./master’s plans in chemical engineering allows students to complete both the B.S.E. degree and a master’s 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.

Admission Requirements

Requirements for admission to graduate degree programs in chemical engineering (M.E., M.S., Ph.D.) conform to the general regulations of The Graduate School, as well as more stringent departmental requirements as described below. In general, the admissions process is highly competitive. Admissions decisions are based on the quality of the applicant’s previous university-level academic work (as reflected by grade point average), letters of recommendation, GRE scores, and other evidence of past accomplishments.

For admission to the M.E., M.S., and Ph.D. programs in chemical engineering, applicants normally hold the B.S. degree in chemical engineering from an accredited engineering program. Students holding B.S. degrees may apply for direct admission to the doctoral program; it is not necessary to complete a master’s degree first. Applicants with degrees (B.S. or higher) in other engineering disciplines or chemistry may be admitted with additional remedial course requirements in chemical engineering at the undergraduate level. The required remedial courses will typically include the prerequisites to required graduate courses and may include additional undergraduate courses in chemical engineering, mathematics, and chemistry. The detailed specification of course requirements and substitutions of courses from other universities will be considered on a case-by-case basis.

For all applicants: GRE scores must be submitted by all applicants seeking financial aid, and are normally expected from all applicants. International applicants must also submit TOEFL or the IELTS Intl. Academic Course Type 2 exam scores. All applicants should submit a statement of purpose (or similar essay) that describes the applicant’s background, research interests, and whether or not financial aid is required. Students admitted to the Ph.D. degree program usually receive financial aid. However, the department does not normally provide financial aid to students in the M.E. or M.S. degree programs.

Programs

- Chemical Engineering, M.E. (https://academicbulletins.sc.edu/graduate/engineering-computing/chemical-engineering/chemical-engineering-me/)
- Chemical Engineering, M.S. (https://academicbulletins.sc.edu/graduate/engineering-computing/chemical-engineering/chemical-engineering-ms/)
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 730 - Chemical Reator Design (3 Credits)
Optimum temperature sequencing. Modeling of non-ideal reactors. Theories of catalysis with emphasis on the rate of diffusion. Interpretation of experimental catalytic data and use of these data in reactor design.

ECHE 739 - Selected Topics in Kinetics and Reactor Design (3 Credits)
Special topics in kinetics and reactor design with emphasis on current research.

ECHE 740 - Distillation (3 Credits)
Analytical, shortcut, and computer techniques for plate contacting of multicomponent systems. Review of binary separations, VL-E models, azeotropic and extractive distillation, effects of non-key components, computational schemes, and convergence criteria.

ECHE 741 - Liquid-Liquid Extraction (3 Credits)
Principles of modeling liquid-liquid extraction cascades. Evaluation of L-L-E, ternary systems, design applications for hydrometallurgical systems, interlinked cascade structures for multiple solute systems, efficiency of process equipment, and synergism.

ECHE 742 - Adsorption Fundamentals and Processes (3 Credits)
Advanced principles of adsorption and adsorption processes including adsorbents, thermodynamics, kinetics, fixed bed adsorption and cyclic adsorption processes.

ECHE 749 - Selected Topics in Separations (3 Credits)
Special topics in separations with emphasis on current research.

ECHE 750 - Process Dynamics and Control (3 Credits)
Advanced topics in chemical process dynamics and control. Multivariate analysis, system identification, sampling, optimal process control.
Prerequisites: ECHE 550.

ECHE 759 - Selected Topics in Process Control (3 Credits)
Special topics in process control with emphasis on current research.

ECHE 769 - Selected Topics in Chemical Engineering Design (3 Credits)
Special topics in chemical engineering design with emphasis on current research.

ECHE 770 - Electrochemical Engineering (3 Credits)
Electrochemical engineering principles developed from thermodynamic, kinetic, mass transfer, and potential theory. Numerical analysis and design of electrochemical systems. Statistical analysis of experimental data and industrial experimental designs.

ECHE 771 - Corrosion Engineering (3 Credits)
Corrosion engineering principles developed from thermodynamic, kinetic, mass transfer, and potential theory. Numerical analysis of corroding systems, statistical analysis of experimental data, and industrial experimental designs.

ECHE 772 - Principles of Polymer Systems (3 Credits)
Theory and applications of polymer systems. Structure, physical properties, rheological, and mechanical behavior of polymers. Polymerization reactions and industrial polymerization processes. Fabrication techniques.

ECHE 789 - Selected Topics in Chemical Engineering (3 Credits)
Approved for special topic offerings.

ECHE 797 - Research (1-12 Credits)
Individual research to be arranged with instructor.

ECHE 798 - Graduate Seminar in Chemical Engineering (1-2 Credits)
Seminar on current topics in chemical engineering. Includes oral presentations by students on research projects.

ECHE 799 - Thesis Preparation (1-12 Credits)
To be arranged by candidates for the master's degree with the thesis advisor.

ECHE 865 - Chemical Process Safety and Loss Prevention (3 Credits)
Chemical process quantitative risk analysis, consequence modeling, risk estimation, and hazards assessment; design principles including inherent safety and mitigation techniques; elements of process safety management.
Prerequisites: ECHE 720.

ECHE 899 - Dissertation Preparation (1-12 Credits)