CHEMICAL, ENVIRONMENTAL AND MATERIALS ENGINEERING

https://ceme.coe.miami.edu/

Degree Programs

The Department of Chemical, Environmental and Materials Engineering (CEME) offers graduate programs leading to:

- MS in Chemical, Environmental and Materials Engineering
- MS in Materials Engineering
- MS in Product Design
- PhD in Chemical, Environmental and Materials Engineering

The specialty areas of study include:

- Aerosols and Air Quality
- Water Quality
- Material Synthesis
- Synthetic Biology
- Sustainable Energy & Environment
- Chemical Product Design

Master's Program

- MS in Chemical, Environmental and Materials Engineering
- MS in Materials Engineering (https://bulletin.miami.edu/graduate-academic-programs/engineering/chemical-environmental-materials-engineering/materials-engineering-ms/)
- MS in Product Design (https://bulletin.miami.edu/graduate-academic-programs/engineering/chemical-environmental-materials-engineering/product-design-ms/)

Doctoral Program:

PhD in Chemical, Environmental, and Materials Engineering

Dual Degree Programs

- B.S. in Chemical Engineering/M.S. in Chemical, Environmental, and Materials Engineering (https://bulletin.miami.edu/graduate-academic-programs/engineering/chemical-environmental-materials-engineering/chemical-engineering-bs-chem-enviro-mat-engineering-ms/)
- B.S. in Chemical Engineering/M.S. in Materials Engineering (https://bulletin.miami.edu/graduate-academic-programs/engineering/chemical-environmental-materials-engineering/chemical-engineering-bs-materials-engineering-ms/)
- B.S. in Chemical Engineering/M.S. in Product Design (https://bulletin.miami.edu/graduate-academic-programs/engineering/chemical-environmental-materials-engineering/chemical-engineering-bs-product-design-ms/)
- B.S. in Environmental Engineering/M.S. in Chemical, Environmental, and Materials Engineering (https://bulletin.miami.edu/graduate-academic-programs/engineering/chemical-environmental-materials-engineering/environmental-engineering-bs-chem-enviro-mat-engineering-ms/)
- B.S. in Environmental Engineering/M.S. in Materials Engineering (https://bulletin.miami.edu/graduate-academic-programs/engineering/chemical-environmental-materials-engineering/environmental-engineering-bs-materials-engineering-ms/)
- B.S. in Environmental Engineering/M.S. in Product Design (https://bulletin.miami.edu/graduate-academic-programs/engineering/chemical-environmental-materials-engineering/environmental-engineering-bs-prodcut-design-ms/)

CET 605. Master's Project. 3 Credit Hours.
Project in Chemical, Environmental or Materials Engineering. Course is an option for the non-thesis master's student.
Components: IND.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

CET 606. Master's Project II. 3 Credit Hours.
Project in Chemical, Environmental or Materials Engineering. Course is an option for the non-thesis master's student. Continuation of the Master's project that students started in CET 605.
Pre-requisite: CET 605.
Components: IND.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

CET 630. 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 633. 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.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 640. Environmental Chemistry. 3 Credit Hours.
Kinetics, equilibrium, acid-base, oxidation-reduction, and reaction chemistry applied to water and wastewater engineering.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 641. 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 642. Solid and Hazardous Waste Engineering. 3 Credit Hours.
Solid-waste characteristics, recycling, incineration, hazardous waste character istics, prevention, and physical and chemical treatment are covered. Design projects are also included.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 643. 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.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 644. 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.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

CET 660. 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.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CET 670. Soft Matter & Colloids. 3 Credit Hours.
an introductory soft matter and colloids course with a particular emphasis on colloids, polymers, surfactant, emulsions, and gel/hydrogel-based technologies. The following topics as applied in an engineering context will be covered: polymer science fundamentals including various polymerization techniques, polymer solution and melt properties, polymer and colloidal gels/hydrogels, physico-chemical aspects of colloidal dispersions, emulsions, surfactants, advanced characterization including rheology and scattering. Applications aspects in a wide range of industries will additionally be covered.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

CET 671. 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.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CET 680. 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
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CET 690. Special Topics. 1-3 Credit Hours.
Sub-titles describing the topics to be offered will be shown in parentheses in the printed class schedule, following the title Special Topics.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 695. 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: Offered by Announcement Only.

CET 703. Graduate Research Seminar. 1 Credit Hour.
Attendance and active participation in a designated semester seminar series.
Components: SEM.
Grading: SUS.
Typically Offered: Fall & Spring.

CET 704. Graduate Teaching. 1-3 Credit Hours.
Teaching or assisting in a course with a substantial level of instructional responsibility. Only open to doctoral students.
Components: LEC.
Grading: SUS.
Typically Offered: Fall & Spring.

CET 730. Advanced Fluid Mechanics. 3 Credit Hours.
Quantitative description of fluid flows including viscous flow, inviscid flow, turbulent flow, compressible flow, and geophysical flows. Transport of tracers. Basics of computational fluid dynamics.
Graduate standing (with a first course in fluid mechanics).
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 735. Water and Wastewater Engineering: Treatment and Reuse. 3 Credit Hours.
Physical treatment processes; Chemical unit processes; Advanced biological treatment processes; Sludge treatment and disposal; Industrial water supply and wastewater treatment; Membrane systems for wastewater treatment and case studies; Advanced wastewater treatment and reuse; Environmental nanotechnology.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 743. Risk Analysis. 3 Credit Hours.
Probabilistic risk assessment, Poisson processes, Bayesian methods, fault trees, contaminant transport models, and dose-response relationships for assessment of natural and technological risks.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 750. Advanced Engineering Reaction Kinetics. 3 Credit Hours.
The theory and application of chemical reaction kinetics to the design of real chemical reactors, including: a - non-isothermal reactors: simultaneous solution of molar and energy balances, reactor stability and multiple steady states; b - non-ideal reactors: residence time distributions and reactor flow models; c - heterogeneous reactors: simultaneous mass transfer and reaction in porous catalysts, overall effectiveness factors. In addition, kinetics and reactor design in biochemical engineering, polymerization processes, and chemical vapor deposition processes will be introduced.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CET 760. Aerosol Instrumentation. 3 Credit Hours.
This course will cover instruments used in aerosol and air quality research. The students are expected to learn the instruments' principal theory, operation, and applications. These instruments can measure the physiochemical and biological properties of the aerosols, including size, concentration, mass, optical properties, chemical composition, toxins, and biological components. We will also discuss methods to construct laboratory, ground and airborne sampling systems that measure aerosol properties representative to those in the ambient environment, where sampling loss can be minimized and quantified.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

CET 780. Indoor Environmental Modeling. 3 Credit Hours.
Prediction of indoor environment using computational fluid dynamics techniques. Advanced topics in thermal comfort and indoor air quality. Basic concepts of turbulence modeling and numerical methods for natural, forced, and mixed convection and jet flows indoors. Simulation of air velocity, temperature, and contaminant concentrations in buildings. Comparison of the simulated results with measured data.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 790. Advanced Topics. 1-3 Credit Hours.
Subject matter offerings based upon student demand and availability of faculty. Subtitles describing the topics to be offered will be shown in parentheses in the printed class schedule, following the title Advanced Topics.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 795. Special Problems. 1-3 Credit Hours.
Research and/or design projects. Individual investigation of current problems. Offered by special arrangement only.
Components: RSC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CET 810. Master's Thesis. 1-6 Credit Hours.
The student working on his/her Master's thesis enrolls for credit as determined by his/her advisor. Credit is not awarded until the thesis has been accepted.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CET 820. Research in Residence - MS. 1-6 Credit Hours.
Used to establish research in residence for the thesis for the Master's degree after the student has enrolled for the permissible cumulative total in CET 810. Credit not granted. May be regarded as full-time residence.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CET 825. Continuous Registration - Master's Study. 1 Credit Hour.
To establish residence for non-thesis master's students who are preparing for major examinations. Credit not granted. Regarded as full time residence.

Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CET 830. Pre-Candidacy Doctoral Dissertation. 1-12 Credit Hours.
Doctoral dissertation credits taken prior to the Ph.D. student's candidacy. The student will enroll for credit as determined by his/her advisor. Not more than 12 credit hours of CET 830 may be taken in a regular semester, nor more than 6 credit hours in a summer session.
Academic Plan Code: CET_PHD.
Components: THE.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CET 840. Post-Candicacy Doctoral Dissertation. 1-12 Credit Hours.
Doctoral dissertation credits taken after the Ph.D. student has been admitted to candidacy. The student will enroll for credit as determined by his/her advisor. Not more than 12 credit hours in CET 840 may be taken in a regular semester, nor more than 6 credits in a summer session.
Milestone: CANDID and Academic Plan Code: CET_PHD.
Components: THE.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CET 850. Research in Residence. 1 Credit Hour.
Used to establish research in residence for the Ph.D. after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. Credit not granted. May be regarded as full-time residence as determined by the Dean of the Graduate School.
Components: THE.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.