CHEMICAL, BIOMOLECULAR, AND CORROSION ENGINEERING

The Department of Chemical, Biomolecular, and Corrosion Engineering (https://www.uakron.edu/engineering/CBE/) offers undergraduate programs in leading to the Bachelor of Science in Chemical Engineering and the Bachelor of Science in Corrosion Engineering. Chemical engineering undergraduates may earn a polymer engineering specialization certificate or a biotechnology certificate. The department also offers an Associate of Applied Science in Corrosion Engineering Technology and a certificate in corrosion technology. The department offers graduate programs leading to a Master of Science in Chemical Engineering, including a five-year BS/MS program in Chemical Engineering. Students can also earn an interdisciplinary Doctor of Philosophy in Engineering.

Mission: The goal of the Chemical, Biomolecular, and Corrosion Engineering Department is to prepare graduates with the necessary skills so that they can contribute to a highly technical global society through their professional careers. The philosophy of the Chemical, Biomolecular, and Corrosion Engineering faculty is to provide a strong theoretical foundation supported by practical applications of that knowledge, which is consistent with the mission of The University of Akron.

The Chemical, Biomolecular, and Corrosion Engineering Department provides a unique opportunity to master teamwork and design project management skills. Teams of freshmen through senior Chemical and Corrosion Engineering undergraduates work on a realistic engineering design project. Besides experience with a range of current engineering topics, the projects allow students to develop teamwork, communication, presentation, project management and information technology skills.

Information specific to the available program options in chemical engineering and corrosion engineering is available:

- Biotechnology Specialization, Certificate (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/chemical-biomolecular-corrosion-engineering/biotechnology-specialization-certificate/)
- Chemical Engineering, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/chemical-biomolecular-corrosion-engineering/chemical-engineering-bs/)
- Chemical Engineering/Polymer Engineering, Certificate (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/chemical-biomolecular-corrosion-engineering/chemical-engineering-polymer-certificate/)
- Corrosion Engineering Technology, AAS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/chemical-biomolecular-corrosion-engineering/corrosion-engineering-technology-aas/)
- Corrosion Engineering, BS (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/chemical-biomolecular-corrosion-engineering/corrosion-engineering-bs/)
- Corrosion Engineering, Minor (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/chemical-biomolecular-corrosion-engineering/corrosion-engineering-minor/)
- Corrosion Technology, Certificate (https://bulletin.uakron.edu/undergraduate/colleges-programs/engineering-polymer-science/chemical-biomolecular-corrosion-engineering/corrosion-technology-certificate/)

Corrosion Engineering Technology (CRET)

CRET 120 Corrosion Engineering Technology Fundamentals I (3 Units)
Pre/Corequisite: CHEM 101 or [CHEM 151 and CHEM 152]. Introduction to corrosion engineering topics including economic impacts of corrosion, types of corrosion, their recognition and prevention, parameters affecting corrosion, and methods of corrosion control. (Formerly 2850:120)

CRET 121 Corrosion Engineering Technology Fundamentals II (4 Units)
Prerequisite: CRET 120. Basic understanding of steps and methods required for combating corrosion including proper design, material selection, protective coating application, inhibitors use, and cathodic and anodic protection. (Formerly 2850:121)

CRET 220 Strategies for Corrosion Prevention (4 Units)
Prerequisite: CRET 121. Pre/Corequisite: EEET 120. This course focuses on the control of corrosion by applying coatings and cathodic protection. (Formerly 2850:220)

CRET 221 Corrosion Engineering Technology Projects (4 Units)
Prerequisite: CRET 220. Course focuses on corrosion/failure analysis and corrosion mitigation, and discussion of regulatory compliance and resource acquisition and allocation. (Formerly 2850:221)

Chemical Engineering (CHEE)

CHEE 101 Tools for Chemical Engineering (2 Units)
Pre/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, CORE 101, or PLYE 101. Pre/Corequisite: MATH 221. 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. Pre/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. Pre/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)
Prerequisite: CHEE 353. Pre/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. Pre/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)

Corrosion Engineering (CORE)

CORE 101 Tools for Corrosion Engineering (2 Units)
Corequisites: MATH 149 and CHEE 110. Introduction to corrosion engineering. Basic concepts of engineering practice. Introduction to professional level software needed for later studies. (Formerly 4250:101)

CORE 105 Corrosion Engineering Computations (2 Units)
Prerequisite: CHEE 101 or CORE 101. Corequisite: CHEM 153. Structure, processing and properties of metals, ceramics, and polymers. (Formerly 4250:105)

CORE 194 Design Project 1 (1 Unit)
Prerequisite: Permission. Individual design project in Corrosion Engineering that is supervised by a faculty member. (Formerly 4250:194)

CORE 200 Material and Energy Balances for Corrosion Engineers (4 Units)
Prerequisites: [CHEE 121 or CORE 105], CHEM 151 and MATH 221. Introduction to material and energy balance calculations applied to the solution of chemical processing and corrosion engineering problems. (Formerly 4250:200)

CORE 294 Design Project 2 (1-2 Units)
Prerequisite: Sophomore standing. Individual design project in Corrosion Engineering that is supervised by a faculty member. (Formerly 4250:294)

CORE 300 Introduction to Corrosion Science and Engineering (3 Units)
Prerequisites: [CHEE:305 and CHEE:220] or [MECE:380 and MECE:300] or [CIVE:380 and MECE:305] or [BMEN:300 and MECE:300] or [CHEE:305 and CHEM:313]. This course introduces the impact of corrosion to the society and the important forms of aqueous corrosion. Students are expected to learn the electrochemical reactions for corrosion, electrochemical phase diagrams, and corrosion kinetics and measurement techniques. (Formerly 4250:300)

CORE 301 Aqueous Corrosion Lab I (1 Unit)
Prerequisites: CHEM 154 and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisite: CORE 300. Laboratory exercises will reinforce the fundamentals of aqueous corrosion. (Formerly 4250:301)

CORE 305 Corrosion Prevention (3 Units)
Prerequisites: CORE 300 and admission to an engineering major within the College of Engineering and Polymer Science. This course covers the basic forms of corrosion including: Localized corrosion, Intergranular corrosion, Environmentally assisted cracking, Atmospheric corrosion and, Microbial induced corrosion. Course presents approaches to mitigating the forms of corrosion using engineering methodologies including: proper materials selection, organic coatings, chemical inhibitors, and cathodic protection. Topics in failure analysis are also discussed. (Formerly 4250:305)

CORE 306 Aqueous Corrosion Lab II (1 Unit)
Prerequisites: CORE 301 and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisite: CORE 305. Laboratory exercises will reinforce the fundamentals of aqueous corrosion. (Formerly 4250:306)

CORE 310 Fundamentals of Dry Corrosion (3 Units)
Prerequisites: CORE 300 and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: CORE 311. Fundamentals of dry/hot corrosion will cover corrosion tendencies, processes and rates at high temperature. An in-depth understanding of the high temperature corrosion mechanisms, materials performance, and the effects of stress will be covered. (Formerly 4250:310)

CORE 311 High Temperature Corrosion Lab (1 Unit)
Prerequisites: CORE 306 and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: CORE 310. Laboratory exercises will reinforce the fundamentals of high temperature corrosion. (Formerly 4250:311)

CORE 340 Corrosion Prevention (Dry) (3 Units)
Prerequisite: CORE 305. Corequisite: CORE 310, MECE 380. This course presents a functional approach to controlling and preventing dry corrosion based upon engineering methodologies to proper materials selection, inorganic coatings, and passivation. Applications in specific industries will be covered. (Formerly 4250:340)

CORE 394 Design Project 3 (1-3 Units)
Prerequisite: Junior standing. Individual design project in Corrosion Engineering that is supervised by a faculty member. (Formerly 4250:394)

CORE 440 Corrosion Engineering Design I (3 Units)
Prerequisites: CORE 305 and admission to an engineering major within the College of Engineering and Polymer Science. This course applies the lessons learned in corrosion prevention and laboratory courses to corrosion case studies. Solutions to existing corrosion problems will be developed based on the analysis of test data. (Formerly 4250:440)

CORE 441 Corrosion Engineering Design II (3 Units)
Prerequisites: CORE 440 and admission to an engineering major within the College of Engineering and Polymer Science. This course focuses on understanding the financial, political, social and health implications of corrosion, corrosion mitigation, and corrosion prevention. Solutions to existing corrosion problems will be developed based on economic, political, social, and health issues. The course will also cover methodologies for preserving assets and reducing operation costs. (Formerly 4250:441)
Gen Ed: Capstone

CORE 450 Engineering Principles of Corrosion (3 Units)
Prerequisite: Junior or greater standing or permission. Engineering principles for understanding corrosion and corrosion mitigation methods. Case studies of corrosion management to reliability and reduce corrosion. Multidisciplinary engineering enrollment encouraged. (Formerly 4250:450)

CORE 465 Corrosion Protection by Coatings (3 Units)
Prerequisites: Junior or greater standing and admission to an approved major in engineering, polymer science and polymer engineering, or chemistry. Principles of corrosion control by coatings. Fundamentals, coating curing mechanisms, coating types, surface preparation, coating application, coating analysis, coating function evaluation, and coating lifetime prediction.

CORE 494 Design Project 4 (1-3 Units)
Prerequisite: Senior Standing. Individual design project in Corrosion Engineering that is supervised by a faculty member. (Formerly 4250:494)

CORE 496 Special Topics in Corrosion Engineering (1-3 Units)
Prerequisite: Permission. (May be repeated for a total of six credits). Topics selected from new and developing areas of corrosion engineering. (Formerly 4250:496)

CORE 497 Honors Project (1-3 Units)
Prerequisites: Senior standing in Honors College or permission. Individual research or design project in Corrosion Engineering that is supervised by a faculty member. Conducted in accordance with the Honors College requirements. (Formerly 4250:497)