

# CHEMICAL ENGINEERING (CHEE)

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## **CHEE 101 Tools for Chemical Engineering (2 Units)**

Corequisites: CHEE:110 and MATH:149. Introduction to Chemical Engineering. Basic concepts of engineering practice. Introduction to professional level software including process simulation, control design, spreadsheets, mathematical computation, and process flow graphics. (Formerly 4200:101)

## **CHEE 110 Project Management and Teamwork I (1 Unit)**

Teams freshmen through senior Chemical Engineering and Corrosion Engineering undergraduates on a design team working on a realistic chemical engineering problem. Develops teamwork, communications, presentation, project management and information technology skills. (Formerly 4200:110)

## **CHEE 121 Chemical Engineering Computations (2 Units)**

Prerequisites: CHEE 101 or CORE 101. Computer programming language, flowcharting, introductory simulation and introductory numerical analysis. (Formerly 4200:121)

## **CHEE 194 Chemical Engineering Design I (1 Unit)**

Prerequisite: CHEE 101 and permission. Individual or group project under faculty supervision. Introduction to chemical engineering processes and modern design technology. Written report is required. (Formerly 4200:194)

## **CHEE 200 Material & Energy Balances (4 Units)**

Prerequisites: [CHEE 121 or CORE 105], CHEM 151, and MATH 221. Introduction to material and energy balance calculations applied to solution of chemical engineering problems. (Formerly 4200:200)

## **CHEE 210 Project Management and Teamwork II (1 Unit)**

Prerequisite: CHEE 110. Teams freshmen through senior Chemical Engineering and Corrosion Engineering undergraduates on a design team working on a realistic engineering problem. Develops teamwork, communications, presentation, project management and information technology skills. (Formerly 4200:210)

## **CHEE 220 Introduction to Thermodynamic Processes (3 Units)**

Prerequisites: MATH 223 and [CHEE 200 or CORE 200]. First and Second Laws of Thermodynamics, work, entropy, heat engines and refrigeration cycles, equations of state, departure functions and reaction equilibria. (Formerly 4200:220)

## **CHEE 225 Equilibrium Thermodynamics (4 Units)**

Prerequisites: [CHEE 200 or CORE 200] and MATH 223. Second law of thermodynamics, entropy, applications, comprehensive treatment of pure and mixed fluids. Phase and chemical equilibrium, flow processes, power production and refrigeration processes covered. (Formerly 4200:225)

## **CHEE 294 Chemical Engineering Design II (1-2 Units)**

Prerequisites: CHEE 121, CHEE 200 and permission. Supervised individual or group design project. Analysis of multi-unit process using simulation and/or experimental techniques. Written report and oral presentation required. (Formerly 4200:294)

## **CHEE 305 Materials Science (2 Units)**

Prerequisite: CHEM 153. Corequisite: PHYS 292. Structure, processing and properties of metals, ceramics and polymers. Special topics, such as composites, corrosion and wear. (Formerly 4200:305)

## **CHEE 308 Introduction to Bio-based Polymers (3 Units)**

Prerequisites: CHEM 263 and junior or greater standing. This course introduces basic concepts of polymer science: building blocks, structure, elementary reactions and polymerization mechanisms, through seven natural polymers. (Formerly 4200:308)

## **CHEE 310 Project Management and Teamwork III (1 Unit)**

Prerequisites: CHEE 210 and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: CORE 300 or CHEE 353. Teams freshmen through senior Chemical Engineering and Corrosion Engineering undergraduates on a design team working on a realistic chemical engineering problem. Develops teamwork, communications, presentation, project management and information technology skills. (Formerly 4200:310)

## **CHEE 320 Phase Equilibrium Thermodynamics (3 Units)**

Prerequisites: CHEE 220 and admission to an engineering major within the College of Engineering and Polymer Science. Thermodynamics of mixtures, excess properties, activity coefficients, mixture fugacity, mixture phase equilibrium and thermodynamic consistency. (Formerly 4200:320)

## **CHEE 321 Transport Phenomena (3 Units)**

Prerequisites: [CHEE 200 or CORE 200], MATH 335 and admission to an engineering major within the College of Engineering and Polymer Science Constitutive equations for momentum, energy and mass transfer. Development of microscopic and macroscopic momentum, energy and mass transfer equations for binary systems. Analogy and dimensionless analysis. Problems and applications in unit operations of chemical engineering. (Formerly 4200:321)

## **CHEE 330 Chemical Reaction Engineering (3 Units)**

Prerequisites: MATH 335, CHEE 220 and admission to an engineering major within the College of Engineering and Polymer Science. Nonequilibrium processes including chemical reaction mechanisms, rate equations and ideal reactor design applied to homogeneous and heterogeneous systems. (Formerly 4200:330)

## **CHEE 341 Process Economics (2 Units)**

Prerequisites: [CHEE 200 or CORE 200] and admission to an engineering major within the College of Engineering and Polymer Science. Theory and application of engineering economy to multi-unit processes. Cost estimation, time value of money, profit analysis, decision making and introduction to project management. (Formerly 4200:341)

## **CHEE 351 Fluid & Thermal Operations (3 Units)**

Prerequisite: CHEE 321 and admission to the College of Engineering and polymer Science. Applications of fluid mechanics including piping, pumping, compression, metering, agitation and separations. Applications of heat transfer by conduction, convection and radiation to design of process equipment. (Formerly 4200:351)

## **CHEE 353 Mass Transfer Operations (3 Units)**

Prerequisites: [CHEE 220 or CHEE 225] and [C- or above in CHEE 200 or CORE 200] and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: CHEE 320. Theory and design of staged operations including distillation, extraction, absorption. Theory and design of continuous mass transfer devices. (Formerly 4200:353)

## **CHEE 360 Chemical Engineering Laboratory (3 Units)**

Prerequisites: CHEE 353. Corequisites: CHEE 330, and CHEE 351. Comprehensive experiments in combined heat and mass transfer, thermodynamics, and reaction kinetics. Data collection and analysis. Comprehensive reports in various formats. (Formerly 4200:360)

**CHEE 394 Chemical Engineering Design III (1-3 Units)**

Prerequisites: CHEE 351 and permission. Supervised individual or group design project. Develop, evaluate and design feasible solutions to an open-ended problem pertinent to chemical engineering. Written report and oral presentation required. (Formerly 4200:394)

**CHEE 408 Polymer Engineering (3 Units)**

Prerequisite: Senior standing or higher or permission. Commercial polymerization, materials selection and property modification, polymer processing, applied rheology and classification of polymer industry. (Formerly 4200:408)

**CHEE 410 Project Management and Teamwork IV (1 Unit)**

Prerequisites: CHEE 310 and admission to an engineering major within the College of Engineering and Polymer Science. Corequisites: CHEE 441 or CORE 440. Teams freshmen through senior Chemical Engineering and Corrosion Engineering undergraduates on a design team working on a realistic chemical engineering problem. Develops teamwork, communications, presentation, project management and information technology skills. (Formerly 4200:410)

**CHEE 421 Fundamentals of Multiphase Transport Phenomena (3 Units)**

Prerequisite: CHEE 321 or equivalent, and instructor permission. Major topics to be covered: Intraphase and interphase transport phenomena, Transport phenomena in multiphase fluids, Transport in Porous Media, Transport in Gas/liquid pipe flows, Computational Fluid Dynamics of multiphase systems, and Case studies. (Formerly 4200:421)

**CHEE 435 Process Analysis & Control (3 Units)**

Prerequisites: CHEE 330, CHEE 353 and admission to an engineering major within the College of Engineering and Polymer Science. Response of simple chemical processes and design of appropriate control systems. (Formerly 4200:435)

**CHEE 438 Energy Integration (3 Units)**

Prerequisite: CHEE 351. This course uses Pinch Design formalism to present the core energy integration tools for energy and area targeting, and tools for integration of reactors, distillation columns, and heat pumps. (Formerly 4200:438)

**CHEE 441 Process Design I (3 Units)**

Prerequisites: CHEE 330, CHEE 341, CHEE 351, CHEE 353 and admission to an engineering major within the College of Engineering and Polymer Science. Application of chemical engineering fundamentals to the design of a multi-unit process. Emphasis on use of process simulators. Advanced equipment design, oral and written communication skills and teamwork. (Formerly 4200:441)

**CHEE 442 Process Design II (3 Units)**

Prerequisites: CHEE 441 and admission to an engineering major within the College of Engineering and Polymer Science. Teaches methods of process conceptualization, preliminary optimization. Specific topics include: chemical process design methodology, design heuristics, energy integration, and process safety review. (Formerly 4200:442)

**Gen Ed:** Capstone

**CHEE 450 Chemical Product Design and Development (3 Units)**

Prerequisite: Senior standing or permission. Introduction to the strategies and processes used to design and development new chemical products from the idea stage through manufacturing. (Formerly 4200:450)

**CHEE 461 Solids Processing (3 Units)**

Prerequisites: CHEE 321 and CHEE 353 or permission. Comprehensive problems in sedimentation, fluidization, drying and other operations involving mechanics of particulate solids in liquid and gas continua. (Formerly 4200:461)

**CHEE 462 Industrial Enzyme Technology (3 Units)**

Prerequisites: CHEE 330 and CHEE 351. Application of chemical engineering to biological processes involving enzymes and their industrial applications. Special emphasis given to the kinetics, control, design, and process economics aspects. (Formerly 4200:462)

**CHEE 463 Pollution Control (3 Units)**

Prerequisite: CHEE 353 or permission. Air and water pollution sources and problems. Engineering aspects and methodology. (Formerly 4200:463)

**CHEE 466 Digitized Data & Simulation (3 Units)**

Prerequisite: Permission. Data acquisition and analysis by digital devices, digital control applications and design. (Formerly 4200:466)

**CHEE 470 Electrochemical Engineering (3 Units)**

Prerequisites: CHEE 321 and CHEE 330. Chemical engineering principles as applied to the study of electrode processes and to the design of electrochemical reactors. Topics include electrochemical thermodynamics, cell polarizations, Faraday's Laws, electrode kinetics, transport processes in electrochemical systems, current distributions, reactor design, experimental methods, commercial processes, and batteries and fuel cells. (Formerly 4200:470)

**CHEE 471 Fuel Engineering (3 Units)**

Prerequisite: CHEE 330 or permission of instructor. Topics related to clean liquid and solid fuels technology. Special emphasis given to design, system analysis, environmental impacts, and novel technologies. (Formerly 4200:471)

**CHEE 472 Separation Processes in Biochemical Engineering (3 Units)**

Introduction to the separation and purification techniques pertinent to bioprocesses, with emphasis on engineering considerations for large scale operations. (Formerly 4200:472)

**CHEE 473 Bioreactor Design (3 Units)**

Prerequisite: CHEE 330 or instructor consent. Design, analysis, and scale-up of bioreactors for various biological processes. (Formerly 4200:473)

**CHEE 488 Chemical Processes Design (3 Units)**

Prerequisite: Permission of instructor or senior standing. Process design and analysis of emerging chemical technologies. Case studies, such as in-situ processing, alternative fuels, bioremediation, and engineering materials manufacture. (Formerly 4200:488)

**CHEE 494 Design Project (3 Units)**

Prerequisite: Permission or senior standing. Individual design project pertinent to chemical engineering under faculty supervision. Written report and oral presentation required. (Formerly 4200:494)

**CHEE 496 Topics in Chemical Engineering (1-3 Units)**

(May be repeated for a total of six credits) Prerequisite: Permission. Topics selected from new and developing areas of chemical engineering, such as electrochemical engineering, coal and synthetic fuels processing, bioengineering, simultaneous heat and mass transfer phenomena and new separation techniques. (Formerly 4200:496)

**CHEE 496-1 Surface Science (1-3 Units)**

Prerequisite: Permission. Topics selected from new and developing areas of chemical engineering, such as electrochemical engineering, coal and synthetic fuels processing, bioengineering, simultaneous heat and mass transfer phenomena and new separation techniques

**CHEE 496-2 Metallurgy Corrosion Resistance (1-3 Units)**

Prerequisite: Permission. Topics selected from new and developing areas of chemical engineering, such as electrochemical engineering, coal and synthetic fuels processing, bioengineering, simultaneous heat and mass transfer phenomena and new separation techniques.

**CHEE 497 Honors Project (1-3 Units)**

(May be repeated for a total of six credits) Prerequisite: Permission.  
Individual creative project pertinent to chemical engineering culminating in undergraduate thesis, supervised by faculty member of the department. (Formerly 4200:497)

**CHEE 499 Research Project: Chemical Engineering (1-3 Units)**

(May be repeated for a total of six credits) Prerequisite: Permission.  
Individual research project pertinent to chemical engineering under faculty supervision. Report required. (Formerly 4200:499)