CHEMICAL ENGINEERING (CHME)

CHME-100 Introduction to Chemical Engineering 4 Credits
Prerequisites: None
Students will be introduced to the discipline of chemical engineering. Class topics include discussion of what chemical engineers do in practice, basic calculations related to chemical engineering, hands-on experiences to improve the understanding of how basic chemical processes work, experiments to demonstrate core concepts, team work skills, time management, spreadsheet and process flow diagram development, and student research opportunities.
Lecture: 4, Lab 0, Other 0

CHME-200 Mass & Energy Balance 4 Credits
Prerequisites: (MATH-100 or MATH-101 or MATH-101X) and (CHEM-135 or CHEM-137)
Minimum Class Standing: Sophomore
An introduction to the study of mass and energy balance for small and large scale industrial plants. The application of mass balances for individual species for steady state operation of systems with chemical reactions is discussed. The energy balances for components and systems will be analyzed to find the energy requirements for operations at industrial scale.
Lecture: 4, Lab 0, Other 0

CHME-210 Chemical Engineering Thermodynamics 4 Credits
Corequisites: MATH-203
Prerequisites: CHME-200
Minimum Class Standing: Sophomore
This course will cover a wide range of topics related to chemical engineering thermodynamics. Energy and entropy balances will be utilized for analyzing small and large scale processes with multiple streams to compute work-loads, energy exchange, and energy efficiency. Computation of thermodynamic properties, as well as free energy and chemical potential, for ideal and non-ideal systems will be discussed using charts, tables, and equations of state. Vapor/Liquid equilibrium (VLE) for both ideal and non-ideal systems will be introduced, with focus on both equations of state and activity models. Fugacity, chemical potential, and partial properties will be discussed. Some advanced topics like reaction equilibrium and liquid-liquid equilibrium systems may also be introduced.
Lecture: 4, Lab 0, Other 0

CHME-225 Computing in Chemical Engineering 2 Credits
Corequisites: MATH-102
Prerequisites: CHME-200
This course introduces the basics of computer programming and its applications to the solution of chemical engineering problems. The student learns about advanced spreadsheet applications and useful computer programs for chemical engineers like Matlab, Polymath, and the Aspen process simulator. The student develops a basic toolset to tackle common tasks like numerical integration, curve fitting, ODE solutions, and data graphics.
Lecture: 2, Lab 0, Other 2

CHME-291 CHME Special Topics 4 Credits
Prerequisites: None
Lecture: 4, Lab 0, Other 0

CHME-310 Fluid Dynamics and Heat Transfer 4 Credits
Corequisites: CHME-200, CHME-325, MATH-203
Prerequisites: None
The application of fluid mechanics, phase transitions, and heat transfer in chemical engineering is demonstrated. Fluid studies including statistics, dynamics, friction losses, Newtonian and non-fluids, pumps, and metering of flows will be discussed. Mixing and agitation processes will be presented. Heat transfer processes, heat exchangers, evaporation and other heat transfer applications involving phase change will be discussed.
Lecture: 4, Lab 0, Other 0

CHME-325 Fluid Dynamics and Heat Transfer Lab 2 Credits
Corequisites: CHME-310
Prerequisites: None
This laboratory course demonstrates concepts in fluid mechanics and heat transfer as they relate to chemical engineering. Process measurements and the concepts of accuracy and precision are covered. Fluid static, dynamics, and metering of flows are explored. Experiments on heat conduction and convection are performed. Heat exchanger design and analysis are introduced. Computational topics include feed loop design and solutions of boundary value problems in momentum and heat transport. Finite element simulations are briefly explored.
Lecture: 0, Lab 2, Other 0

CHME-330 Mass Transfer and Separations 4 Credits
Prerequisites: CHME-210
An introduction to the applications of chemical engineering separation processes. Binary separations and multi-component separations including distillation, absorption, adsorption, leaching, drying, evaporation, extraction, membranes, filtration, and crystallization will be covered. Design of gas/liquid, liquid-liquid and liquid-solid separation processes will be discussed; methods covered include McCabe-Thiele methods, short-cut methods, sizing plate columns and packed columns, plate and column efficiencies, and mass transfer coefficient. Practical applications of mass transfer rates will be covered. Special topics including separation of azeotropes and combined separation units may be included.
Lecture: 4, Lab 0, Other 0

CHME-350 Reaction Engineering 4 Credits
Corequisites: CHME-210, MATH-204
Prerequisites: None
Concepts of reaction rates, stoichiometry and equilibrium will be applied to the analysis of chemical reacting systems, derivation of rate expressions from reaction mechanisms and equilibrium or steady state assumptions, design of chemical reactors via synthesis of chemical kinetics, transport phenomena, and mass energy balances. Topics covered include: batch, plug flow and continuously stirred reactors for chemical reactions and heterogeneous catalysis; and heat and mass transport in reactors.
Lecture: 4, Lab 0, Other 0

CHME-360 Sustainable Engineering Design: Energy and the Environment 4 Credits
Prerequisites: CHEM-135 or CHEM-137
This course is designed to introduce students to the concepts involved in designing sustainable processes and products, while also focusing on applications related to energy and the environment. The first part of the course introduces the concept of sustainability and defines it in various contexts. It will explore the connections between industrial design and its impact on the environment, such as water and air quality. Concepts and principles to enhance environmental, social, and economic sustainability of engineering designs will be introduced. The final part of the course will explore topics in extended areas such as waste-to-fuel conversion, life-cycle analysis, and battery sustainable design, among others.
Lecture: 0, Lab 0, Other 4

CHME-425 Separations, Reactions, and Prototyping Lab 3 Credits
Prerequisites: CHME-330 and CHME-350
This laboratory applies principles of reaction engineering and separations to the fabrication of a student-designed process. Topics covered include literature reviews, process safety, application and optimization of separation processes and reactors, process simulation, and design and fabrication of reactive and separation processes. Binary and multicomponent separation experiments include distillation, absorption, adsorption, filtration, and drying. Reaction engineering experiences include design of experiments to collect and regress reaction kinetic data and operation of batch and flow chemical reactors. This course will culminate in the demonstration of a student designed and built chemical engineering process.
Lecture: 0, Lab 3, Other 1

CHME-430 Process Controls 4 Credits
Prerequisites: CHME-330 and CHME-350
An understanding of the basic principles and methods underlying the steady state and dynamic characterization of chemical process control will be provided. This course introduces dynamic processes and the engineering tasks of process operations and control. Subject covers modeling the static and dynamic behavior of processes; control strategies; fundamentals and design of PID feedback, feed forward, cascade, and other control structures; controls equipment and instrumentation; statistical design of experiment; and process monitoring and statistical process control.
Lecture: 4, Lab 0, Other 0

CHME-440 Senior Chemical Engineering Design I 4 Credits
Prerequisites: ECON-201 and CHME-330 and CHME-350
Minimum Class Standing: Senior
This is the first of two advanced design courses incorporating core chemical engineering principles into the design of a plant. Topics related to plant design include optimization, plant economics and profitability, safety and environmental considerations, and ethics. Computer simulation tools will be used to aid in the designs. Three to four major designs will be completed in the form of design reports and oral presentations. Contemporary topics will be incorporated into the design projects.
Lecture: 4, Lab 0, Other 0

CHME-480 Chemical Engineering Capstone 4 Credits
Prerequisites: CHME-440
Minimum Class Standing: Senior
This is the second of two advanced courses incorporating ore chemical engineering principles into the design of a plant. Concepts built through the first semester course will be strengthened and applied to new design projects. Additional design topics including debottlenecking and troubleshooting will be introduced. Optimization to improve process performance and energy savings will be utilized and applied to course projects. Green engineering and environmental standards will be discussed as related to chemical engineering design. Students will complete large-scale industrial design projects in teams throughout the course. Finally, chemical product design concepts and strategies will be discussed.
Lecture: 4, Lab 0, Other 0

CHME-491 Adv Chemical Engng Elective 4 Credits
Prerequisites: None
An interdisciplinary advanced course focusing on a specific Chemical Engineering topic. This course is a one-time offering whose content is determined by current faculty interest, and provides a comprehensive and coherent examination of the chosen topic. This course may be repeated for credit under different topics.
Lecture: 4, Lab 4, Other 0