

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

CHME 202 Mass and Energy Balances

Prerequisites: CHEM 110A/110L or CHEM 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; ENVE 410

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 9 Global/Diversity

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 332

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 333

CHME 315 Energy Science and Engineering

Prerequisites: Sophomore and Junior standing in science and engineering

Description: Focuses on energy fundamentals, energy types, energy production, energy conversion, energy storage, energy conservation and coupling. Also discusses clean energy technologies, energy economics, energy management, and sustainability of energy systems. Develops understanding of energy problems and their solutions.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL

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 312 or parallel, 331, 332; CHME 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 or parallel.**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 408**CHME 332 Transport Operations I****Prerequisites:** MATH 208; CHME 223 or parallel**Description:** Macroscopic and microscopic phenomena in fluid mechanics applied to chemical processes. Basic conservation laws, flow kinematics, laminar flow, non-viscous and viscous flow of incompressible fluids, and boundary layer theory.**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 334; CHME 420; CHME 835; CIVE 420; ENVE 410**CHME 333 Transport Operations II****Prerequisites:** CHME 312 or parallel, CHME 332**Description:** Heat transfer by conduction, convection, and radiation applied to chemical and biochemical processes. Heat exchanger design and performance.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CHME 330; CHME 408; CHME 475, CHME 875; CHME 815; CHME 835; CHME 935; CHME 995**CHME 334 Transport Operations III****Prerequisites:** CHME 332**Description:** Diffusive and convective transport of chemical species applied to chemical and biochemical processes including reaction and separation.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CHME 408**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 395 Chemical & Biomolecular Engineering Industrial Co-operative Educational Experience****Prerequisites:** Open to Chemical & Biomolecular Engineering majors only who have been accepted into co-op job. Approval of faculty instructor is required.**Notes:** A report and presentation will be submitted to summarize the co-op experience.**Description:** Participation in a full-time co-operative educational experience in industry. Practical on-the-job experience to apply classroom theory in the chemical & biomolecular engineering industry.**Credit Hours:** 0-3**Min credits per semester:****Max credits per semester:** 3**Max credits per degree:** 6**Grading Option:** Graded**Experiential Learning:** Internship/Co-op**CHME 408 Product Design and Development****Prerequisites:** CHME 331, CHME 333, CHME 334**Description:** Analysis of product design and development with the function of the product required by customers. Brainstorming toward creative models and prototypes from initial concept to completion with a feasibility study.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**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

ACE: ACE 8 Civic/Ethics/Stewardship

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

Experiential Learning: Case/Project-Based Learning

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 331, CHME 333, CHME 334. Credit toward the degree may be earned in only one of BSEN 206/CONE 206 or CHME 452

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

Experiential Learning: Case/Project-Based Learning

CHME 454 Chemical Process Engineering

Crosslisted with: CHME 854

Prerequisites: CHME 430, CHME 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 431**Description:** Engineering processes for production of biologics and metabolic products, with emphasis on biopharmaceutical production by bacteria, yeast, and mammalian systems.**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 223 or MECH 200 or BSEN 244**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. Credit toward the degree cannot be earned in both CHME 499 and CHME 499H.

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