Chemical Engineering, M.S.Ch.E., Ph.D.

**Degrees Offered**

- Masters of Science, Engineering (M.S.E.)
- Masters of Science, Chemical Engineering (M.S.Ch.E.)
- Doctor of Philosophy, Chemical Engineering (Ph.D.)

**Nature of the Program**

The department is authorized to admit students to the following degree programs: master's of science in chemical engineering (M.S. Ch.E.), master's of science in engineering (M.S.E.), and doctor of philosophy (Ph.D.). A problem report option is also available as an alternative to the traditional research based master's degree. Students in these programs must comply with the rules and regulations as presented in the general requirements for graduate work in the college and in the Department of Chemical and Biomedical Engineering. Students interested in pursuing work for a master's or doctoral degree in chemical engineering should contact the department for copies of the required guidelines and application information.

**Program Outcomes**

Holders of graduate degrees will understand the advanced principles of chemical engineering. These include reaction engineering, transport phenomena, and thermodynamics.

- Holders of graduate degrees will have an expert-level understanding of the background and theory/principles of their research topics.
- Holders of Ph.D. degrees will be able to initiate research ideas in order to solve specific problems and to write research proposals on these ideas.
- Holders of Ph.D. degrees will have furthered a novel research idea.
- Holders of graduate degrees will be able to plan research projects, to perform the tasks, and to draw conclusions based on sound scientific and engineering principles.
- Holders of graduate degrees will be able to write technical articles for publication in refereed journals and to make oral and poster presentations at technical meetings.
- Holders of graduate degrees will demonstrate initiative in research planning and management, including safety and environmental issues.
- Holders of graduate degrees will be technically prepared for a lifetime of continuing education.
- Holders of graduate degrees will understand professional and ethical responsibilities.

**Admissions**

**CHEMICAL ENGINEERING MASTERS ADMISSIONS REQUIREMENTS**

All applicants for Chemical Engineering Masters Programs must satisfy the following criteria to qualify for admission:

- A minimum cumulative grade point average of 3.0, or equivalent, (on a 4.0 scale) in all previous college work.
- Three letters of reference.
- A personal statement.
- International applicants must submit proof of English language proficiency.
- International students must provide Graduate Record Examination scores.
- A baccalaureate degrees in chemical engineering, other engineering fields, mathematics, or basic sciences.
- Students not holding a baccalaureate degree in chemical engineering are eligible for the Masters of Science in Engineering (M.S.E.) Program. These students must take an additional nine hours of junior level course work in the first two semesters. Alternatively, students taking a total of 18 hours at junior level in the first two semesters are eligible for the M.S.Ch.E. Program.
- Admitted students will receive a letter specifying the course work required in the first two semesters.

**CHEMICAL ENGINEERING DOCTORAL DEGREE PROGRAMS**

All applicants for Chemical Engineering Doctoral degree must satisfy the following criteria to qualify for admission:

- Admission to the Ph.D. Program is open to all qualified students. Generally, students without a B.S. or M.S. in chemical engineering are not admitted directly to the Ph.D. Program.
- A minimum cumulative grade point average of 3.0, or equivalent, (on a 4.0 scale) in all previous college work.
- Three letters of reference.
- A personal statement.
- International applicants must submit proof of English language proficiency.
- International students must provide Graduate Record Examination scores.

MSChE Major Code: 3010
PhD Major Code: 3011

For specific information on the following programs, please see the links to the right:
- Chemical Engineering, M.S.Ch.E.

For specific information on the following programs, please see the links to the right:
- Chemical Engineering, Ph.D.

COURSES

CHE 516. Oil & Gas Refining. 3 Hours.
PR: Graduate standing and instructor approval. The fundamental principles to analyze refining processes in modern petroleum refineries, chemistry and processes for the conversion of natural gas to products equivalent to those from petroleum.

CHE 531. Mathematical Methods in Chemical Engineering. 3 Hours.
PR: MATH 261 and consent. Classification and solution of mathematical problems important in chemical engineering. Treatment and interpretation of engineering data. Analytical methods for ordinary and partial differential equations, including orthogonal functions and integral transforms. Vector calculus. (3 hr. lec.).

CHE 556. Corrosion Engineering. 3 Hours.
PR: CHE 320 or CHEM 341 or equivalent. Basic mechanisms of various types of corrosion such as galvanic corrosion, pitting corrosion and stress corrosion cracking; methods of corrosion prevention such as cathodic and anodic prevention, by using coatings and inhibitors, and by selecting proper alloys. (3 hr. lec.).

CHE 556. Electronic Materials Processing. 3 Hours.
PR: Graduate standing in Engineering, Physics, Chemistry, or instructor consent. Design and application of thermal, plasma, and ion assisted processing methodologies; design and function of key process tools and components; vacuum technology; solid state, gas phase, surface, and plasma chemistry underpinnings; thin film nucleation, growth, and etching; effects of processing methods and conditions on materials properties.

CHE 580. Advanced Cellular Machinery. 3 Hours.
PR: Consent. Coverage and application of principles of cellular biology to enable the integration of cell components into biotechnological applications.

CHE 591. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

CHE 593. Special Topics. 1-6 Hours.
PR: Consent. A study of contemporary topics selected from recent developments in the field.

CHE 610. Fluidization Engineering. 3 Hours.
PR: Consent. Fundamentals of fluidization, two-phase flow theory and powder characteristics, structure and property of the emulsion phase and bubbles, mass and heat-transfer in fluidized beds with and without chemical reaction. (3 hr. lec.).

CHE 615. Transport Phenomena. 3 Hours.
PR: Consent. Introduction to equations of change (heat, mass, and momentum transfer) with a differential-balance approach. Use in Newtonian flow, turbulent flow, mass and energy transfer, radiation, convection. Estimation of transport coefficients. (3 hr. lec.).

CHE 620. Thermodynamics. 3 Hours.
PR: Consent. Logical development of thermodynamic principles. These are applied to selected topics including development and application of the phase rule, physical and chemical equilibria in complex systems, and nonideal solutions. Introduction to nonequilibrium thermodynamics. (3 hr. lec.).

CHE 625. Chemical Reaction Engineering. 3 Hours.
PR: Consent. Homogeneous and heterogeneous reaction systems, batch and flow ideal reactors, macro- and micro-mixing, non-ideal reactors, diffusion and reaction in porous catalysts, reactor stability analysis, special topics. (3 hr. lec.).

CHE 693. Special Topics. 6 Hours.
A study of contemporary topics selected from recent developments in the field.

CHE 694. Seminar. 1-6 Hours.
Seminars on current research by visitors and graduate students.

CHE 695. Independent Study. 1-9 Hours.
Faculty-supervised study of topics not available through regular course offerings.
CHE 697. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.)

CHE 716. Advanced Fluid Dynamics. 3 Hours.
PR: Consent. Analysis of flow of fluids and transport of momentum and mechanical energy. Differential equations of fluid flow; potential flow, laminar boundary-layer theory, and non-Newtonian fluids. (3 hr. lec.).

CHE 717. Advanced Heat Transfer. 3 Hours.
PR: Consent. Theory of transport of thermal energy in solids and fluids as well as radiative transfer. Steady state and transient conduction; heat transfer to flowing fluids; evaporation; boiling and condensation; packed- and fluid-bed heat transfer. (3 hr. lec.).

CHE 718. Advanced Mass Transfer. 3 Hours.
PR: Consent. Theory of diffusion, interphase mass-transfer theory, turbulent transport, simultaneous mass and heat transfer, mass transfer with chemical reaction, high mass-transfer rates, and multicomponent macroscopic balances. (3 hr. lec.).

CHE 720. Applied Statistical and Molecular Thermodynamics. 3 Hours.
PR: CHE 620 and consent. The connection between macroscopic phenomena (thermodynamics) and microscopic phenomena (statistical and quantum mechanics). Thermodynamics modeling for process analysis. Equations of state, perturbation theories, mixing rules, computer simulation, group-contribution models, and physical-property prediction. (3 hr. lec.).

CHE 726. Catalysis. 3 Hours.
PR: CHE 625 or consent. Physical and chemical properties of catalytic solids, nature and theories of absorption, thermodynamics of catalysis, theories of mass and energy transport, theoretical and experimental reaction rates, reactor design, and optimization. (3 hr. lec.).

CHE 730. Advanced Numerical Methods. 3 Hours.

CHE 731. Optimization of Chemical Engineering Systems. 3 Hours.
PR: Consent. Optimization in engineering design, unconstrained optimization and differential calculus, equality constraints optimization, search technique, maximum principles, geometric and dynamic programming, linear and nonlinear programming, and calculus of variations. (3 hr. lec.).

CHE 790. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in college teaching of chemical engineering. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading may be S/U.).

CHE 791. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

CHE 792. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

CHE 793. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

CHE 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

CHE 796. Graduate Seminar. 1-3 Hours.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

CHE 797. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).