

CHEMICAL AND ENVIRONMENTAL ENGINEERING (CHEE)

CHEE 1000 Orientation And Computing For Chemical and Environmental Engineers

[0-3 credit hours]

An introduction to the UToledo campus, campus resources, the College of Engineering, and Chemical and Environmental Engineering. Primary emphasis is on engineering computing, data analysis, and basic chemical engineering calculations.

Term Offered: Fall

CHEE 1010 Professional Development

[1 credit hour]

Social protocol and ethics in industry. Resume writing and interview skills are presented in preparation for the Co-op experience. Review of resource materials for technical and non-technical individual learning. Oral and written presentation techniques are emphasized.

Prerequisites: CHEE 1000 with a minimum grade of D-

Term Offered: Spring

CHEE 2010 Mass And Energy Balances

[3 credit hours]

Introduction to the principles and techniques used in chemical engineering. Basic concepts of mathematics, physics and chemistry are applied to solving problems involving stoichiometry, material balances and energy balances.

Prerequisites: CHEE 1000 with a minimum grade of D- and (MATH 1850 (may be taken concurrently) with a minimum grade of D- and CHEM 1230 (may be taken concurrently) with a minimum grade of D-)

Term Offered: Spring

CHEE 2110 Process Fluid Mechanics

[3 credit hours]

A comprehensive introduction to process fluid mechanics. Topics include: hydrostatics, characteristics of laminar and turbulent flow, mechanical energy balance, flow through packed beds and fluidization of solids, design of pumping systems and piping networks and metering of fluids.

Prerequisites: CHEE 2010 with a minimum grade of D- and MATH 1860 with a minimum grade of D-

Term Offered: Spring

CHEE 2230 Chemical Engineering Thermodynamics I

[3 credit hours]

The principles of thermodynamics and their application to chemical engineering. Topics include states and properties of matter, the first and second law of thermodynamics and thermo-chemical effects.

Prerequisites: CHEE 2010 with a minimum grade of D- and MATH 1850 with a minimum grade of D- and MATH 1860 (may be taken concurrently) with a minimum grade of D- and CHEM 1240 (may be taken concurrently) with a minimum grade of D-

Term Offered: Fall

CHEE 2330 Chemical Engineering Thermodynamics II

[3 credit hours]

Topics include properties of fluid mixtures, phase equilibria, chemical equilibria, power generation and refrigeration processes.

Prerequisites: CHEE 2230 with a minimum grade of D- and MATH 1860 with a minimum grade of D- and CHEE 2010 with a minimum grade of D- and CHEM 1240 with a minimum grade of D-

Term Offered: Spring, Summer

CHEE 3030 Separation Processes

[3 credit hours]

An introduction to equilibrium-based separation processes. Topics include distillation, extraction, leaching, drying and membrane separations. Preliminary equipment design calculations.

Prerequisites: CHEE 2330 with a minimum grade of D-

Term Offered: Spring, Fall

CHEE 3110 Process Heat Transfer

[3 credit hours]

Fundamental equations of heat transfer. Fourier's law. Steady and unsteady thermal conduction. Heat transfer coefficients. Condensation and boiling. Forced and natural convection. Radiation, Kirchoff's law and view factors. Design of different types of heat exchangers.

Prerequisites: CHEE 2110 (may be taken concurrently) with a minimum grade of D- and CHEE 2230 with a minimum grade of D-

Corequisites: CHEE 2110

Term Offered: Spring

CHEE 3120 Mass Transfer

[3 credit hours]

Mass transfer and its application in chemical engineering separations. Diffusivity, mass transfer coefficients and Fick's Law. Applications in continuous and stagewise processes, including absorption, extraction and distillation.

Prerequisites: (CHEE 2110 with a minimum grade of D- and CHEE 3030 (may be taken concurrently) with a minimum grade of D-) and MATH 2850 (may be taken concurrently) with a minimum grade of D-

Term Offered: Fall

CHEE 3300 Reactor Engineering And Design

[3 credit hours]

Fundamentals of chemical reaction engineering. Rate laws, kinetics and mechanisms of homogeneous and heterogeneous reactions. Analysis of reaction rate data. Design of industrial reactors.

Prerequisites: CHEE 2230 with a minimum grade of D- and CHEM 2410 with a minimum grade of D- and MATH 2850 (may be taken concurrently) with a minimum grade of D-

Term Offered: Fall

CHEE 3400 Process Dynamics And Control

[3 credit hours]

An introduction to designing control systems for chemical engineering processes. Process stability and controller design and selection.

Application of Laplace transforms, frequency response techniques and simulation software for open-loop and closed-loop analysis.

Prerequisites: CHEE 3300 with a minimum grade of D- and MATH 2860 with a minimum grade of D- or MATH 3860 with a minimum grade of D- or MATH 3820 with a minimum grade of D- and CHEE 2110 with a minimum grade of D-

Term Offered: Fall

CHEE 3940 Co-Op Work Experience

[1 credit hour]

Approved co-op work experience. Course may be repeated.

Prerequisites: CHEE 1010 with a minimum grade of D- and CHEE 2010 with a minimum grade of D-**Term Offered:** Spring, Summer, Fall**CHEE 3950 Co-Op Experience**

[1 credit hour]

Approved co-op work experience beyond third required co-op experience. Course may be repeated.

Prerequisites: CHEE 3940 with a minimum grade of D-**Term Offered:** Spring, Summer, Fall**CHEE 4010 Green Engineering Principles**

[3 credit hours]

The principles of chemical process analysis and design are introduced for the development of the 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 material and energy usage is demonstrated.

Prerequisites: CHEM 1240 with a minimum grade of D-**Term Offered:** Spring, Fall**CHEE 4110 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 4010 with a minimum grade of D-**Corequisites:** CHEE 4520**Term Offered:** Spring, Fall**CHEE 4120 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

Prerequisites: CHEM 1230 with a minimum grade of D-**Term Offered:** Spring**CHEE 4410 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 4500 Chemical Engineering Laboratory I**

[3 credit hours]

An experimental study of the design and performance of selected chemical engineering processes and equipment. Analysis of data, design of experiments and laboratory reports are emphasized.

Prerequisites: (CHEE 2110 with a minimum grade of D- and CHEE 3030 with a minimum grade of D- and CHEE 3110 with a minimum grade of D-)**Term Offered:** Spring, Fall**CHEE 4520 Chemical Process Economics And Design**

[3 credit hours]

Chemical equipment and process design. Introduction to simulation and flow-sheeting techniques and software. Topics include plant safety and pollution prevention, market analysis, cost estimating, decision making and cash flow analysis.

Prerequisites: CHEE 2110 with a minimum grade of D- and CHEE 2330 with a minimum grade of D- and CHEE 3030 with a minimum grade of D- and CHEE 3110 with a minimum grade of D- and CHEE 3940 with a minimum grade of PS**Term Offered:** Spring, Summer**CHEE 4540 Chemical Process Simulation And Design**

[3 credit hours]

Application of chemical engineering fundamentals and the use of process simulators in the synthesis of chemical processes. Use of cost factors and environmental considerations in process decisions. The solution of a comprehensive case study and the preparation of a formal report are required.

Prerequisites: CHEE 3120 with a minimum grade of D- and CHEE 4520 with a minimum grade of D- and CHEE 3300 with a minimum grade of D-**Term Offered:** Fall**CHEE 4550 Chemical Engineering Laboratory II**

[3 credit hours]

An experimental study of the design and performance of selected chemical engineering process equipment, focusing on heat and mass transfer and process control. Design of experiments, analysis of data and presentation techniques are emphasized.

Prerequisites: (CHEE 3300 (may be taken concurrently) with a minimum grade of D- and CHEE 3120 (may be taken concurrently) with a minimum grade of D- and CHEE 3400 (may be taken concurrently) with a minimum grade of D- and CHEE 4500 (may be taken concurrently) with a minimum grade of D-)**Term Offered:** Fall**CHEE 4800 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 4960 Senior Honors Thesis**

[3 credit hours]

Independent research under the guidance of a faculty member, requiring an oral report and a written thesis upon completion of work.

Term Offered: Spring, Summer, Fall**CHEE 4980 Special Topics In Chemical Engineering**

[1-4 credit hours]

Special topics of interest to chemical engineers - upper division.

Term Offered: Spring, Summer, Fall**CHEE 4990 Independent Studies In Chemical Engineering**

[1-4 credit hours]

Independent studies in chemical engineering - upper division.

Term Offered: Spring, Summer, Fall