

DEPARTMENT OF CHEMICAL ENGINEERING

Maria Coleman, chair

The Department of Chemical Engineering offers graduate courses and conducts research in the areas of advanced materials, alternative energy, biomass conversion to chemicals and materials, polymer science and engineering, and membrane science and engineering. Students may select from a variety of courses and research topics in each area. The department offers two graduate degrees, a Master of Science in Chemical Engineering (M.S.Ch.E.) and a Doctor of Philosophy in Engineering (Ph.D.).

Alternative energy research focuses on the production of fuels from lignocellulosic biomass and algae. Faculty also are developing processes for the conversion of biomass to chemicals and materials, including polymers and fuels. Advanced materials and complex fluid formulations are being developed for application in catalysis, drug delivery, energy, home/personal care products, nanosensors, and nanocomposites. Packaging is the focus of work in polymer science and engineering, especially the development of sustainable packaging materials with enhanced barrier properties for product preservation and improved recyclability. This work is conducted largely through the University's Polymer Institute. Finally, membrane materials and processes are being developed for desalination, wastewater treatment, carbon dioxide capture, and energy production.

Degrees Offered

M.S. in Chemical Engineering (<https://catalog.utoledo.edu/graduate/engineering/departments/chemical-engineering/ms-chemical-engineering/>)

Ph.D. in Engineering (Chemical Engineering) (<https://catalog.utoledo.edu/graduate/engineering/departments/chemical-engineering/phd-engineering/>)

COURSES

CHEE 5410 Bioseparations

[3 credit hours]

Introduction to, analysis and industrial design of processes required to separate and purify proteins and other biological compounds for the downstream processing of bioreactor products. The separations techniques will include filtration, chromatography and crystallization.

Prerequisites: BIOE 3400 with a minimum grade of D- or CHEE 3120 with a minimum grade of D-

Term Offered: Fall

CHEE 5800 Polymer Science And Engineering

[3 credit hours]

Polymerization processes, characterization, structure and properties of polymers, processing and engineering applications of the major polymer types.

Term Offered: Fall

CHEE 5930 Seminars in Chemical Engineering

[0-1 credit hours]

Research topics of current interest to chemical engineers will be presented by internal and external speakers in a research seminar format.

Term Offered: Spring, Fall

CHEE 6010 Green Engineering Principles

[3 credit hours]

The principles of chemical process analysis and design are introduced for the development of green engineering processes. Common components of chemical processes are reviewed and quantitative analyses of process performance and economics developed. The impact of design variables on materials and energy usage is demonstrated.

Term Offered: Fall

CHEE 6110 Green Engineering Applications

[3 credit hours]

Applications of green engineering principles in the chemical industry are discussed. Metrics for comparing process options are introduced along with common techniques for improving process performance.

Prerequisites: CHEE 6010 with a minimum grade of C

Term Offered: Spring

CHEE 6120 Biofuels

[3 credit hours]

The technical, economic, social, and political issues associated with energy consumption are discussed. The potential for biofuels to replace current energy sources is examined based on the historical evolution of the industry and current research activity.

Term Offered: Spring

CHEE 6500 Advanced Chemical Reaction Engineering

[3 credit hours]

Analysis of kinetic, diffusive and flow factors on chemical reactor performance. Topics include batch, plug flow and CSTR reactors, empirical rate expressions, residence time distributions, catalytic reactors, stability and optimization, analysis of catalytic reaction rate expressions.

Term Offered: Spring, Fall

CHEE 6510 Advanced Chemical Engineering Thermodynamics

[3 credit hours]

Advanced treatment of fundamental principles of thermodynamics, especially as related to calculation of phase equilibria. Topics include intermolecular potentials, excess functions, theories of solutions, high-pressure equilibria and introductory statistical mechanics.

Term Offered: Spring, Fall

CHEE 6550 Transport Phenomena I

[3 credit hours]

Students learn how to formulate and solve engineering problems involving momentum transfer from the microscopic view. Topics include vector/tensor analysis, approximation methods, computational solutions and non-Newtonian fluid phenomena.

Term Offered: Fall

CHEE 6560 Transport Phenomena II

[3 credit hours]

Students learn how to formulate and solve engineering problems involving simultaneous momentum, heat and mass transfer from the microscopic view. Topics include conduction, radiation, diffusion, forced convection and free convection.

Prerequisites: CHEE 6550 with a minimum grade of D-

Term Offered: Spring

CHEE 6860 Polymer Laboratory Methods

[3 credit hours]

Characterization of polymers by physical testing (tensile, creep and rheological), physicochemical methods (viscosity, gel permeation chromatography), thermal analysis, spectroscopy, light microscopy, permeation, density, light scattering and processing.

Term Offered: Spring, Fall

CHEE 6920 Chemical Engineering Project

[1-6 credit hours]

Students will perform a special project of an advanced nature in Chemical Engineering under the supervision of a faculty advisor. The project will culminate in submission of a written report. The course is intended primarily for Masters students pursuing a project Masters in Chemical Engineering.

Term Offered: Spring, Summer, Fall

CHEE 6960 Master's Graduate Research And Thesis

[1-9 credit hours]

Graduate research towards the completion of a Master's Degree.

Term Offered: Spring, Summer, Fall

CHEE 6970 Graduate Engineering Internship

[1-6 credit hours]

Academic advisor approved industrial or non-profit internship to provide an experiential learning component to the Master's/ doctoral degree program.

Prerequisites: GNEN 5000 (may be taken concurrently) with a minimum grade of S

Term Offered: Spring, Summer, Fall

CHEE 6980 Special Topics In Chemical Engineering

[1-6 credit hours]

Selected topics from current chemical engineering research with intensive investigation into the recent literature in an area of mutual interest to the student and the instructor.

Term Offered: Spring, Summer, Fall

CHEE 6990 Independent Study In Chemical Engineering

[1-6 credit hours]

The student, under the guidance of their research advisor, explores in-depth specific areas or topics related to their project, thesis, or dissertation research, or other academic interests.

Term Offered: Spring, Summer, Fall

CHEE 8010 Green Engineering Principles

[3 credit hours]

The principles of chemical process analysis and design are introduced for the development of green engineering processes. Common components of chemical processes are reviewed and quantitative analyses of process performance and economics developed. The impact of design variables on materials and energy usage is demonstrated.

Term Offered: Fall

CHEE 8110 Green Engineering Applications

[3 credit hours]

Applications of green engineering principles in the chemical industry are discussed. Metrics for comparing process options are introduced along with common techniques for improving process performance.

Prerequisites: CHEE 8010 with a minimum grade of C

Term Offered: Spring

CHEE 8120 Biofuels

[3 credit hours]

The technical, economic, social, and political issues associated with energy consumption are discussed. The potential for biofuels to replace current energy sources is examined based on the historical evolution of the industry and current research activity.

Term Offered: Spring

CHEE 8500 Advanced Chemical Reaction Engineering

[3 credit hours]

Analysis of kinetic, diffusive and flow factors on chemical reactor performance. Topics include batch, plug flow and CSTR reactors, empirical rate expressions, residence time distributions, catalytic reactors, stability and optimization, analysis of catalytic reaction rate expressions.

Term Offered: Spring, Fall

CHEE 8510 Advanced Chemical Engineering Thermodynamics

[3 credit hours]

Advanced treatment of fundamental principles of thermodynamics, especially as related to calculation of phase equilibria. Topics include intermolecular potentials, excess functions, theories of solutions, high-pressure equilibria and introductory statistical mechanics.

Term Offered: Spring, Fall

CHEE 8550 Transport Phenomena I

[3 credit hours]

Students learn how to formulate and solve engineering problems involving momentum transfer from the microscopic view. Topics include vector/tensor analysis, approximation methods, computational solutions and non-Newtonian fluid phenomena.

Term Offered: Fall

CHEE 8560 Transport Phenomena II

[3 credit hours]

Students learn how to formulate and solve engineering problems involving simultaneous momentum, heat and mass transfer from the microscopic view. Topics include conduction, radiation, diffusion, forced convection and free convection.

Prerequisites: CHEE 8550 with a minimum grade of D-

Term Offered: Spring

CHEE 8860 Polymer Laboratory Methods

[3 credit hours]

Characterization of polymers by physical testing (tensile, creep and rheological), physicochemical methods (viscosity, gel permeation chromatography), thermal analysis, spectroscopy, light microscopy, permeation, density, light scattering and processing.

Term Offered: Spring, Fall

CHEE 8960 Doctoral Graduate Research And Dissertation

[1-9 credit hours]

Graduate research towards the completion of a Doctoral Degree.

Term Offered: Spring, Summer, Fall

CHEE 8970 Graduate Engineering Internship

[1-6 credit hours]

Academic advisor approved industrial or non-profit internship to provide an experiential learning component to the Master's/ doctoral degree program.

Prerequisites: GNEN 5000 (may be taken concurrently) with a minimum grade of S

Term Offered: Spring, Summer, Fall

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Selected topics from current chemical engineering research with intensive investigation into the recent literature in an area of mutual interest to the student and the instructor.

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Term Offered: Spring, Summer, Fall