
101 TOOLS FOR CHEMICAL ENGINEERING (2 credits)

- Corequisites: 110 and 3450:149. 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.

110 PROJECT MANAGEMENT AND TEAMWORK I (1 credits)

- Prerequisites: none. Teams freshmen through senior Chemical and Biomolecular Engineering undergraduates on a design team working on a realistic chemical engineering problem. Develops teamwork, communications, presentation, project management and information technology skills.

121 CHEMICAL ENGINEERING COMPUTATIONS (2 credits)

- Prerequisites: 101 or permission. Computer programming language, flowcharting, introductory simulation and introductory numerical analysis.

194 CHEMICAL ENGINEERING DESIGN I (1 credit)

- Prerequisites: 4200:101 and permission. Individual or group project under faculty supervision. Introduction to chemical engineering processes and modern design technology. Written report is required.

200 MATERIAL AND ENERGY BALANCES (4 credits)

- Prerequisites: 121, 3450:221 and 3150:151. Introduction to material, energy balance calculations applied to solution of chemical problems.

210 PROJECT MANAGEMENT AND TEAMWORK II (1 credits)

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

225 EQUILIBRIUM THERMODYNAMICS (4 credits)

- Prerequisites: 200 and 3450:223. Second law of thermodynamics, entropy, applications, comprehensive treatment of pure and mixed fluids. Phase and chemical equilibria, flow processes, power production and refrigeration processes covered.

294 CHEMICAL ENGINEERING DESIGN II (1-2 credits)

- Prerequisites: 121, 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.

305 MATERIALS SCIENCE (2 credits)

- Prerequisites: 3150:153 and 3650:292 and junior standing. Structure, processing and properties of metals, ceramics and polymers. Special topics, such as composites, corrosion and wear.

310 PROJECT MANAGEMENT AND TEAMWORK III (1 credits)

- Prerequisites: 4200:210. Teams freshmen through senior Chemical and Biomolecular Engineering undergraduates on a design team working on a realistic chemical engineering problem. Develops teamwork, communications, presentation, project management and information technology skills.
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321 TRANSPORT PHENOMENA (3 credits)

- Prerequisites: 200 and 3450:335. 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.
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330 CHEMICAL REACTION ENGINEERING (3 credits)

- Prerequisite: 225 and 3450:335. Nonequilibrium processes including chemical reaction mechanisms, rate equations and ideal reactor design applied to homogeneous and heterogeneous systems.
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341 PROCESS ECONOMICS (2 credits)

- Prerequisite: 200. 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.
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351 FLUID AND THERMAL OPERATIONS (3 credits)

- Prerequisite: 321. 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.
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353 MASS TRANSFER OPERATIONS (3 credits)

- Prerequisites: 225 and C- or above in 200. Theory and design of staged operations including distillation, extraction, absorption. Theory and design of continuous mass transfer devices.
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360 CHEMICAL ENGINEERING LABORATORY (3 credits)

- Prerequisites: 330; corequisites: 330, 351. Comprehensive experiments in combined heat and mass transfer, thermodynamics, and reaction kinetics. Data collection and analysis. Comprehensive reports in various formats.
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394 CHEMICAL ENGINEERING DESIGN III (1-3 credits)

- Prerequisites: 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.
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408 POLYMER ENGINEERING (3 credits)

- Prerequisite: permission or senior standing. Commercial polymerization, materials selection and property modification, polymer processing, applied rheology and classification of polymer industry.

410 PROJECT MANAGEMENT AND TEAMWORK IV (1 credits)

- Prerequisites: 4200:310. Teams freshmen through senior Chemical and Biomolecular Engineering undergraduates on a design team working on a realistic chemical engineering problem. Develops teamwork, communications, presentation, project management and information technology skills.
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421/521 FUNDAMENTALS OF MULTIPHASE TRANSPORT PHENOMENA (3 credits)

- Prerequisite: 4200:321 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.
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435 PROCESS ANALYSIS AND CONTROL (3 credits)

- Prerequisites: 330, 353. Response of simple and chemical processes and design of appropriate control systems.
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441 PROCESS DESIGN I (3 credits)

- Prerequisites: 330, 351, 353, and 341. 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.
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442 PROCESS DESIGN II (3 credits)

- Prerequisite: 441 or permission. Teaches methods of process conceptualization, preliminary optimization. Specific topics include: chemical process design methodology, design heuristics, energy integration, and process safety review.
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450 CHEMICAL PRODUCT DESIGN & DEVL (3 credits)

- 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.
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461/561 SOLIDS PROCESSING (3 credits)

- Prerequisites: 321 and 353 or permission. Comprehensive problems in sedimentation, fluidization, drying and other operations involving mechanics of particulate solids in liquid and gas continua.
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462 INDUSTRIAL ENZYME TECHNOLOGY (3 credits)

- Prerequisites: 330 and 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.
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463 POLLUTION CONTROL (3 credits)

- Prerequisite: 353 or permission. Air and water pollution sources and problems. Engineering aspects and methodology.
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466 DIGITIZED DATA & SIMULATION (3 credits)

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- Prerequisite: permission. Data acquisition and analysis by digital devices, digital control applications and design.
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470 ELECTROCHEMICAL ENGINEERING (3 credits)

- Prerequisites: 321, 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.
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471 FUEL ENGINEERING (3 credits)

- Prerequisite: 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.
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472 SEPARATION PROCESSES IN BIOCHEMICAL ENGINEERING (3 credits)

- Introduction to the separation and purification techniques pertinent to bioprocesses, with emphasis on engineering considerations for large scale operations.
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473 BIOREACTOR DESIGN (3 credits)

- Prerequisite: 330 or instructor's consent. Design, analysis, and scale-up of bioreactors for various biological processes.
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488 CHEMICAL PROCESSES DESIGN (3 credits)

- 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.
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494 DESIGN PROJECT (3 credits)

- Prerequisite: Permission or senior standing. Individual design project pertinent to chemical engineering under faculty supervision. Written report and oral presentation required.
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496 TOPICS IN CHEMICAL ENGINEERING (1-3 credits)

- (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.
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497 HONORS PROJECT (1-3 credits)

- (May be repeated for a total of six credits) Prerequisite: special permission. Individual creative project pertinent to chemical engineering culminating in undergraduate thesis, supervised by faculty member of the department.
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499 RESEARCH PROJECT (1-3 credits)

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