

CHEMICAL AND BIOMOLECULAR ENGINEERING (CHME)

CHME 113 Introduction to Chemical Engineering I

Description: The profession of chemical engineering. Chemical engineers' impact on today's societal issues, team problem solving, communication skills, and the introduction of chemical process flow sheets.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

CHME 114 Introduction to Chemical Engineering II

Prerequisites: MATH 106 or parallel, CHEM 109A and 109L or CHEM 113A and 113L or parallel

Description: Analytical and computational methods for solving problems related to chemical process measurements, properties of single compounds, properties of mixtures, stoichiometry.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded with Option

Prerequisite for: CHME 202

CHME 202 Mass and Energy Balances

Prerequisites: A grade of C- or better in CHME 114; MATH 107 or parallel.

Description: Application of the principle of conservation of mass and energy in the analysis of steady-state chemical processes. Topics in physical, chemical, and thermal property estimation.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: CHME 212; CHME 223

CHME 204 Carbon Footprints: From Greenhouse Gases to Global Warming

Prerequisites: MATH 101, 103, or Placement into MATH 102 or above.

Description: Introduction to the concepts of carbon footprints of various human activities, household items and devices, and basic calculations of "carbon accounting". Discuss the global, regional and local impact of carbon accounting.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

ACE: ACE 4 Science

CHME 212 Introduction to Chemical Engineering Computation

Prerequisites: MATH 107 or MATH 107H, CHME 202

Description: Numerical solution of linear and nonlinear systems of equations, matrix eigenvalue analysis, linear programming and optimization, data regression and model identification. Numerical methods and mathematical packages such as MATLAB that form the basis for computational methods will be emphasized.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: CHME 312

CHME 223 Chemical Engineering Thermodynamics I

Prerequisites: A grade of C- or better in CHME 202.

Description: Application of the three fundamental laws to chemical engineering problems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: CHME 331

CHME 312 Chemical Engineering Computation

Prerequisites: MATH 221, CSCE 155N or CHME 212

Description: Computational methods in orthogonal polynomials, numerical integration, matrix operations and ordinary differential equations as they apply to chemical engineering problems such as separations, reactor design, transport operations and control.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: CHME 330

CHME 323 Chemical Engineering Thermodynamics and Kinetics

Crosslisted with: CHME 823

Prerequisites: CHME 223

Description: Application to multi-component systems; thermodynamics, phase equilibria, chemical reaction equilibria, and process analysis.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: CHME 324; CHME 805; CHME 825; CHME 845;

CHME 847, CHME 447; CHME 935; CHME 995

CHME 324 Molecular Processes and Applications

Prerequisites: CHME 323 or parallel

Description: Microscopic processes, such as statistical thermodynamics and molecular kinetics are introduced. Emphasis is placed on an engineering approach to developing problem-solving skills in systems requiring molecular-level understanding.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

CHME 330 Chemical Engineering Laboratory I

Prerequisites: CHME 331, 332; CHME 312, 333 or parallel

Description: Selected experiments in chemical engineering thermodynamics, heat and momentum transfer, and separations. Emphasis on interpretation of results and written reports.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Course and Laboratory Fee: \$25

CHME 331 Equilibrium Stage Operations

Prerequisites: MATH 107; CHME 223

Description: Phase equilibrium and mass and energy balances applied to staged mass transfer operations.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: CHME 330

CHME 332 Transport Operations I

Crosslisted with: CHME 832

Prerequisites: MATH 208; CHME 223

Description: Mass, momentum and energy transport phenomena and their application in chemical engineering.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: AGEN 325, BSEN 325; AGEN 344, BSEN 344; CHME 330; CHME 333, CHME 833; CHME 420; CHME 835; CIVE 420; ENVE 410

CHME 333 Transport Operations II

Crosslisted with: CHME 833

Prerequisites: CHME 312, CHME 332

Description: Continuation of CHME 332/832.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: CHME 475, CHME 875; CHME 815; CHME 835; CHME 935; CHME 995

CHME 371 Stem Cell Engineering and Regenerative Medicine

Crosslisted with: CHME 871

Prerequisites: CHEM 109A and 109L or CHEM 113A and 113L.

Description: Introduction to stem cells and regenerative medicine with emphasis on stem cells and their application in the treatment of diseases and translational lab-to-clinic hurdles in stem cell therapy

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

CHME 409 Process Intensification and Sustainability

Crosslisted with: CHME 809

Prerequisites: Senior Standing

Description: Process intensification focuses on considerable improvements in tens to hundred percent in manufacturing by modification of existing operations or new designs. Optimization of manufacturing processes is at the core of PI

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

CHME 412 Introduction to Atomistic Simulations

Crosslisted with: CHME 812

Prerequisites: Senior standing

Description: Theory and application of quantum-based computational methods used to model, predict and analyze materials properties.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

CHME 420 Chemical Process Safety

Prerequisites: CHME 332

Description: Introduction to chemical process safety with topics emphasizing industrial hygiene, toxicology, hazard identification, inherently safer design, and engineering controls.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Offered: FALL/SPR

CHME 430 Chemical Engineering Laboratory II

Crosslisted with: CHME 830

Prerequisites: CHME 330; CHME 442 or parallel; CHME 462 or parallel.

Description: Selected experiments in chemical engineering. Emphasis on experimental design, interpretation of results, and formal oral and written presentation.

Credit Hours: 4

Max credits per semester: 4

Max credits per degree: 4

Grading Option: Graded with Option

Course and Laboratory Fee: \$25

CHME 434 Diffusional Operations

Crosslisted with: CHME 834

Prerequisites: CHME 332

Description: Application of diffusional theory to the design of processing equipment required for absorption, adsorption, leaching, drying, and chemical reactions.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

CHME 442 Chemical Reactor Engineering and Design

Crosslisted with: CHME 842

Prerequisites: CHME 323

Description: Basic principles of chemical kinetics are coupled with models descriptive of rates of energy and mass transfer for the analysis and design of reactor systems.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

Prerequisite for: CHME 845

CHME 447 Principles and Applications of Catalysis in Reaction Engineering

Crosslisted with: CHME 847

Prerequisites: CHME 323.

Description: Principles and applications of heterogeneous catalysis, mechanisms, catalytic reactor types and catalyst characterization and performance. Case studies on current catalytic technologies.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded with Option

CHME 452 Chemical Engineering Process Economics and Optimization**Crosslisted with:** CHME 852**Prerequisites:** CHME 333, CHME 331, CHME 434**Notes:** Credit toward the degree may be earned only in CHME 452/852**Description:** Criteria of chemical process economics: cost and asset accounting, time value of money, profitability, alternative investments, minimum attractive rate of return, sensitivity and risk analysis. Process optimization in: plant operations, unit operations, using successive calculations, linear programming and dynamic programming.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHME 453 Chemical Engineering Process Design and Safety****Crosslisted with:** CHME 853**Prerequisites:** CHME 452**Description:** Design, evaluation, and safety considerations of chemical engineering process applications.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**CHME 454 Chemical Process Engineering****Crosslisted with:** CHME 854**Prerequisites:** CHME 430 and 312.**Description:** Practical and theoretical aspects of chemical process analysis, simulation, and synthesis. Case studies used to illustrate principles. Use of the digital computer as a tool of the process engineer is stressed.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHME 460 Automatic Process Control Laboratory****Crosslisted with:** CHME 860**Prerequisites:** Parallel: CHME 462.**Description:** Selected laboratory experiments to demonstrate the theory of the dynamics and control of chemical processes.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$25**CHME 462 Automatic Process Control****Crosslisted with:** CHME 862**Prerequisites:** MATH 221, CHME 333**Description:** Analysis and design of automatic control systems. Dynamic responses of measuring instruments, control elements, stability of control systems, and process equipment included in control loops.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CHME 965**CHME 470 Biomanufacturing Laboratory****Prerequisites:** CHME 473**Description:** Selected experiments in molecular biology, bioprocess development, fermentation, purification, and analytical methods as they pertain to biomanufacturing.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHME 473 Biochemical Engineering****Crosslisted with:** CHME 873**Prerequisites:** CHEM 262, CHEM 431**Description:** Dynamics of microbial growth and death. Engineering processes for microbiological synthesis of cellular materials and industrial products, with emphasis on food and pharmaceutical production by bacteria and fungi.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CHME 470; CHME 474, CHME 874**CHME 474 Advanced Biochemical Engineering****Crosslisted with:** CHME 874**Prerequisites:** CHME 473/873.**Description:** Recent theoretical and technical developments in biochemical engineering.**Credit Hours:** 2-6**Min credits per semester:** 2**Max credits per semester:** 6**Max credits per degree:** 6**Grading Option:** Graded with Option**CHME 475 Biochemical Separations****Crosslisted with:** CHME 875**Prerequisites:** CHME 333/833**Description:** Separation and purification of compounds of biological origin from an analytical perspective. Application of unit operations for these separations.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHME 476 Micro/Nano systems for Engineering and Life Sciences****Crosslisted with:** CHME 876**Prerequisites:** Senior standing**Description:** Introduction to a number of biological problems facing living systems and show how micro/nanotechnology is being used to solve those problems. Emphasis on engineering perspectives of the life sciences.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option

CHME 477 Molecular Bioengineering**Crosslisted with:** CHME 877**Prerequisites:** Senior standing or permission.**Description:** Introduction to fundamentals and up-to-date developments in the field of bioengineering at the molecular level. Topics to cover include recombinant DNA methods, protein engineering, microbial cell factories, synthetic and systems biology, DNA and protein therapeutics.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**CHME 482 Polymers****Crosslisted with:** CHME 882**Prerequisites:** CHEM 262, 264 or 264A, and MATH 221**Description:** Introduction to polymer synthesis, structure, polymer physics, thermodynamics, kinetics, polymer characterization techniques, polymer properties and applications.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHME 483 Chemical Processes in Semiconductor Manufacturing****Crosslisted with:** CHME 883**Prerequisites:** A grade of C or better in ECEN 211 and MATH 208**Description:** Introduction to the basic chemical processes used in chip manufacturing, with emphasis on: thin-film metal and dielectric deposition, etching, ion implantation, diffusion, lithography, and planarization. Discuss material synthesis and processing and the principle physical/chemical governing phenomena.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHME 486 Electrochemical Engineering****Crosslisted with:** CHME 886**Prerequisites:** CHME 333, and CHME 442, or MECH 310 and MATL 360.**Description:** Thermodynamic and kinetic principles of electrochemistry are applied to the design and analysis of electrochemical processes, including chemical production, batteries, fuel cells, and corrosion prevention.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHME 489 Air Pollution, Assessment and Control****Crosslisted with:** CHME 889**Prerequisites:** Senior standing**Description:** Survey of the present status of the air pollution problem and the application of engineering and scientific principles to its practical and effective coordinated control.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHME 496 Advanced Topics in Chemical Engineering Computation****Crosslisted with:** CHME 896**Prerequisites:** CHME 312 or CSCE 455/855 or MECH 480/880, and permission.**Description:** Intensive treatment of special topics of current research interest in such areas as steady-state and dynamic process simulation, design optimization, chemical process synthesis, computer-aided product research, stochastic optimization, and numerical methods applied to transport problems.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 6**Grading Option:** Graded with Option**Prerequisite for:** CHME 915**CHME 499 Senior Problems****Prerequisites:** Senior standing in chemical engineering.**Description:** Research and development problems which include literature surveys, equipment design and operation, and development of correlations.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 6**Grading Option:** Graded with Option**CHME 499H Honors Thesis****Prerequisites:** Senior standing in chemical engineering, admission to the University Honors Program.**Description:** Honors thesis research project meeting the requirements of the University Honors Program. Independent research project executed under the guidance of a member of the faculty of the Department of Chemical Engineering which contributes to the advancement of knowledge in the field. Culminates in the presentation of an honors thesis to the department and college.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 6**Grading Option:** Graded