CIVIL, ARCHITECTURAL AND ENVIRONMENTAL ENGINEERING

http://cae.miami.edu

Dept. Code: CAE

Degree Programs
The Department of Civil, Architectural, and Environmental Engineering offers graduate programs leading to the degrees of:

- Master of Science in Architectural Engineering
- Master of Science in Civil Engineering
- Doctor of Philosophy in Civil Engineering

The specialty areas of study in Civil Engineering include:

- structural engineering and structural materials
- environmental engineering
- water-resources engineering

The specialty areas of study in Architectural Engineering include:

- integrated building systems
- MEP systems

In all fields of specialization, up to one-half of the required course work for the selected degree may be taken outside of the Department.

Admission Requirements
All students applying to the graduate program are required to submit GRE scores and three letters of recommendation. Admission criteria are described under Colleges of Engineering – Graduate Admission Requirements.

1. International students should consult the section on admissions.
2. Students who hold a bachelor’s degree in a field other than their proposed major may be admitted to the graduate program and to candidacy upon completion of appropriate undergraduate deficiency courses, in addition to the regular requirements for the graduate degree.

Research Opportunities - Civil Engineering

- Current research activities in the Department include properties of concrete materials, composite structural systems, fiber-reinforced concrete, modeling and simulation of engineering materials, multi-scale modeling of materials, fracture mechanics, structural steel behavior, structural health monitoring, structural repair and rehabilitation.

Research Opportunities - Architectural Engineering

- Current research activities in the Department include energy, indoor air quality, heating, ventilating and air conditioning (HVAC), environmentally compatible construction materials and systems, life-cycle building systems integration, and sustainable affordable housing.

Research Opportunities - Environmental Engineering

- Current research activities in the Department include development of new physicochemical water and wastewater treatment processes, potable wastewater reuse, solid and hazardous waste management, health and environmental risk analysis, environmental/economic planning for sustainable development, hazardous waste remediation, environmental health studies, water quality studies, ground-water, surface-water, and contaminant-transport processes, hydrologic processes, water resources planning and management, and water policy.

Masters
Masters Programs in Civil, Architectural and Environmental Engineering

- M.S. in Architectural Engineering (http://bulletin.miami.edu/graduate-academic-programs/engineering/civil-architectural-environmental-engineering/architectural-engineering-ms)
- M.S. in Civil Engineering (http://bulletin.miami.edu/graduate-academic-programs/engineering/civil-architectural-environmental-engineering/civil-engineering-ms)

Doctoral
Doctoral Program in Civil, Architectural and Environmental Engineering

- Ph.D. in Civil Engineering (http://bulletin.miami.edu/graduate-academic-programs/engineering/civil-architectural-environmental-engineering/civil-engineering-phd)

Courses
CAE 610. Structural Mechanics. 3 Credit Hours.
Analysis of stress and deformation of solids. Application to systems in the elastic and inelastic range. Topics include beams of special geometry and support, stress concentrations, stresses in elastic foundations, torsion, energy methods, failure theories, and brittle fracture.

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

CAE 611. Advanced Structural Analysis. 3 Credit Hours.
General methods of indeterminate analysis. Elements of energy method in indeterminate analysis of axial, flexural torsional, and composite members. Basic flexural and stiffness methods and matrix development are also included.

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

CAE 620. Advanced Design of Concrete Structures. 3 Credit Hours.
Design of reinforced concrete flat plates, flat slabs, two-way slabs, long columns, and slab-column connections are discussed. Deflections, crack widths, and background of current ACI Building Code are also included.

Components: LEC.
Grading: GRD.
Typically Offered: Spring.
CAE 621. Advanced Design of Steel Structures. 3 Credit Hours.
Steel framing systems, design of members and connections of braced and rigid frames, design for torsion, and design of steel-concrete composite members are discussed.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CAE 622. Design of Prestressed Concrete Structures. 3 Credit Hours.
Materials and systems for prestressing, design of prestressed concrete members for flexure and shear, camber, deflection, and crack control are discussed. Design of continuous beams, compression members, two-way concrete floor systems, and the loss of prestress are also included. Prequisite: CAE 320.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 623. Design of Masonry Structures. 3 Credit Hours.
Masonry construction. Design of flexural and compression members, bearing walls, shear walls, diaphragms, and connections of masonry structures. Arches, vaults, and buttresses are also included.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 625. Timber Structural Systems. 3 Credit Hours.
Engineering properties of timber, design of tension, compression, and flexural members are covered. The design and detail of connections and hardware, and the design of timber systems and heavy timber construction is also included.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 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.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CAE 631. Surface-Water Hydrology. 3 Credit Hours.
Rainwater characteristics, abstraction processes, surface-runoff, routing, and water-quality models. Design of stormwater-management systems, evapotranspiration, and regional water-management is also included as well as case studies.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 632. Ground-Water Hydrology. 3 Credit Hours.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 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.

CAE 640. Environmental Chemistry. 3 Credit Hours.
Kinetics, equilibrium, acid-base, oxidation-reduction, and reaction chemistry applied to water and wastewater engineering. Prerequisite: CAE 603.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CAE 641. Engineering Systems For Disease Control And Bioremediation. 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: Fall.

CAE 642. 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.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CAE 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: Spring.

CAE 653. Transportation Systems Planning and Demand Modeling. 3 Credit Hours.
Transportation demand analysis and forecasting. Sampling techniques, collection and analysis of survey data. Disaggregate and aggregate models. Trip generation, distribution, modal split and assignment. Transportation network equilibrium. Transportation system management.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.
CAE 660. Sustainable Construction. 3 Credit Hours.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 661. Computer Aided Architectural Engineering Design. 3 Credit Hours.
Requisite: Junior Status or Permission of Instructor.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

CAE 670. Advanced Foundation Engineering. 3 Credit Hours.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

CAE 680. Hospital and Health Care Facility Design. 3 Credit Hours.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 681. Energy-Efficient Building Design. 3 Credit Hours.
Concepts and methods of energy-efficient and environmentally-friendly building design. Topics include energy and sustainable design strategies, climate, passive and active solar design, passive cooling systems, daylighting, and computer simulation of energy flows in buildings. A quantitative understanding of energy fundamentals, examples from practice, and design exercises using computer simulation programs are emphasized.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

CAE 682. Energy-Efficient Building Design. 3 Credit Hours.
Components: LEC.
Grading: GRD.

CAE 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.

CAE 691. 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: IND.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 694. 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: IND.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 695. Special Problems. 1-4 Credit Hours.
Project course introducing methods of research through an individual investigation of current problems. Offered by special arrangement only.
Components: IND.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 699. Cooperative Education. 1 Credit Hour.
Practical application of classroom theory through alternating semester or summer employment with industries offering positions consistent with the student’s field of study. Course may be repeated. Periodic reports and conferences are required.
Components: IND.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 702. Finite Element Methods. 3 Credit Hours.
Variational principles and their application to finite element methods. Applications to: plane stress and plane strain, three-dimensional stress analysis, bending of plates, and axi-symmetric shells. Lecture, 3 hours.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 703. Master's Design Project I. 3 Credit Hours.
Comprehensive design project in civil, architectural, or environmental engineering.
Components: LEC.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CAE 704. Master's Design Project II. 3 Credit Hours.
Continuation of CAE 703.
Components: LEC.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CAE 705. Master's Project. 3 Credit Hours.
Project in civil, architectural, and environmental engineering. Course is required for the non-thesis master's student.
Components: THI.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.
CAE 711. Theory of Elasticity. 3 Credit Hours.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 712. Structural Reliability. 3 Credit Hours.
Development of structural safety concepts, design code applications, load process analysis, and interaction of load and resistance variability. Consideration is given to structural system serviceability and safety. Prerequisite: IEN 311 or Permission of Instructor.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 714. Structural Dynamics. 3 Credit Hours.
Dynamic responses of structural elements in both the elastic and inelastic ranges. Lagrange's equations, energy models, numerical and analytical methods, vibrations of continuous systems (beams and plates) are discussed. Assigned readings.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 716. Fracture Mechanics. 3 Credit Hours.
Theory of fracture mechanics for linear elastic and nonlinear material behavior, energy release rate, stress intensity factor, and J-integral with practical application to brittle fracture and fatigue. Case studies involving civil infrastructure such as bridges, buildings, pipelines and ships. Metallurgical aspects of fatigue and fracture.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 730. Environmental Hydrology. 3 Credit Hours.
Principles of ecohydrology, agricultural hydrology, impacts of climate change, fundamentals of remote sensing and geographic information systems for hydrologic applications, statistical applications in hydrology.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 731. Wastewater Treatment and System Design. 3 Credit Hours.
Characterization of domestic wastewater and flows. Sources of wastewater and health considerations. Unit processes for treatment of wastewater including screening, sedimentation, filtration, flocculation, flotation, activated sludge, disinfection, sludge digestion, and sludge disposal.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 732. Water Treatment and System Design. 3 Credit Hours.
Drinking water treatment standards, philosophy of setting standards, public health aspects of organic and inorganic contaminants, basis for design of treatment facilities, design of unit processes for aeration, sedimentation, coagulation, filtration, softening, disinfection, and oxidation are covered. Theory of membrane processes, ion exchange, and water treatment plant residuals are also included.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 735. Water and Wastewater Engineering: Treatment and Reuse. 3 Credit Hours.

CAE 738. Environmental Modeling. 3 Credit Hours.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 743. Risk Analysis. 3 Credit Hours.

CAE 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.

CAE 790. Special Problems. 1-3 Credit Hours.
Research and/or design projects. Individual investigation of current problems. Offered by special arrangement only.
Components: IND.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 795. 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: IND.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 796. 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: IND.
Grading: GRD.
Typically Offered: Offered by Announcement Only.
CAE 797. 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: IND.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

CAE 810. Master's Thesis. 1-6 Credit Hours.
The student working on his/her Master's thesis enrolls for credit, in most departments not to exceed six, 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.

CAE 820. Research in Residence. 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 CAE 710 (usually six credits). Credit not granted. May be regarded as full-time residence.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CAE 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.

CAE 830. Pre-Candidacy Doctoral Dissertation. 1-12 Credit Hours.
Doctoral dissertation credits taken prior to Ph.D. student’s candidacy. The student will enroll for credit as determined by his/her advisor. Not more than 12 hours of CAE 730 may be taken in a regular semester, nor more than six in a summer session.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CAE 840. Post-Candidacy Doctoral Dissertation. 1-12 Credit Hours.
Doctoral dissertation credits taken after Ph.D. student has been admitted to candidacy. The student will enroll for credit as determined by his/her advisor. Not more than 12 credits in CAE 740 may be taken in a regular semester, nor more than six credits in a summer session.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

CAE 850. Research in Residence. 1 Credit Hour.
Used to establish research in residence for the Ph.D. and D.A., 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: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.