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# Civil and Environmental Engineering

## Faculty and Fields of Interest

**Edberg, William** Assistant Professor of Civil and Environmental Engineering (2002), BSCE 1993 University of Massachusetts, MSCE 1995 University of Delaware, PhD 2001 University of Delaware. *Specialization:* Structural engineering.

**Fennessey, Neil M** Associate Professor of Civil and Environmental Engineering (1995), BS 1975, BSCE 1983 University of Massachusetts Amherst, SMCE 1986 Massachusetts Institute of Technology, PhD 1994 Tufts University. *Specializations:* hydrology, water resources engineering.

**Jackivicz, Thomas Paul** Professor of Civil and Environmental Engineering (1972), BSCE 1965, MS 1969 University of Miami, PhD 1973 University of Massachusetts Amherst, Registered Professional Engineer. *Specializations:* Environmental engineering, surveying.

**Jhaveri, Madhusudan** Professor of Civil and Environmental Engineering (1974), BSC 1963 SVV, Gujarat, India, MS 1968 North Dakota State University, PhD 1977 New Jersey Institute of Technology, Registered Professional Engineer. *Specializations:* Geotechnical engineering, solid mechanics.

**Miller, Heather J** Associate Professor of Civil and Environmental Engineering (1994), BS 1984 Northeastern University, ME 1986 University of Virginia, PhD 1994 University of New Hampshire, Registered Professional Engineer. *Specialization:* Geotechnical engineering.

**Mogawer, Walaa S** (Graduate Program Director) Professor of Civil and Environmental Engineering (1989), BSc 1981 Kuwait University, MSc 1984, PhD 1989 University of Rhode Island, Registered Professional Engineer. *Specialization:* Transportation engineering.

**Papakonstantinou, Christos** Assistant Professor of Civil and Environmental Engineering (2003), BS 1995 Aristotle University of Thessaloniki, MS 2000 University of South Carolina, PhD 2002 Rutgers State University. *Specialization:* Structural engineering.

**Sengupta, Sukalyan** (Department Chairperson) Associate Professor of Civil and Environmental Engineering (1994), BS 1985 Calcutta University, MS 1991, PhD 1994 Lehigh University, Registered Professional Engineer. *Specialization:* Environmental engineering.

## Department of Civil and Environmental Engineering College of Engineering

The MS in Civil and Environmental Engineering builds on a strong undergraduate degree with close linkages to regional industries through faculty consulting and student projects, with specialization emphases in Structural and Geotechnical Engineering, Environmental and Water Resources Engineering, and Transportation Engineering.

The MS in Civil and Environmental Engineering assists the region's industries, small businesses, and governmental agencies by providing an accessible source of graduate education for its engineering employees. Southeastern Massachusetts has been forecast to be the fastest growing region in the Commonwealth.

The need for advanced degrees in Civil and Environmental Engineering is both regional and global. With recent major improvements in high-speed access to this region and the extraordinary rise in real estate value in suburban Boston, the region is experiencing residential growth pressure and its attendant development and infrastructure problems. Moreover, this region has been facing a number of environmental problems that could impact its economic development. These include but are not limited to water quality and quantity issues for the Environmental Protection Agency (EPA) designated sole-source aquifers of Cape Cod and Plymouth-Carver, lake eutrophication, hazardous waste handling, preservation of the ecological health of the bays, industrial wastewater treatment, solid waste handling, and leachate collection and treatment. Our master's degree program helps provide environmental professionals working in this region, now and in the future, with skills that are needed to handle such challenges.

The educational goals of the program include enhancing the knowledge of professional practicing civil and environmental engineers so that they are equipped to handle the complex problems of today, and providing them with the skills, experience, and confidence to solve problems not yet encountered. Specifically, the program has the following goals for its graduates:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to design and conduct experiments, as well as to analyze and interpret data.
- An ability to design a system, component or process to meet desired needs.
- An ability to function as a team member.
- An ability to identify, formulate and solve engineering problems.

- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- An ability to act as a leader and direct civil engineering projects.
- Knowledge of contemporary issues and professional culture in the specialty area.

The program offers small classes, close contact with a diverse faculty, and easy access to well-supported research facilities to provide state-of-the-art learning and research experiences.

Courses are scheduled to permit either full-time or part-time study, and are offered at times that are convenient for students employed in industry and government.

### Resources

The faculty in Civil and Environmental Engineering Department are active in funded research activities and thus are in a strong position to support graduate students in conducting world class research in such areas as hydrology, water resources engineering, transportation materials and systems, water and wastewater treatment, hazardous waste decontamination, geotechnical design and geoenvironmental engineering, and structural analysis and design.

The Civil and Environmental Engineering Department maintains the Geotechnical, Environmental, Fluid Mechanics, Mechanics of Materials, and Transportation Laboratories for research and educational purposes. The ATMC facility in Fall River, MA, currently has transportation materials and environmental laboratories assigned to faculty members in the department.

### Admission Requirements

Admission to the MS program is competitive. Students possessing a bachelor's or master's degree from a recognized institution and a strong academic background in civil or environmental engineering or a similar discipline are encouraged to apply for admission. Typically, MS applicants with an undergraduate cumulative grade point average of 3.0 on a 4.0 grading scale for all engineering, math, and physics courses will be considered.

Applicants for the MS in Civil and Environmental Engineering must submit the required application materials to the Graduate Office.

## Degree Requirements (MS degree)

In addition:

- Transcripts should show class rank if available.
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The three letters of recommendation should be from persons in the field of the applicant's academic major at the institution most recently attended or be from supervisors familiar with the applicant's recent job performance.

- The essay should be from 300 to 600 words in length. This essay should indicate the prospective student's graduate study objectives, research interests and experience, and business or industry experience if applicable. If the applicant also applies for a teaching or research assistantship, the application must include any special skills or experience that would assist in assistantship decisions.

- GRE scores for the general test must be submitted by degree seeking applicants, except by those who are or are about to be graduates of the University of Massachusetts Dartmouth in Civil Engineering or who are or are about to be recipients of a Civil Engineering graduate certificate. Quantitative GRE scores of 700 or higher will be considered.

- Foreign students' scores on the TOEFL should be 550 minimum for admission and 600 minimum to be eligible for a teaching assistantship (213/250 for TOEFL computer based scores).

### Graduate Financial Assistance

Inquiries regarding graduate student financial assistance should be made to the Director of the Graduate Program. For information about loans or other assistance, please consult the chapter on "Expenses and Financial Assistance."

Many employers will assist employees in furthering their professional education; contact the personnel office at your place of work.

### Contact

Dr Walaa S Mogawer  
 Graduate Program Director,  
 Civil and Environmental Engineering  
 508 999-8468  
 wmogawer@umassd.edu

University of Massachusetts Dartmouth  
 285 Old Westport Road  
 North Dartmouth, MA 02747-2300

Thirty (30) credits are required as follows:

#### Required Core Courses (3 credits)

CEN 501 Orientation	no credits
CEN 504 Statistical Methods	3

*12 or 15 credits selected from the following lists, based on the student's specialty area of preference. Students who choose the Thesis Option select 12 credits and those who choose the Project Option select 15 credits. The remaining 9 credits must be selected with and approved by the thesis/project advisor.*

#### Structural/Geotechnical Engineering Area (At least three courses with the CEN prefix)

CEN 512 Advanced Structural Analysis (3)
CEN 516 Advanced Concrete Design (3)
CEN 517 Prestressed Concrete Design (3)
CEN 520 Advanced Steel Design (3)
CEN 433/CEN 533 Special Topic in Geotechnical Engineering (3)
CEN 552 Advanced Soil Mechanics (3)
CEN 538 Structural Dynamics (3)
CEN 421/CEN 521 Matrix Analysis (3)
MNE 503 Continuum Mechanics (3)
MNE 511 Theory of Elasticity (MNE 503 is a prerequisite) (3)
MNE 513 Theory of Plates and Shells (3)
MNE 515 Finite Element Analysis (3)
TET 517 Fiber Reinforced Polymeric Materials (3)
MNE 501 Adv. Engineering Mathematics (3)
ENL 510 Thesis/Project Research (3)

#### Environmental/Water Resources Engineering Area

CHM 531 Chemical Kinetics (3)
CEN 554 Surface Water Hydrology (3)
CEN 558 Open Channel Flow Hydraulics (3)
CEN 443/CEN 562 Water Resources Planning & Management (3)
CEN 566 Environmental Chemistry (3)
CEN 570 Reaction Processes in Environmental Engineering (3)
CEN 572 Advanced Processes in Environmental Engineering (3)
CEN 574 Hazardous Waste Management (3)
CEN 433/CEN 533 Special Topic in Geotechnical Engineering (3)
MNE 501 Adv. Engineering Mathematics (3)
ENL 510 Thesis/Project Research (3)

#### Transportation Engineering Area (At least three courses with the CEN prefix)

CEN 582 Pavement Design (3)
CEN 584 Pavement Materials (3)
CEN 586 Pavement Management (3)

CEN 590 Intelligent Transportation Systems (3)
CEN 433/CEN 533 Special Topic in Geotechnical Engineering (3)
MNE 503 Continuum Mechanics (3)
MNE 511 Theory of Elasticity (MNE 503 is a prerequisite) (3)
MNE 501 Adv. Engineering Mathematics (3)
ENL 510 Thesis/Project Research (3)

*Master's Thesis, six (6) credits; or Master's Project, three (3) credits*

The thesis option requires the completion of a 6 credit research thesis usually involving a theoretical or experimental investigation of a fundamental nature. The project option requires the successful completion of a 3-credit project, usually involving a theoretical or experimental investigation of an applied nature, often in conjunction with a company's or government agency's interests. A maximum of 6 credits of CEN 595 may be allowed upon approval by the student's advisor.

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## Civil and Environmental Engineering Courses

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**CEN 504** three credits

### **Statistical Methods in Civil and Environmental Engineering**

Prerequisite: MTH 331 or equivalent

Concepts of the conduct of research in an empirical setting. Statistical modeling tools and techniques for handling empirical data.

Dedicated software package will be used in class.

**CEN 512** three credits

### **Advanced Structural Analysis**

Prerequisite: CEN 306 or equivalent

Advanced classical methods of structural analysis. Structures subjected to mechanical and thermal loads. Superposition principle. Generalized functions and their application for the analysis of structures. Influence line method. Introduction to plate and shell theory.

**CEN 514** three credits

### **Environmental Water Chemistry**

Prerequisite: CEN 412 or equivalent

Chemical principles and applications of those principles to the analysis and understanding of aqueous environmental chemistry in natural waters and wastewaters. The chemistry of ionic equilibria, redox reactions, precipitation/dissolution, acid-base concepts, buffer capacity, complexation, hydrolysis and biological reactions. Applying basic principles of aqueous chemistry for quantifying complex, environmental systems. Specific examples of air-water-soil interactions and consequent effects. Heterogeneous equilibria with more than one solid phase. Kinetics and thermodynamics of some important ionic and biological reactions. Laboratory experiments.

**CEN 516** three credits

### **Advanced Analysis and Design of Reinforced Concrete**

Prerequisite: CEN 307 or equivalent

Application of ultimate strength design procedures to continuous beams and frames. Analysis of biaxial bending and buckling behavior of compression members. Serviceability behavior and theories for deflection and cracking of one-dimensional and two-dimensional elements. Design of multistory structures, two way slabs, joints in buildings, and miscellaneous topics.

**CEN 517** three credits

### **Prestressed Concrete Analysis and Design**

Prerequisite: CEN 307 or equivalent

Behavior, analysis and design of prestressed concrete structures. Covers flexure, shear, axial load, torsion, bond anchorage design and construction considerations for pretensioned and post-tensioned concrete. Deflections, slab design, and study of axially loaded members.

**CEN 520** three credits

### **Advanced Steel Design**

Prerequisite: CEN 408 or equivalent

Application of ultimate and elastic design procedures to continuous beams and frames, composite members, statically indeterminate trusses and arches. Plastic analysis and design of steel members. Fatigue and fracture of steel.

**CEN 521** three credits

### **Matrix Methods of Structural Analysis**

Prerequisite: CEN 306 or equivalent

Fundamental matrix algebra including inversion of matrices. Stiffness matrices for spring assemblages, trusses, beams, and two and three dimensional frames. Introduction to flexibility method. Computer programs are used by students to solve matrix equations.

**CEN 522** three credits

### **Design of Structural Systems**

Prerequisite: CEN 3081 or equivalent

Introduction to the behavior of various two and three dimensional load carrying structural systems and also some means by which the students can compare alternate structural systems. Design concepts, design assumptions, and methods of analysis are stressed. The selection of the optimum system for a particular structure is also discussed. For students interested in a career in structural engineering.

**CEN 533** three credits

### **Special Topic in Geotechnical Engineering**

Prerequisite: CEN 305 and 315, or equivalent

Selected topics of special interest in geotechnical and geoenvironmental engineering. Topics will include geotechnical aspects of landfill design, design principals and uses of geosynthetics for drainage systems, separation, and soil reinforcement, slope stability analysis, and various other techniques for soil stabilization and site improvement. May be repeated with change of content.

**CEN 538** three credits

### **Structural Dynamics**

Prerequisite: EGR 242 and CEN 306, or equivalents

Behavior of structures and structural components exposed to time dependent loadings. Vibrations of systems; descriptions of dynamic systems. Single degree of freedom and multiple degree of freedom systems. Base excitation caused by earthquake motions.

**CEN 552** three credits

### **Advanced Soil Mechanics**

Prerequisite: CEN 305 and 315, or equivalent

Behavior of cohesionless and cohesive soils; limit analysis; failure theories and lateral earth

pressures; stresses within earth mass; steady-state flow through porous media; consolidation and time rate settlement; shear strength of cohesive soils.

**CEN 554** three credits

### **Surface Water Hydrology**

Prerequisite: CEN 311 or equivalent

Advanced analysis and methods in surface water hydrology. Linear and nonlinear hydrograph methods. Kinematic wave and other hydraulic routing techniques. Advanced techniques for evaporation, infiltration, and snow melt.

**CEN 558** three credits

### **Open Channel Flow Hydraulics**

Prerequisite: CEN 311 or equivalent

Energy and momentum concepts, frictional resistance in open channels. Rapidly and gradually varied flow in open channels; unsteady flow in open channels; channel and culvert design.

**CEN 562** three credits

### **Water Resources Planning & Management**

Prerequisite: CEN 443 or equivalent

Relationship of hydrology and hydraulics with the ultimate goal of designing a project. Concepts of precipitation, runoff, hydrograph analysis, frequency analysis, flood routing, hydrologic synthesis, and simulation techniques for large basins as well as urban and small watersheds. Also included are backwater curves, submerged weirs, and water hammer.

**CEN 570** three credits

### **Reaction Processes in Environmental Engineering**

Prerequisite: CEN 531 or equivalent

Theory and application of adsorption, ion exchange, reverse osmosis, air stripping and chemical oxidation in water and wastewater treatment. Modeling engineered treatment processes.

**CEN 572** three credits

### **Advanced Processes in Environmental Engineering**

Prerequisite: CEN 531 or equivalent

Advanced concentrated study of a selected topic in environmental engineering such as non-point source pollution control, water reuse systems, new concepts in treatment technology, toxic substance control, etc. The instructor and student select topic. Courses may include specialized laboratory research, literature review, and specialty conference attendance.

**CEN 573** three credits

### **Water Treatment**

Prerequisite: CEN 411 or equivalent

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Theory and design of water treatment system components and their integration to achieve desired water quality. Traditional processes such as coagulation, flocculation, sedimentation, filtration, and disinfection will be covered. Special emphasis will be placed on new technologies such as reverse osmosis, ion exchange, and ultrafiltration. Estimation of design parameters will be undertaken.

**CEN 574** three credits

**Hazardous Waste Management**

Prerequisite: CEN 514 or equivalent  
Regulations for collection, transportation, disposal and storage of hazardous wastes. Containment systems, monitoring, types of liners, new and available technologies to eliminate or recover the hazardous components of the wastes.

**CEN 580** three credits

**GeoEnvironmental Engineering**

Prerequisite: CEN 433 or equivalent  
Principles of interaction of soil and rock with various environmental cycles. Physical and chemical properties of soil. Environmental site characterization: drilling technology, geotechnical and geophysical methods, monitoring well design and construction, groundwater, soil and gas sampling procedures, sensor technologies. Contaminant transport, detection and containment. Principles of containment facilities: landfills, leachate collection, cut-off walls, permeable barriers, stability analysis. Soil and groundwater restoration stabilization, bioremediation, washing, electrotechnologies, soil vapor technologies.

**CEN 582** three credits

**Pavement Design**

Prerequisite: CEN 309 or equivalent  
Pavement types; pavement system components; stresses in the pavement structure. Design factors and criteria, pavement stabilization, structural design of flexible and rigid pavements for highways and airports, pavement maintenance and overlay design.

**CEN 584** three credits

**Pavement Materials**

Prerequisite: CEN 309, CEN 319, or equivalent  
Bituminous and nonbituminous materials and mix-design, asphalt binder, bituminous mixtures, conventional and superpave mix-design methods, surface and subgrade soils, mineral aggregates, Portland cement concretes, material characterization and testing, fracture, fatigue, and permanent deformation, pavement materials and additives, and pavement recycling.

**CEN 586** three credits

**Pavement Management**

Prerequisite: CEN 309 or equivalent  
Pavement performance concepts. Criteria for pavement evaluation. Measurement of pavement distress and structural capacity. Analysis and interpretation of pavement evaluation data. Correlation of data with performance ratings. Formulation and evaluation of maintenance and rehabilitation alternatives.

**CEN 588** three credits

**Intelligent Transportation Systems**

Prerequisite: CEN 334 or equivalent  
Application of advanced technology to the vehicle and the roadway to solve traffic congestion, safety, and air quality problems.

**CEN 590** six credits

**Masters Thesis**

Prerequisites: Graduate standing, Thesis Option, and approval of the student's Graduate Committee  
Thesis research on an experimental or theoretical project in civil and environmental engineering under a faculty advisor. A formal thesis must be submitted to fulfill the course requirements.

**CEN 592** three credits

**Masters Project**

Prerequisites: Graduate standing, Project Option, and approval of the student's Graduate Committee  
Project research in conjunction with industry or government under a faculty advisor. A formal report must be submitted to fulfill the course requirements.

**CEN 595** three credits

**Independent Study**

Prerequisites: Permission of instructor and Graduate Committee  
Study under the supervision of a faculty member in an area not otherwise part of the discipline's course offerings. Conditions and hours to be arranged.