

# CHEMICAL ENGINEERING (CME)

## Chemical Engineering (CME) Courses

### **CME 5503. Chemical Engineering Ethics and Leadership. (3-0) 3 Credit Hours.**

A study of professional engineering ethics, including the history of ethical thinking, codes and professionalism, and problem-solving techniques. The connection of engineering ethics to emerging ESG issues. Leadership is introduced using the Student Leadership Challenge to provide fundamental principles of leadership. The course will include case studies, guest speakers, and experiential learning to reinforce the topics. Differential Tuition: \$165.

### **CME 6103. Chemical Engineering Kinetics and Reactor Design. (3-0) 3 Credit Hours.**

This course will cover the study of chemical reaction kinetics and mechanisms in complex homogeneous and heterogeneous reaction systems. It will include analysis of experimental data, modeling, and analysis and design of chemical reactors for such systems. Differential Tuition: \$165.

### **CME 6113. Heterogeneous Catalysis and Surface Science. (3-0) 3 Credit Hours.**

Students will learn about important industrial catalysts for a variety of applications in energy and fuels, the environment, and sustainability. They will learn about the functions of different key components within a formulation. Students will gain insight into the characterization of catalysts by temperature-programmed methods, adsorption approaches, spectroscopic techniques, and isotope tracers. They will learn about catalyst performance parameters, such as selectivity, activity, and stability. They will examine the root causes of deactivation (sintering, attrition, Ostwald ripening, oxidation, and poisoning), as well as possibilities for catalyst regeneration. They will learn about how diffusional limitations can impact catalyst performance. Differential Tuition: \$165.

### **CME 6123. Electrochemical Engineering. (3-0) 3 Credit Hours.**

This course will teach the fundamentals of electrochemistry and apply them to electrochemical reactor analysis and design. Building on a theoretical foundation of thermodynamics, kinetics and transport processes in electrochemical systems, and current and potential distribution, this course will examine corrosion engineering, electrodeposition, batteries and fuel cells, industrial electrolysis, and electrosynthesis. Differential Tuition: \$165.

### **CME 6133. Biochemical Engineering. (3-0) 3 Credit Hours.**

The course will introduce students to the principles that govern biochemical processes. Topics to be covered include fluid, heat, and mass balances involved with chemical and enzymatic reactions and microbial cell growth kinetics and transport. A focus will be given to fermenters, their design, and applications in the industry. Differential Tuition: \$165.

### **CME 6203. Advanced Chemical Engineering Thermodynamics. (3-0) 3 Credit Hours.**

Advanced treatment of pure and multicomponent thermodynamic systems. Topics covered include equations of state, corresponding states, activity coefficient models, and intermolecular forces. The focus of the course is on phase and chemical equilibria in chemical engineering. Differential Tuition: \$165.

### **CME 6303. Transport Phenomena. (3-0) 3 Credit Hours.**

Advanced study of single and multidimensional steady-state and transient problems in heat, mass, and momentum transfer. The course includes analytical and numerical approximation methods and boundary layer theory. Differential Tuition: \$165.

### **CME 6403. Mathematical and Numerical Methods in Chemical Engineering. (3-0) 3 Credit Hours.**

This course will introduce students to advanced mathematical and numerical methods necessary to solve problems frequently encountered in chemical engineering and related disciplines. Topics covered include vector differential and integral calculus, linear algebraic equations, and ordinary and partial differential equations. Differential Tuition: \$165.

### **CME 6601. Chemical Engineering Research Seminar. (1-0) 1 Credit Hour.**

Students will attend research presentations by invited speakers. The seminar coordinator may require students to present their research. May be repeated for credit, but no more than 4 credit hours may be applied to the Ph.D. in Chemical Engineering. The grade report for the course is either "CR" (satisfactory performance) or "NC" (unsatisfactory performance). Differential Tuition: \$55.

### **CME 6703. Electronic and Local Atomic Structure using Synchrotron Methods. (3-0) 3 Credit Hours.**

In this course, the student will learn how to model the local atomic structure of metal and metal oxide catalysts by extended X-ray absorption fine structure spectroscopy using software such as WinXAS, Atoms, FEFF, and FEFIT. The student will learn how to reduce and normalize experimental data with WinXAS. Then, the student will utilize Atoms software to arrange atoms spatially, requiring knowledge of basic crystallography. The student will construct theoretical spectra for extended X-ray absorption fine structure spectroscopy based on interatomic interactions and scattering paths. The student will then utilize FEFIT to fit experimental data with theoretical spectra using parameters such as coordination number, Debye-Waller factor, lattice contraction/expansion, and shift in binding energy. Differential Tuition: \$165.

### **CME 6803. Introduction to Polymer Science and Engineering. (3-0) 3 Credit Hours.**

This course reviews the basic principles and features of polymeric materials to identify and understand the key structure-property-processing relationship of polymers, understand and apply polymers design for different applications, including biomedical applications, evaluate the trend of polymeric materials, and design and analyze the performance of contemporary polymeric materials. Differential Tuition: \$165.

### **CME 6813. Self-healing Polymers. (3-0) 3 Credit Hours.**

This course covers basic principles and features of self-healing polymers including fundamental physical and chemical properties, mathematical models, synthesis, processing, characterization, and contemporary applications. Differential Tuition: \$165.

### **CME 6903. Fundamentals of Interfaces, Nanoparticles, and other Colloids. (3-0) 3 Credit Hours.**

Introduction to nanoparticle colloids, emulsions, foams, and interfacial science. Topics covered include thermodynamics of interfaces, wetting, interfacial tension, molecular scale forces at interfaces, DLVO theory, and non-DLVO forces. Differential Tuition: \$165.

### **CME 6943. Chemical Engineering Internship. (0-0) 3 Credit Hours.**

Internship in a non-academic R&D center. No more than 3 credit hours will apply to the Ph.D. in Chemical Engineering. Differential Tuition: \$165.

**CME 6951. Independent Study in Chemical Engineering. (0-0) 1 Credit Hour.**

Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of regular course offerings. May be repeated for credit on a different topic of study, but no more than 6 credit hours may be applied to the degree. Differential Tuition: \$55.

**CME 6952. Independent Study in Chemical Engineering. (0-0) 2 Credit Hours.**

Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of regular course offerings. May be repeated for credit on a different topic of study, but no more than 6 credit hours may be applied to the degree. Differential Tuition: \$110.

**CME 6953. Independent Study in Chemical Engineering. (0-0) 3 Credit Hours.**

Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of regular course offerings. May be repeated for credit on a different topic of study, but no more than 6 credit hours may be applied to the degree. Differential Tuition: \$165.

**CME 6973. Topics in Chemical Engineering. (3-0) 3 Credit Hours.**

An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. May be repeated for credit as topics vary, but not more than 6 hours may be applied to the Ph.D. in Chemical Engineering. Differential Tuition: \$165.

**CME 7101. Doctoral Research. (0-0) 1 Credit Hour.**

This course consists of independent, original research under the direction of a faculty advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Research is required. Differential Tuition: \$55.

**CME 7102. Doctoral Research. (0-0) 2 Credit Hours.**

This course consists of independent, original research under the direction of a faculty advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Research is required. Differential Tuition: \$110.

**CME 7103. Doctoral Research. (0-0) 3 Credit Hours.**

This course consists of independent, original research under the direction of a faculty advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Research is required. Differential Tuition: \$165.

**CME 7106. Doctoral Research. (0-0) 6 Credit Hours.**

This course consists of independent, original research under the direction of a faculty advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Research is required. Differential Tuition: \$330.

**CME 7201. Doctoral Dissertation. (0-0) 1 Credit Hour.**

This course consists of independent, original research under the direction of a faculty advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Dissertation is required. Differential Tuition: \$55.

**CME 7202. Doctoral Dissertation. (0-0) 2 Credit Hours.**

This course consists of independent, original research under the direction of a faculty advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Dissertation is required. Differential Tuition: \$110.

**CME 7203. Doctoral Dissertation. (0-0) 3 Credit Hours.**

This course consists of independent, original research under the direction of a faculty advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Dissertation is required. Differential Tuition: \$165.

**CME 7206. Doctoral Dissertation. (0-0) 6 Credit Hours.**

This course consists of independent, original research under the direction of a faculty advisor. May be repeated for credit. A minimum of 18 credit hours of Doctoral Dissertation is required. Differential Tuition: \$330.