

CHEMICAL, ENVIRONMENTAL AND MATERIALS ENGINEERING

<https://ceme.coe.miami.edu/index.html>

The department offers one undergraduate degree:

- Bachelor of Science in Environmental Engineering.

Environmental Engineering

Environmental engineers are leaders in the application of engineering principles to improve and maintain the environment for the protection of human health, for the protection of nature's beneficial ecosystems, and for environment related enhancement of the quality of human life. Environmental engineers are employed by government agencies, consulting firms, industries, non-profit organizations, and universities.

Advanced Writing and Communication Skills

Environmental Engineering students satisfy the University's Advanced Writing and Communication Skills requirement by completing a set of classroom courses, laboratory courses and design courses where they learn effective oral, graphical and technical writing skills. Environmental Engineering students acquire Advanced Writing and Communication skills in the following core courses:

- CET 345 – **Environmental Laboratory and Analysis**
- CAE 402 - **Professional Engineering Practice**
- CET 404 - **Senior Design Project II**

Dual B.S./M.S. Degrees

- B.S. in Environmental Engineering/M.S. in Civil Engineering (<http://bulletin.miami.edu/undergraduate-academic-programs/engineering/chemical-environmental-materials-engineering/environmental-engineering-bs-civil-engineering-ms/>)
- B.S. in Environmental Engineering/M.S. in Industrial Engineering (<http://bulletin.miami.edu/undergraduate-academic-programs/engineering/chemical-environmental-materials-engineering/environmental-engineering-bs-industrial-engineering-ms/>)

CET 200. Engineering Analysis of Chemical, Environmental, and Materials Systems. 3 Credit Hours.

The use of mathematics and engineering analysis for chemical and physical processes. The use of balance equations and rate laws for describing mass and energy conservation in physical processes with and without chemical reactions.

Prerequisite: MTH 162 and PHY 222.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 240. Environmental Quality Control. 3 Credit Hours.

Exploration of contemporary environmental issues. Introduction to engineering approaches for protecting and cleaning up the environment, techniques for assessing the impact of human activity on the environment, strategies for pollution control and implementation of environmental mitigation measures. Not open to civil or environmental engineering majors.

Requisite: Sophomore Standing or Higher.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 300. Computational Methods for Engineers. 3 Credit Hours.

Numerical methods for solving problems commonly encountered in engineering analysis and design. Implementation of numerical methods using software such as Excel and MATLAB.

Prerequisite: MTH 162.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 330. Fluid Mechanics. 3 Credit Hours.

Properties of fluids, gas systems, pressure distribution in static fluids, and hydrostatic forces on plane and curved surfaces are discussed. Kinematics and dynamics of fluid motion, dimensional analysis and similitude, flow in closed conduits, pumps, design of water distribution systems, and an introduction to flow in open channels is also included.

Prerequisite: CAE 210 and (PHY 222 or PHY 230).

Components: LEC.

Grading: GRD.

Typically Offered: Fall & Spring.

CET 340. Introduction to Environmental Engineering. 3 Credit Hours.

Environmental mass and energy balances, introduction to environmental chemistry, air pollution, water pollution, sustainable solid waste management, risk assessment, and global atmospheric change are discussed.

Prerequisites: MTH 162 or MTH 172, and CHM 121 or CHM 151.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 345. Environmental Laboratory and Analysis. 3 Credit Hours.

Laboratory-based course focusing on the analysis of environmental samples including water, wastewater, air, and solids. Basic analytical techniques and quality control are also included as well as an introduction to advanced analytical measurements.

Prerequisite: CET 340 and (CHM 121 or CHM 151).

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 350. Chemical Reaction Engineering Kinetics. 3 Credit Hours.

Culmination of undergraduate courses in chemistry, material and energy balances, transport phenomena, numerical methods, and thermodynamics. Introduces the principles and calculation techniques used to analyze and design chemical reactors to produce petrochemicals, advanced materials, polymers, and biochemicals.

Prerequisite: CET 200.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 351. Mass Transfer Operations. 3 Credit Hours.

Fundamentals of interphase mass transfer and transfer units, and design of differential mass transfer equipment, with special emphasis on absorption, stripping, humidification and drying.

CET 200 and MAE 303.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 395. Undergraduate Research. 1-3 Credit Hours.

This course allows undergraduate students to engage in research (experimental and/or computational) dealing with an ongoing research topic in the environmental engineering field.

Components: RSC.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

CET 403. Senior Design Project I - Engineering Design. 3 Credit Hours.

A two semester comprehensive design project applying the knowledge acquired during earlier coursework and implementing the pedagogy of life-long learning. Team projects incorporate interdisciplinary design skills, engineering standards and realistic constraints. The faculty coordinator working with practicing design professionals provide consultation, guidance and recommendations on aspects such as problem definition, evaluation of design alternatives and approaches. The course progresses along the customary design sequence of pre-design, schematic design and design development phases established in Civil, Architectural and Environmental Engineering practice.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 404. Senior Design Project II – Integrated Engineering Documents. 3 Credit Hours.

The second semester of a two semester comprehensive design project applying the knowledge acquired during earlier coursework and implementing the pedagogy of life-long learning. Team projects incorporating interdisciplinary design skills, engineering standards and realistic constraints.

The faculty coordinator working with several practicing design professionals provide consultation, guidance, and recommendations on aspects of preparing the construction documents required for project procurement and construction. Using the designs produced in CET 403 the course develops the drawings, specifications and calculations required for a comprehensive construction documents package.

Prerequisite: CET 403.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 430. Water-Resources Engineering I. 3 Credit Hours.

Basic principles of open channel flow. Computation of water surface profiles. Design of hydraulic structures, design of lined and unlined open channels, and design of sanitary sewer systems. Introduction to hydrology and analysis of hydrologic data. Rainfall characteristics and peak runoff models.

Prerequisite: CET 330 or CAE 330.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 440. Water Quality Control Systems. 3 Credit Hours.

Physical, Chemical and Biological Transformations; Water and Wastewater Treatment Processes; Water Treatment Plant Design; Wastewater Treatment Plant Design; Case Studies

Prerequisite: CET 330 or CAE 330 and CET 340.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 450. Process Dynamics and Control. 3 Credit Hours.

Modeling, dynamics, and automatic control of chemical processes. Analysis of control system design performance and stability, feedback, and feedforward schemes. Computer implementation and laboratory applications.

CET 350 and CET 351.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 455. Unit Operations Laboratory. 1 Credit Hour.

Operating and performance characteristics of process sensors, incompressible fluid flow, and thermodynamic systems. Documentation required to design and operate a chemical process safely, efficiently and profitably. Structure, analyze, design, and implement a closed-loop PID controllers.

CET 350 and CET 351.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 530. Water Resources Engineering II. 3 Credit Hours.

Runoff models, routing models, water-quality models, and evapotranspiration models. Design of storm water management systems. Principles of groundwater flow. Design of wells and wellfields for public water supply. Legal regulatory, and economic components of water-resources management systems. Comprehensive design project.

Prerequisite: CET 430 or CAE 430 OR permission of instructor.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 533. Water-Quality Control in Natural Systems. 3 Credit Hours.

Water quality regulations, fate and transport processes, water-quality control in rivers, lakes, wetlands, oceans, and ground water.

Pre or Corequisite: CET 430 and CET 440.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 540. Environmental Chemistry. 3 Credit Hours.

Kinetics, equilibrium, acid-base, oxidation-reduction, and reaction chemistry applied to water and wastewater engineering.

Prerequisite: CHM 121.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 541. Environmental Engineering Microbiology. 3 Credit Hours.

Classification of microorganisms. Microbial agents of infectious diseases and modes of disease transmission. Control of pathogens through water and waste treatment, food protection, and insect control. Microbial ecology and bioremediation systems. Laboratory exercises in microbiology.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 542. Solid and Hazardous Waste Engineering. 3 Credit Hours.

Solid-waste characteristics, recycling, incineration, hazardous waste characteristics, prevention, and physical and chemical treatment are covered. Design projects are also included.

Prerequisite: CET 340.

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 543. Air Pollution Control Engineering. 3 Credit Hours.

Fundamentals of air pollution and air quality; properties and control of particulates, volatile organic compounds, carbon monoxide, sulfur oxides, and nitrogen oxides; motor vehicle emissions; health and aesthetic effects (acid rain, visibility), laws and regulations, meteorology and pollutant transport in the atmosphere; indoor air pollution.

Prerequisite: MAE 303 and (CET 330 or CAE 330 or MAE 309).

Components: LEC.

Grading: GRD.

Typically Offered: Offered by Announcement Only.

CET 544. Introduction to Atmospheric Chemistry. 3 Credit Hours.

This course covers the basic principles of atmospheric chemistry. Concepts taught will include gas phase reactions, the production and destruction of ozone, aerosol size and composition.

Senior Standing.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 560. Aerosol Science and Technology. 3 Credit Hours.

This course will introduce key concepts of aerosol science and engineering and the fundamentals of particulate matter transport, formation and growth in environmental, energy and other engineered systems.

PHY 222.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 571. Chemical Product Design. 3 Credit Hours.

This course is designed to develop the formulation design background required to design a range of different consumer and pharma products (skin care, haircare, make-up, foods, homecare, laundry, agro products, pharma etc) Understanding of component self-assembly and interaction effects between components in complex multicomponent mixtures and understanding of the impact of formulation conditions (pH, electrolyte, perfume etc) on the interactions and performance will be built during the course. Novel formulation tools and strategies such as AI/Machine Learning coupled with high throughput robotic platforms for developing formulation labs of the future will be discussed. Design of sustainable formulations will additionally be covered.

CET 570.

Components: LEC.

Grading: GRD.

Typically Offered: Spring.

CET 580. Affordable and Sustainable Batteries. 3 Credit Hours.

Basic thermodynamics and kinetics of electrochemical reactions with emphasis on the principle and performance of batteries. Foundations and applications of modern electrochemistry and rechargeable battery technologies (CHM 121 or CHM 151) and PHY 222.

Components: LEC.

Grading: GRD.

Typically Offered: Fall.

CET 590. Special Topics. 1-3 Credit Hours.

A course that does not have an established course number. Usually a one-time course offering or an experimental course prior to assigning a formal course number.

Components: LEC.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

CET 595. Special Problems. 1-3 Credit Hours.

Project course introducing methods of research through an individual investigation of current problems. Offered by special arrangement only.

Components: RSC.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.