

# Chemical and Materials Engineering

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## Mission

The Department of Chemical and Materials Engineering is dedicated to developing and maintaining undergraduate and graduate programs that educate students in the safe control and manipulation of matter in industrially important chemical and materials systems. The faculty will continue to educate students and maintain its programs by providing intellectual leadership, innovative teaching, university and community service, while conducting internationally recognized research. Undergraduate and graduate programs within the department are continuously refined based on national standards and are designed to encourage interdisciplinary education. Research objectives focus on technology important to the further development of the university, the community, the state of Alabama, and the nation.

## Degree Programs

The Department of Chemical and Materials Engineering offers coursework and research leading to the Master of Science degree in Engineering. The Doctor of Philosophy degree is available through the Materials Science PhD program, the Biotechnology Science and Engineering Program, or the Chemical Engineering Option of the Mechanical Engineering PhD program.

The range of research interests in the chemical engineering faculty is broad. It affords graduate students opportunities for advanced work in processes, reaction engineering, electrochemical systems, material processing and biotechnology and energy. The MSE degree granted in these areas of concentration is equivalent to those available in a traditional chemical engineering program. Please contact the Department of Chemical and Materials Engineering (256.824.6810) or visit the CHE homepage at <http://www.uah.edu/eng/departments/cme> for further details.

## Chemical Engineering, MSE

The MSE in CHE requires a total of 30 semester hours. There are two options: Plan One includes 24 semester hours of coursework and 6 semester hour of thesis work and Plan Two The basic program of study contains a minimum of 18 semester hours of graduate-level course work that must include 12 semester hours in graduate chemical engineering courses and 6 semester hours of courses in Graduate Engineering Analysis.

## Chemical Engineering, PhD options

The College of Engineering does not offer a PhD in Chemical Engineering. However, students with a background in chemical engineering may pursue one the following interdisciplinary options:

- PhD in Materials Science. This program is innovative joint-program involving all three campuses of the University of Alabama System (UAB, UAH, and UA) and multiple departments from the UAH College of Science and College of Engineering. The requirements include a three-part program examination, 48 credit hours of graduate coursework, 18 credit hours of dissertation (MTS 799) and successful defense of a doctoral dissertation.
- PhD in Biotechnology Science and Engineering. This is a joint program between the UAH College of Science and College of Engineering. The requirements include 48 credit hours of graduate coursework, 18 credit hours of dissertation (BSE 799) and successful completion of a preliminary examination and a doctoral dissertation.
- PhD in Mechanical Engineering with a Chemical Engineering option. The Chemical Engineering Option of the Mechanical Engineering PhD program requires 48 credit hours of graduate coursework. Students should consult the requirements for the Mechanical Engineering PhD.

Students who wish to pursue one of these options should consult the catalog entries for these programs for more information or visit the CME Department office.

## Graduate Programs in Chemical & Materials Engineering

- Chemical Engineering, MSE (<http://catalog.uah.edu/grad/colleges-departments/engineering/chemical-materials-engineering/chemical-engineering-mse>)

CHE 540 - PHYSICAL PROP OF FLUIDS  
Semester Hours: 3

Theoretical, experimental, and correlation methods for determining and predicting the thermodynamic and transport properties of various fluids. Critical properties, equations of state, vapor pressure and latent heat, heat capacity. Viscosity, thermal conductivity, diffusion coefficient, phase equilibrium, heat and free energy for formation.

CHE 541 - CHEMICAL KINETICS & REACTOR DE

Semester Hours: 3

Fundamental principles of chemical kinetics and chemical reactor engineering along with the design of both thermal and catalytic reactors.

CHE 549 - INTRO ENVIRONMENTAL ENGR

Semester Hours: 3

Engineering aspects of air, water, and thermal pollution. Hydrologic cycle, water sources and uses; industrial and other sources of primary and secondary pollutants. Transport process in environmental problems and in their control.

CHE 552 - EXPER TECH IN FLUID MECH

Semester Hours: 3

CHE 559 - SELECTED TOPICS/CHE

Semester Hours: 1-6

Discussion of biocompatible polymers and their application in drug delivery systems. Polymers of natural and synthetic origin will be studied, special emphasis will be placed upon the synthesis of biocompatible polymers. The formation of polymeric micelles, hydrogels and liposomes will be studied. The process of extravasation as uptake mechanism for polymeric delivery systems will be discussed. Reading material will be based on the latest publications in the field.

CHE 560 - INTRO TO BIOPROCESS ENGR

Semester Hours: 3

Application of engineering principles to the analysis of and the development and design of processes using biological catalysts including enzymes, plant and animal cells, and genetically engineered cells. Other topics include fermentation and biological mass transport processes.

CHE 561 - BIOSEPARATIONS RECOMBI TECH/PR

Semester Hours: 3

General characteristics of separation processes used in the biotechnology industry, including removal of insolubles, isolation and purification of thermally sensitive products for final use by the customer. Application of unit operation principles for biological separations, recombinant DNA techniques, protein engineering.

CHE 594 - APPLIED MATERIALS PROCESSING

Semester Hours: 3

Synthesis and processing methods of materials for engineering applications. Selection and use of materials performance factors for design of structural and functional components. Use of computational methods in solving open-ended design problems that depend on an understanding of the nature and properties of materials will be emphasized. All classes of materials are covered.

CHE 595 - POLYMER ENGINEERING

Semester Hours: 3

Engineering principles of polymers and their role in manufacturing processes. Aspects of polymer phenomena and their relationship to processing of structural and functional components.

CHE 641 - ADV THERMODYNAMICS

Semester Hours: 3

Application of classical thermodynamics. Treatment of problems involving nonideal gases and liquids, phase equilibrium, and chemical equilibrium.

CHE 642 - PHYSICOCHEMICAL HYDRODYNAMICS

Semester Hours: 3

Treatment of electrokinetic phenomena, axial dispersion, convective diffusion in liquids, Brownian motion, flows driven by surface tensions, capillary motion.

CHE 644 - INTRO ELECTROCHEM SYSTEM

Semester Hours: 3

Thermodynamics, transport, and kinetics of electrodes and cells. Systems analysis of batteries, fuel cells, porous electrodes, electroplating, electrowinning, and corrosion processes. Convective diffusion at high Schmidt numbers.

CHE 646 - THERMODYNAMICS OF MATRLS

Semester Hours: 3

Fundamental thermodynamic review, phase equilibrium, chemical reaction equilibrium, free energy, binary and ternary phase transformations, solution models and selected topics.

**CHE 648 - TRANSPORT PHENOMENA I**

Semester Hours: 3

Introduction to transport phenomena, fluid and continuum mechanics. Exact solutions of the Navier-Stokes equation. Introduction to boundary-layer. Multiphase flows. Capillary flows.

**CHE 649 - TRANSPORT PHENOMENA II**

Semester Hours: 3

Introduction to transport phenomena with emphasis on energy and mass transport. Equations of energy change. Free and forced convection. Equations of mass change. Ficks Law. The Stephan-Maxwell equations. Mass transport in multiphase systems.

**CHE 650 - PRINC LIQUID/SOLID INTER**

Semester Hours: 3

Applies basic principles in thermodynamics and kinetics to characterize surfaces and surface phenomena. Fundamental properties of gas-liquid, liquid-liquid, solid-liquid, and solid-gas interfaces and phenomena occurring at these interfaces.

**CHE 652 - INTRO TO AIR POLLU CONTROL**

Semester Hours: 3

Technology of air pollution dealing with air pollutants, effects, sources, combustion processes, and abatement and control technology. Engineering contributions to both the problems and their solutions. Nature of air pollution problem and fundamental technological approaches to its solution.

**CHE 657 - ADVANCED PROCESS CONTROL**

Semester Hours: 3

Application of modern control theory to chemical processes; multivariable control; estimation and adaptive control, optimal control.

**CHE 658 - CATALYSIS/REACTOR DESIGN**

Semester Hours: 3

Treatment of homogeneous and heterogeneous reaction kinetics, transport in fluid-solid reactions, catalyst deactivation and their effects on the analysis and design of chemical reactors.

**CHE 659 - SELECTED TOPICS/CHE**

Semester Hours: 1-6

**CHE 696 - GRAD INTERNSHIP CHE ENGR**

Semester Hours: 1-9

Active involvement in an engineering project in an engineering enterprise, professional organization or government agency that has particular interest and relevance to the graduate student. Permission of CHE faculty member required.

**CHE 699 - MASTER'S THESIS**

Semester Hours: 1-9

**CHE 724 - INSTR METH/BIO-MTLS CHARACTERI**

Semester Hours: 3

**CHE 725 - INSTR METH/BIO-MTLS CHARACTERI**

Semester Hours: 4

**CHE 747 - ADV TOP/BIOENGINEERING**

Semester Hours: 3

Engineering aspects of microbial processes and the processing of biological materials. Integrating knowledge of governing biological properties and principles with chemical engineering methodology. Emphasis on current literature in the areas of purification and separation technology, bioprocess development and biomaterials.

**CHE 749 - MASS TRANSPORT**

Semester Hours: 3

Mass transfer in solid and fluid systems under steady and transient conditions. Integration of momentum, heat and mass transfer equations with application to reactive, rheological and multicomponent systems.

**CHE 757 - OPT TECH/FLUID MECHANICS**

Semester Hours: 3

Laser courses, molecular interactions with light and diatomic spectroscopy needed fluorescence, Brillouin scattering, four wave mixing, CARS and other applications in optical fluid diagnostics.

CHE 759 - ADV SELECTED TOPICS IN CHE

Semester Hours: 1-3

CHE 799 - DOCTORAL DISSERTATION

Semester Hours: 1-9

Required each semester student is enrolled and receiving direction on doctoral dissertation.