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# Civil and Environmental Engineering

In the College of Engineering

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## Faculty

Janusz C. Supernak, Ph.D., Professor of Civil and Environmental Engineering, Chair of Department

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Victor M. Ponce, Ph.D., Professor of Civil and Environmental Engineering

Bruce D. Westermo, Ph.D., Professor of Civil and Environmental Engineering (Graduate Adviser)

M. Ziad Bayasi, Ph.D., P.E., Associate Professor of Civil and Environmental Engineering

M. Nazmi Sharabi, Ph.D., Associate Professor of Civil and Environmental Engineering

Badri Badriyha, Ph.D., Assistant Professor of Civil and Environmental Engineering

Fatih Buyuksonmez, Ph.D., Assistant Professor of Civil and Environmental Engineering

## Courses Acceptable on Master's Degree Programs in Civil and Environmental Engineering (CIV E) (ENV E)

### UPPER DIVISION COURSES IN CIVIL ENGINEERING (CIV E)

#### 521. Structural Analysis II (3) I

Prerequisite: Civil Engineering 321.

Analysis of statically indeterminate structures by virtual work. Advanced treatment of slope deflection, moment distribution. Arch analysis, secondary stresses in trusses. Advanced treatment of influence lines. Introduction to matrix analysis of structures. (Formerly numbered Civil and Environmental Engineering 521.)

#### 525. Design of Steel Structures (3) I, II

Prerequisite: Civil Engineering 321.

Mechanical behavior of structural steel. Design of steel beams, girders, columns and members subjected to combined stresses. Design of various types of connections of steel structures; plate girders, continuous beams and rigid frames. (Formerly numbered Civil and Environmental Engineering 525.)

#### 528. Masonry Structures Design (3) I

Prerequisites: Civil Engineering 301 and 321.

Analysis and design of masonry beams, retaining walls, shear walls, bearing walls, and columns. Use of allowable stress and strength design methods. Design project, including structural system analysis and lateral design of masonry buildings.

#### 530. Open Channel Hydraulics (3) I, II

Prerequisite: Civil Engineering 444. **Proof of completion of prerequisite required:** Copy of transcript.

Principles of open channel flow; analysis and problems of critical, uniform, gradually-varied, and rapidly-varied flows, design and environmental problems; computer simulations and applications; and culvert hydraulics. (Formerly numbered Civil and Environmental Engineering 530.)

#### 580. Traffic Engineering Design (3)

Prerequisite: Civil Engineering 481.

Sizing and configuration of highway facilities based on capacity analysis. Traffic signal design, impact and mitigation studies, parking, safety design. (Formerly numbered Civil and Environmental Engineering 580.)

#### 596. Advanced Civil Engineering Topics (1-3) I, II

Prerequisites: Minimum grade point average of 3.0 and consent of instructor.

Modern developments in civil engineering. See Class Schedule for specific content. Maximum credit of six units for any combination of Civil Engineering 496, 499 and 596 applicable to a bachelor's degree. Maximum combined credit of six units of Civil Engineering 596 and 696 applicable to a 30-unit master's degree.

### UPPER DIVISION COURSES IN ENVIRONMENTAL ENGINEERING (ENV E)

#### 553. Environmental Engineering Laboratory (3)

Two lectures and three hours of laboratory.

Prerequisites: Chemistry 200 and Environmental Engineering 355.

**Proof of completion of prerequisite required for Environmental Engineering 355:** Copy of transcript.

Analysis of natural waters and wastewaters. Sampling and analysis of hazardous environmental pollutants. Techniques to analyze solid waste. (Formerly numbered Civil and Environmental Engineering 553.)

#### 554. Process Fundamentals of Environmental Systems (3)

Prerequisites: Environmental Engineering 355 and Engineering Mechanics 340. **Proof of completion of prerequisites required:** Copy of transcript.

Equilibrium and kinetics of chemical and biological reactions of environmental systems. Considerations of mass-transfer and fluid dynamics in water quality management and air pollution control. (Formerly numbered Civil and Environmental Engineering 554.)

#### 555. Water and Wastewater Engineering (3) I

Prerequisite: Environmental Engineering 355. **Proof of completion of prerequisite required:** Copy of transcript.

Water and wastewater. Physical, chemical and biological methods of treatment. Advanced waste treatment processes. Water reclamation. (Formerly numbered Civil and Environmental Engineering 555.)

#### 556. Air Quality Management (3)

Prerequisite: Environmental Engineering 355. **Proof of completion of prerequisite required:** Copy of transcript.

Sources of air pollutants. Transportation, diffusion, and transformation of pollutants in the atmosphere. Measurement and control of air pollution. (Formerly numbered Civil and Environmental Engineering 556.)

**558. Solid Waste Management (3) II**

Prerequisite: Environmental Engineering 355. **Proof of completion of prerequisite required:** Copy of transcript.

Management of municipal solid waste from a civil engineering perspective, including waste minimization and recycling. Engineered volume reduction through composting, incineration, mechanical compaction, and other methods. Ultimate disposal, landfill design and legislative regulations. (Formerly numbered Civil and Environmental Engineering 558.)

**560. Environmental Engineering Design (3)**

Prerequisites: Environmental Engineering 555, 558 and Engineering 430.

Application of engineering principles and design techniques to design of environmental engineering projects. (Formerly numbered Civil and Environmental Engineering 560.)

**596. Advanced Environmental Engineering Topics (1-3) I, II**

Prerequisites: Minimum grade point average of 3.0 and consent of instructor.

Modern developments in environmental engineering. See Class Schedule for specific content. Maximum credit of six units for any combination of Environmental Engineering 496, 499 and 596 applicable to a bachelor's degree. Maximum combined credit of six units of Environmental Engineering 596 and 696 applicable to a 30-unit master's degree.

**GRADUATE COURSES IN CIVIL ENGINEERING (CIV E)**

**605. Prestressed Concrete Structures (3)**

Prerequisite: Civil Engineering 421 with minimum grade of C.

Fundamental concepts of prestressed concrete theory. Design applications to various types of structures. (Formerly numbered Civil and Environmental Engineering 605.)

**607. Dynamics of Structures (3)**

Prerequisite: Civil Engineering 521 with minimum grade of C.

Dynamic disturbances, structures with variable degelastic beams; continuous beams, rigid frames, floor systems. Energy methods in structural dynamics. (Formerly numbered Civil and Environmental Engineering 607.)

**608. Earthquake Engineering (3)**

Prerequisite: Civil Engineering 607.

Elements of seismology. Methods of analysis for earthquake loads. Procedures and code provisions for the design of earthquake-resistant structures. (Formerly numbered Civil and Environmental Engineering 608.)

**610. Finite Element Analysis of Structures (3)**

Prerequisites: Engineering 120 and Civil Engineering 321 with minimum grade of C.

General procedure, various types of finite elements; analysis and design of isotropic and orthotropic plates and shells, deep beams, and shear walls using finite element technique; use of digital computers for solutions. Application to civil engineering structures. (Formerly numbered Civil and Environmental Engineering 610.)

**612. Advanced Concrete Materials (3)**

Two lectures and three hours of laboratory.

Prerequisite: Civil Engineering 421.

Microstructure and cracking behavior of concrete. Theory and application of high strength and fiber reinforced concrete. Concrete durability additives and fiber reinforced plastic reinforcement for concrete. Innovative applications of advanced concrete materials. Includes a laboratory project. (Formerly numbered Civil and Environmental Engineering 612.)

**620. Traffic Flow and Control (3)**

Prerequisites: Civil Engineering 481 or City Planning 625 or Geography 559, with minimum grade of C.

Advanced treatment of traffic flow and control issues. Highway capacity and traffic flow characteristics, traffic flow modeling, intersection control, freeway control systems, intelligent transportation systems. (Formerly numbered Civil and Environmental Engineering 620.)

**621. Transportation Demand Analysis (3)**

Prerequisite: Civil Engineering 481 or Geography 559 or City Planning 625, with minimum grade of C.

Travel demand modeling with emphasis on application to growing metropolitan areas; four-step travel demand forecasting; disaggregate, behavioral, and activity-based approaches; recent methodological developments; transportation-land use interactions. (Formerly numbered Civil and Environmental Engineering 621.)

**622. Mass Transit Engineering (3)**

Prerequisites: Civil Engineering 481 or City Planning 625 or Geography 559, with minimum grade of C.

Transit system characteristics, analysis of demand for transit services, transit system planning, scheduling, analysis and design. (Formerly numbered Civil and Environmental Engineering 622.)

**632. Computational Hydraulics and Hydrology (3)**

Prerequisites: Civil Engineering 445 and 530.

Computational methods applied to hydraulics and hydrology. Explicit and implicit schemes for solving hyperbolic problems. Method of characteristics. One- and two-dimensional nonsteady open channel flow simulation. (Formerly numbered Civil and Environmental Engineering 632.)

**633. Environmental Hydrology (3)**

Prerequisite: Civil Engineering 445 and Environmental Engineering 355.

Hydrosphere function, hydroclimatology, hydrographic characteristics, desertification, hydroecology, salinity modeling and management, stream and lake restoration, and case studies. (Formerly numbered Civil and Environmental Engineering 633.)

**634. Surface Water Hydrology (3)**

Prerequisite: Civil Engineering 445.

Hydrologic systems. Physical hydrology. Kinematic wave theory. Diffusion and dynamic wave theories. Watershed and stream channel routing. Hydrologic simulation. (Formerly numbered Civil and Environmental Engineering 634.)

**638. Sedimentation and River Engineering (3)**

Prerequisite: Civil Engineering 444 with minimum grade of C.

Hydraulics of sediment transport; erosion and sedimentation problems; river mechanics and morphology; mathematical modeling of river hydraulics; sediment transport and river channel changes. Design and environmental problems; erosion control and river training. (Formerly numbered Civil and Environmental Engineering 638.)

**640. Advanced Soil Mechanics (3)**

Prerequisites: Civil Engineering 462 and 463 with minimum grades of C.

Advanced theories of soil mechanics applied to geotechnical and environmental engineering. Classification of terrestrial and marine soils, compaction, consolidation, expansion, stress distribution, strength, permeability and seepage, site improvement, and remediation. (Formerly numbered Civil and Environmental Engineering 640.)

**641. Advanced Foundation Engineering (3)**

Prerequisites: Civil Engineering 462 and 463 with minimum grades of C.

Advanced theories of soil bearing capacity, settlement, and stress distribution applied to design of shallow and deep foundations and earth retaining structures. Subsurface exploration and dewatering methods. (Formerly numbered Civil and Environmental Engineering 641.)

**642. Groundwater Seepage and Earth Dams (3)**

Prerequisites: Civil Engineering 462 and 463 with minimum grades of C.

Groundwater seepage and contaminant transport in saturated and unsaturated soils. Flow nets for homogeneous and layered soils. Design and stability analysis of embankments and earth dams. (Formerly numbered Civil and Environmental Engineering 642.)

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### 644. Soil Dynamics (3)

Prerequisite: Civil Engineering 462 and 463 with a minimum grade of C.

Behavior of soil and soil-structure systems under dynamic loading. Applications include dynamic earth bearing capacity and pressure, soil spring constants for machine foundation design, liquefaction analysis, site response spectra, and seismic stability of slopes. Case histories discussed. (Formerly numbered Civil and Environmental Engineering 644.)

### 696. Advanced Topics in Civil Engineering (2 or 3)

Intensive study in specific areas of civil engineering. May be repeated with new content. See Class Schedule for specific content. Maximum credit six units applicable to a master's degree. Maximum combined credit of six units of Civil Engineering 596 and 696 applicable to a 30-unit master's degree.

### 781. Seminar in Transportation Engineering (2 or 3)

Prerequisites: Minimum grade point average of 3.0 and consent of instructor.

An intensive study in transportation engineering. Maximum credit six units applicable to a master's degree. (Formerly numbered Civil and Environmental Engineering 781.)

### 797. Independent Research (1-3) Cr/NC/RP

Prerequisite: Consent of graduate adviser.

Independent research in civil and environmental engineering. Maximum credit three units applicable to a master's degree.

### 798. Special Study (1-3) Cr/NC/RP

Prerequisite: Consent of staff; to be arranged with department chair and instructor.

Individual study. Maximum credit three units applicable to a master's degree.

### 799A. Thesis or Project (3) Cr/NC/RP

Prerequisites: An officially appointed thesis committee and advancement to candidacy. Preparation of a project or thesis for the master's degree.

### 799B. Thesis or Project Extension (0) Cr/NC

Prerequisite: Prior registration in Thesis or Project 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis or project is granted final approval

## GRADUATE COURSES IN ENVIRONMENTAL ENGINEERING (ENV E)

### 637. Process Design for Industrial Waste Treatment (3)

Prerequisite: Environmental Engineering 555 or 647 and 648.

Process design of physical, chemical, and biological treatment methods for in-plant treatment of industrial waste streams. (Formerly numbered Civil and Environmental Engineering 637.)

### 645. Aquatic Chemistry for Environmental Engineers (3)

Chemistry of natural and polluted water. Process chemistry for water and wastewater treatment. (Formerly numbered Civil and Environmental Engineering 645.)

### 646. Microbiological Principles of Environmental Engineering (3)

Prerequisite: Environmental Engineering 554.

Relationships and significance of microorganisms to organic matter decomposition, mineral transformations, and environmental quality. Applied study in natural (water, sediments, wetlands) and disturbed ecosystems (landfills, contaminated sediments, and groundwater). (Formerly numbered Civil and Environmental Engineering 646.)

### 647. Physical and Chemical Processes of Water Pollution Control (3)

Prerequisite: Environmental Engineering 645.

Engineering principles and design of physical and chemical processes used in water and wastewater treatment. (Formerly numbered Civil and Environmental Engineering 647.)

### 648. Biological Processes and Bioremediation Engineering (3)

Prerequisite: Environmental Engineering 646.

Engineering principles and design of biological processes used in wastewater and bioremediation treatment technologies. (Formerly numbered Civil and Environmental Engineering 648.)

### 696. Advanced Topics in Environmental Engineering (2 or 3)

Intensive study in specific areas of civil engineering. May be repeated with new content. See Class Schedule for specific content. Maximum credit six units applicable to a master's degree. Maximum combined credit of six units of Civil Engineering 596 and Environmental Engineering 696 applicable to a 30-unit master's degree.

### 797. Independent Research (1-3) Cr/NC/RP

Prerequisite: Consent of graduate adviser.

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Prerequisite: Prior registration in Thesis or Project 799A with an assigned grade symbol of RP.

Registration required in any semester or term following assignment of RP in Course 799A in which the student expects to use the facilities and resources of the university; also student must be registered in the course when the completed thesis or project is granted final approval.

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