

# CIVIL AND ENVIRONMENTAL ENGINEERING

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Chairperson: Mumtaz Usmen

<http://www.cee.eng.wayne.edu>

The urban crisis in America has brought into sharp focus the profession of civil engineering and the responsibilities of its practitioners. The civil engineer is a leader in such diverse areas of concern as the design of structural systems; water resources planning; the treatment and ultimate disposal of noxious solid and liquid wastes; design of building systems which will provide adequate housing for urban dwellers, commerce and industry; the development of adequate transportation systems; construction methods and management; and the implementation and management of public works infrastructure projects designed to improve the urban environment. The responsibilities of the civil engineer directly involve the health, safety and welfare of the public.

The Department of Civil and Environmental Engineering offers graduate degree programs in which students may specialize in the following areas: structures, geotechnical engineering (M.S. only), environmental engineering, transportation, and construction management.

DATTA, TAPAN K.: Ph.D., Michigan State University; M.S., Wayne State University; B.E., Graduate Diploma, University of Calcutta; Professor

EAMON, CHRISTOPHER D.: Ph.D., M.Arch., M.S., University of Michigan; B.S., University of Wisconsin; Associate Professor

KAZAN, E. EMRAH: Ph.D., M.S., Wayne State University; B.S., Suleyman Demirel University; Lecturer

MCELMURRY, SHAWN: Ph.D., M.S., Michigan State University; B.S., Central Michigan University; Associate Professor

MENKULASI, FATMIR: PhD, Virginia Tech; Assistant Professor

MILLER, CAROL J.: Ph.D., M.S., B.S., University of Michigan; Professor

REMIAS, STEPHEN M.: Ph.D., M.S., Purdue University; B.S., Michigan State University; Assistant Professor

USMEN, MUMTAZ A.: Ph.D., West Virginia University; M.S.C.E., California State University, Long Beach; B.S.C.E., Robert College; Professor and Chair

WU, HWAI-CHUNG: Ph.D., Massachusetts Institute of Technology; M.S. Auburn University; B.S., National Taiwan University; Associate Professor

ZHANG, YONGLI: Ph.D., University of Virginia; M.S., Guangxi University; B.S., Sichuan University; Assistant Professor

- Civil Engineering (M.S.) (<http://bulletins.wayne.edu/graduate/college-engineering/civil-environmental-engineering/civil-engineering-ms>)
- Civil Engineering (Ph.D.) (<http://bulletins.wayne.edu/graduate/college-engineering/civil-environmental-engineering/civil-engineering-phd>)

## CE 5220 Environmental Chemistry Cr. 3

Fundamentals of aqueous chemistry for environmental engineers and scientists. Basic chemistry, equilibria, kinetics and thermodynamics; includes acid/base reactions, precipitation/dissolution, oxidation/reduction reactions and partitioning. Offered Every Other Year.

**Course Material Fees:** \$5

## CE 5230 Water Supply and Wastewater Engineering Cr. 3

Analysis and design of water supply and wastewater treatment systems; water distribution systems; treatment of municipal water supplies, including sedimentation, softening, filtration and disinfection; design of sanitary and storm sewers; primary, secondary and tertiary treatment plant design; sludge handling. Offered Yearly.

**Prerequisite:** CE 4210 with a minimum grade of C-  
**Course Material Fees:** \$5

## CE 5350 Introduction to Structural Dynamics Cr. 4

Dynamic properties of structures, Modeling of dynamic loads. Structural response to dynamic loading. Structural design requirements for dynamic loads. Fundamental techniques of dynamic system analysis. Offered Winter.

**Prerequisite:** ME 3400 with a minimum grade of C- and CE 4400 with a minimum grade of C-

## CE 5370 Finite Element Analysis Fundamentals Cr. 3

Matrix structural analysis, discretization of continuous structural systems, stress analysis. Commercial finite element software preprocessing for developing finite element models; post-processing for evaluating analysis results. Offered Fall.

**Prerequisites:** CE 4400 with a minimum grade of C-

## CE 5410 Energy, Emissions, Environment (E3) Design Cr. 3

Provides students the tools to uncover the relation between energy consumption and energy generation and optimize processes to take most advantage of low emitting energy options. Exposes students to design tools and methodologies from a diverse group of sources including US EPA, DOE, EIA, and the latest in emerging research. Offered Fall.

**Equivalent:** AET 5410, STE 5410

## CE 5510 Geotechnical Engineering I Cr. 4

Site investigation, site improvement, bearing capacity and settlement of shallow foundations, axial capacity and lateral deflection of deep foundations, design of conventional earth retaining walls, and basics of slope stability analyses. Offered Fall.

**Prerequisites:** CE 4510 with a minimum grade of C-

## CE 5520 Geotechnical Engineering II Cr. 3

Lateral earth pressure theories, design of conventional earth-retaining walls and of reinforced earth walls, anchored sheet-pile walls and cofferdams, fundamentals of soft-ground tunneling, two- and three-dimensional slope stability analyses, and static design of earth dams. Offered Every Other Year.

**Prerequisites:** CE 4510 with a minimum grade of C-

## CE 5610 Highway Design Cr. 3

Application of standards, theory and practice in design of streets and highways. Design of streets and highways including cross section elements, shoulder and roadside features. Pavement design and rehabilitation work. Offered Yearly.

**Prerequisites:** CE 4640 with a minimum grade of C-

## CE 5810 Legal Aspects of Engineering and Construction Cr. 3

Business of contracting, construction, liabilities of owner, architect, engineer and contractor. Rights in land, boundaries and foundations. Case studies. Offered Fall.

**Course Material Fees:** \$5

## CE 5830 Business of Engineering Cr. 3

Defining the engineering company, creating the organization, support services, business development, project management, scheduling, budgeting and profitability, operations, financial management and risk management. Offered Every Term.

**Prerequisites:** CE 4850 with a minimum grade of C-

## CE 5995 Special Topics in Civil Engineering I Cr. 1-3

Topics to be announced in Schedule of Classes. Offered Intermittently.  
**Repeatable for 12 Credits**

**CE 6010 Introduction to Construction Engineering and Management Cr. 3**

An introduction to the organization and management of construction projects. Project lifecycle including engineering, procurement and construction phases. Fundamentals of cost estimating, scheduling, quality, safety and risk management, legal and ethical aspects, construction productivity and lean construction, building codes, and building information modeling. Offered Winter.

**Prerequisites:** CE 4850 with a minimum grade of C-

**Course Material Fees:** \$5

**CE 6050 Construction Cost Estimating Cr. 3**

Estimating construction costs of engineering projects including materials, man-hours, equipment and overhead. Emphasis on construction equipment, including productivity and planning. Bidding and bid documents. Offered Every Other Year.

**Prerequisites:** CE 4850 with a minimum grade of C-

**CE 6060 Construction Techniques and Methods Cr. 3**

Construction techniques and methods for excavation, foundations, concrete, wood, steel, masonry, heavy construction, wastewater treatment plants, highways and roads, high rise structures, bridges, and tunneling projects. Offered Every Other Year.

**Prerequisites:** CE 4450 with a minimum grade of C-

**CE 6130 Open Channel Hydraulics Cr. 3**

Theoretical development of equations governing flow in open channels. Application to real-world engineering problems involving water surface profiles, flood studies, and river. Offered Winter.

**Prerequisites:** CE 3250 with a minimum grade of C-

**CE 6150 Hydrologic Analysis and Design Cr. 3**

Principles of surface water hydrology and their application for evaluation of floods and the design of surface runoff control system; watershed characteristics; design storms and SCS methods; unit hydrographs; hydrologic models; application of computer methods. Offered Every Other Year.

**Prerequisite:** CE 6130

**CE 6190 Groundwater Cr. 3**

Historical background, aquifers and aquitards, saturated and unsaturated flow, sources of ground water contamination, artificial recharge of ground water, development of ground water basins and efficient use of ground water resources. Offered Yearly.

**Prerequisites:** CE 3250 with a minimum grade of C-

**CE 6270 Sustainability Assessment and Management Cr. 3**

Sustainability assessment and management for engineering design and development; theoretical, regulatory, and practical implications; Detroit and global applications. Offered Yearly.

**Prerequisites:** CE 4210 with a minimum grade of C-

**Equivalent:** STE 6270

**CE 6330 Advanced Structural Analysis Cr. 3**

Effect of axial loads on stiffness of flexural members. Buckling of trusses and rigid frames. Matrix method of analysis. Complex structures. Computer applications. Offered Fall.

**Prerequisites:** CE 4410 with a minimum grade of C-

**CE 6340 Bridge Design and Evaluation Cr. 3**

Concepts, procedures, methods of design and condition evaluation for modern highway bridges, according to current specifications. Entire system is covered, including superstructure, substructure, and their connections. Offered Every Other Year.

**Prerequisites:** CE 4420 with a minimum grade of C-

**CE 6370 Advanced Reinforced Concrete Design Cr. 4**

Theory and design of two-way slabs, footings, retaining walls, shear walls, and composite beams using ultimate strength design. Precast and prestressed concrete fundamentals. Offered Winter.

**Prerequisites:** CE 4420 with a minimum grade of C-

**CE 6410 Advanced Steel Design Cr. 3**

Advanced topics of structural steel design: thin walled rolled and built-up members, beam columns, lateral torsional buckling, steel fatigue design, connection details. Steel design project. Offered Every Other Year.

**Prerequisites:** CE 4420 with a minimum grade of C-

**CE 6580 Geoenvironmental Engineering I Cr. 4**

Properties and test methods for natural and synthetic materials used in landfills; analysis of chemical interactions, flow mechanisms, stability and settlement for the design of landfill components. Offered Yearly.

**Prerequisites:** CE 4510 with a minimum grade of C-

**CE 6660 Pavement Asset Management Cr. 3**

Principles and practices of pavement management at the network and project level: serviceability, pavement design models, economic analysis, and priority programming. Offered Yearly.

**Prerequisites:** CE 4640 with a minimum grade of C-

**CE 6880 Building Information Modeling (BIM) Cr. 3**

Lectures, hands-on demonstrations and lab exercises to familiarize students with concepts and tools in Revit Architecture 2010 software; how software integrates 3D and 2D modeling. Includes an overview of the Building Information Modeling (BIM) process; integration of designs from different disciplines (architectural, structural and MEP) in a BIM model; and use of BIM tools (including Revit and Navisworks) to create 2D, 3D, 4D (schedule) and 5D (cost) models for project control purposes, as well as clash detections. Offered Every Other Year.

**Prerequisites:** CE 3010 with a minimum grade of C-

**CE 6910 Pharmaceutical Waste: Environmental Impact and Management Cr. 2-3**

Course designed for advanced professional and graduate students with sufficient chemistry and/or biological sciences background who are interested in the environmental impact, management, and regulation of waste pharmaceuticals as emerging issues. Offered Spring/Summer.

**Restriction(s):** Enrollment is limited to Graduate or Professional level students.

**Equivalent:** PSC 6910

**CE 6991 Internship in Industry Cr. 1-4**

Written report describing internship experience. Offered Every Term.

**Repeatable for 4 Credits**

**CE 7020 Construction Safety Cr. 3**

Safety problems in the construction industry and their technical and managerial solutions, construction accident and failure analysis and control. Safety program design and implementation with TQM integration. Offered Yearly.

**Prerequisite:** CE 6010 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7070 Risk and Reliability in Civil Engineering Cr. 3**

Uncertainty in civil engineering practice (e.g., loads, traffic, water demand, construction quality). Reliability theory based on probabilistic and statistical methods. Reliability-based engineering design and decision making. Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7080 Civil Engineering Research Methods Cr. 3**

Methods of data collecting and statistical analysis in context of civil engineering. Applications of advanced statistical analysis techniques, theory, discussion of methodological limitations. Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students; enrollment limited to students in the College of Engineering.

**CE 7190 Groundwater Modeling Cr. 3**

Analytical and numerical models of groundwater hydraulics and contaminant transport. Application of theoretical material developed in CE 6190. Case studies of model applications to real field problems. Offered Yearly.

**Prerequisite:** CE 6190 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7220 Industrial Waste Treatment Cr. 4**

A study of the sources of specific industrial waste waters and their treatability by physical, chemical and biological processes, including the industries' obligation in the prevention of stream pollution. Problems and solutions involved in combined treatment of industrial and domestic waste waters. Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Course Material Fees:** \$10

**CE 7260 Surface Water-Quality Modeling and Management Cr. 4**

Principles and mechanisms governing the rate and transport of conventional and toxic pollutants in natural water; mathematical modeling of water quality in surface water systems; model applications for managing waste loads in lakes and rivers. Offered Intermittently.

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7280 Applied Environmental Microbiology Cr. 3**

Provides knowledge of microbiology, roles and relations of microorganisms to the environment. Topics include practical applications of environmental microbiology to environmental issues including water treatment, biodegradation and bioremediation of environmental pollutants, production of alternative fuels, and emerging environmental concern. Special consideration will be given to water treatment and microbe-mediated cycling of organic materials (i.e. pollutants) in a variety of natural and engineered environment. Offered Winter.

**Restriction(s):** Enrollment is limited to Graduate level students; enrollment limited to students in the College of Engineering.

**CE 7300 Advanced Structural Mechanics Cr. 3**

Theory of bending and torsion of bars, beams on elastic foundations. Introduction to theory of thin plates. Linear elastic fracture mechanics, application to brittle solids. Offered Fall.

**Prerequisite:** CE 6330 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7311 Sustainability of Urban Environmental Systems Cr. 2**

Students will be introduced to topics in urban sustainability from multiple disciplinary perspectives such as: ecology, anthropology, communication, engineering, economics and urban planning. Questions in fostering a more sustainable urbanism will be introduced and evaluated. Offered Fall.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Equivalent:** BIO 7310

**CE 7370 Advanced Finite Element Analysis Cr. 3**

Advanced topics in finite element analysis; stability analysis and vibrations of structural systems; modeling of complex structures, dynamic analysis, and nonlinear structural problems; and computer applications. Offered Every Other Year.

**Prerequisite:** CE 5370 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7380 Advanced Topics in Steel Design Cr. 3**

Focuses on steel plasticity, plastic mechanism analysis, and the application of these concepts to design for strength and stability of steel structures. Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7385 Advanced Topics in Reinforced Concrete Design Cr. 3**

Focuses on reinforced concrete plasticity, plastic mechanism analysis, and the application of these concepts to design for strength of reinforced concrete structures. Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7460 Advanced Composite Materials for Civil Infrastructure Cr. 3**

Infrastructure problems. Advanced fiber reinforced plastics, including applications in primary/secondary and marine structures, and in rehabilitation. High performance fiber reinforced concrete. Controlled composite properties via composite design. Review of composite analysis and failure criteria based on micromechanics and laminate theory. Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7500 Engineering Properties of Soils Cr. 4**

Overview of experimental methods in geotechnical engineering, instrumentation and data acquisition methods, statistical analysis of test data, tests and theories for settlement predictions, tests and theories for hydraulic conductivity determination, tests and theories for static and cyclic stress-strain-volume change behavior of soils. Offered Every Other Year.

**Prerequisite:** CE 5510 with a minimum grade of C and CE 5520 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7530 Advanced Soil Mechanics Cr. 4**

Stress-strain and volume-change behavior of sands and clays for both drained and undrained loading conditions, to gain insight in mechanical behavior of foundation soils. Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Course Material Fees:** \$5

**CE 7550 Geosynthetics Engineering Cr. 4**

Fundamental principles for testing, design, and construction of geosynthetics in civil engineering applications. Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7580 Environmental Remediation Cr. 4**

Site assessment; soil and groundwater investigation for remediation; application of remediation technologies; legislation related to remediation. Offered Yearly.

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7600 Highway Safety and Risk Management Cr. 3**

The focus of this course is on developing knowledge, skills, and abilities for planning, managing, and operating safe roadways for all users and modes of travel. It includes analysis of roadway design alternatives, statistical analysis of roadway safety issues, and crash countermeasure selection and evaluation. Students should have prior knowledge of the roadway geometric design process, traffic flow fundamentals (i.e., volume, density, speed, etc.), traffic control devices, and basic statistics (linear regression, t-tests, p-values, etc.). Offered Every Other Year.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Course Material Fees:** \$15

**CE 7620 Traffic Engineering Control and Operation Cr. 3**

Traffic flow theories, macroscopic and microscopic models of traffic control, statistical analysis; design and application of intelligent transportation systems on traffic flow characteristics; evaluation. Offered Yearly.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Course Material Fees:** \$10

**CE 7630 Urban Transportation Planning Cr. 4**

Planning and analysis of urban transportation, travel demand models, land use planning and public transportation; household and origin-destination survey techniques; and demand elasticities multi-criteria evaluation. Offered Fall.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Course Material Fees:** \$5

**CE 7640 Economic Analysis in Transportation Systems Cr. 4**

Application of engineering economy and price theory in optimization of transportation systems; analysis of congestion costs, externalities, primary and secondary costs and benefits; evaluation of alternatives and completed projects and programs. Offered Yearly.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Course Material Fees:** \$10

**CE 7670 Advanced Traffic Signal Systems Cr. 3**

Analysis and design of traffic signal systems. Hardware, communication and detection systems associated with microcomputer-based signal systems. Coordinated signal systems. Offered Every Other Year.

**Prerequisite:** CE 7620 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7830 Construction Planning and Scheduling Cr. 3**

Planning and scheduling of construction projects, project networks and critical path methods, resource leveling, use of Primavera software. Offered Yearly.

**Prerequisite:** CE 6010 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7840 Facilities Management Cr. 3**

Buildings and grounds operations and maintenance, planning design and construction, facilities economics and financing, real estate administration, environmental health and safety, health issues. Offered Winter.

**Prerequisite:** CE 6010 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7850 Construction Contract Administration Cr. 3**

Project documentation; project setup and contract directory development; adding new contracts; purchase orders; recording materials deliveries; producing daily reports; preparing minutes of meetings; log submittals and handling correspondence; tracking contracts and costs, setup and preparing progress payment requisitions, managing claims and change orders. Offered Every Other Year.

**Prerequisite:** CE 6010 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7860 Construction Accounting and Financial Management Cr. 3**

Construction financial management, construction accounting systems, analysis of financial statements, monitoring and controlling construction costs, managing overhead costs, markup, profit center analysis, cash flows for construction projects, financing, making financial decisions. Offered Every Other Year.

**Prerequisite:** CE 6010 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7890 Integrated Construction Project Management Cr. 3**

Construction project management framework, construction project integration, project scope management, time management, cost management, quality management, procurement management, risk management, communication management. Offered Every Other Year.

**Prerequisite:** CE 7830 with a minimum grade of C

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 7990 Directed Study Cr. 1-4**

Offered Every Term.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Repeatable for 6 Credits**

**CE 7995 Special Topics in Civil Engineering II Cr. 1-3**

A consideration of special subject matter in civil engineering. Topics to be announced in Schedule of Classes. Offered Intermittently.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Repeatable for 12 Credits**

**CE 7996 Research Cr. 1-4**

Offered Every Term.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Repeatable for 6 Credits**

**CE 8999 Master's Thesis Research and Direction Cr. 1-8**

Offered Every Term.

**Restriction(s):** Enrollment is limited to Graduate level students; enrollment limited to students with a class of Candidate Masters.

**Repeatable for 8 Credits**

**CE 9990 Pre-Doctoral Candidacy Research Cr. 1-8**

Research in preparation for doctoral dissertation. Offered Every Term.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Repeatable for 12 Credits**

**CE 9991 Doctoral Candidate Status I: Dissertation Research and Direction Cr. 7.5**

Offered Every Term.

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 9992 Doctoral Candidate Status II: Dissertation Research and Direction Cr. 7.5**

Offered Every Term.

**Prerequisite:** CE 9991 with a minimum grade of S

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 9993 Doctoral Candidate Status III: Dissertation Research and Direction Cr. 7.5**

Offered Every Term.

**Prerequisite:** CE 9992 with a minimum grade of S

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 9994 Doctoral Candidate Status IV: Dissertation Research and Direction Cr. 7.5**

Offered Every Term.

**Prerequisite:** CE 9993 with a minimum grade of S

**Restriction(s):** Enrollment is limited to Graduate level students.

**CE 9995 Candidate Maintenance Status: Doctoral Dissertation Research and Direction Cr. 0**

Offered Every Term.

**Restriction(s):** Enrollment is limited to Graduate level students.

**Repeatable for 0 Credits**