

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

OVERVIEW

Defne Apul, chair

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The department of civil and environmental engineering offers graduate degree programs and conducts research in two focus areas – environmental and infrastructure engineering. Environmental engineering includes advanced study in areas such as:

- sustainable buildings;
- water infrastructure sustainability;
- contaminated sediments;
- microbial degradation of organic compounds;
- microbial sensors;
- computer modeling of contaminant release and dispersion in soils and in air;
- environmental decision making;
- risk assessment; and
- wastewater treatment processes.

Infrastructure engineering includes:

- structural and earthquake engineering,
- transportation engineering and
- geotechnical engineering.
 - geotechnical engineering includes advanced study in areas such as:
 - shallow and deep foundations,
 - groundwater and seepage, and
 - experimental and theoretical soil mechanics.
 - structural engineering includes advanced study in areas such as:
 - earthquake engineering;
 - structural repair and rehabilitation;
 - structural health monitoring;
 - numerical and experimental analysis; and
 - design.
 - transportation engineering includes advanced study in areas such as:
 - traffic and facility design;
 - urban transportation planning;
 - pavement materials' properties and design;
 - pavement management;
 - intelligent transportation systems; and
 - transportation system management and economics.

Degrees Offered

MS in Civil Engineering (<http://utoledo-public.courseleaf.com/graduate/engineering/departments/civil-engineering/ms-civil-engineering/>)

PhD in Engineering (Civil Engineering) (<http://utoledo-public.courseleaf.com/graduate/engineering/departments/civil-engineering/phd-civil-engineering/>)

COURSES

CIVE 5210 Advanced Soil Mechanics

[3 credit hours]

A study of soil behavior including stress distributions, deformation, consolidation and shear strength. The course focuses upon the development and use of well accepted solutions and practical applications.

CIVE 5240 Design With Geosynthetics

[3 credit hours]

Use of geosynthetic materials in engineering design for reinforcement, barrier, separation and/or drainage functions. Design applications for geotechnical, transportation and environmental uses.

CIVE 5300 Advanced Mechanics Of Materials

[3 credit hours]

Introduction to theory of elasticity, plane-stress and plane-strain problems, yield criteria and failure theories, bending of beams, energy methods, curved flexural members, unsymmetrical bending, torsion, shear center and axisymmetrically loaded members.

Term Offered: Fall

CIVE 5320 Computer-Aided Analysis of Structures

[3 credit hours]

Matrix analysis of continuous beams, trusses and frames by force method and displacement method. Methods of consistent deformation and slope deflection will be discussed to complement the matrix analysis. Computer applications.

Prerequisites: CIVE 3310 with a minimum grade of D-

CIVE 5340 Experimental Mechanics

[3 credit hours]

Application of experimental techniques to stress analysis. Comparison of experimental and analytical methods. Theory of electrical resistance strain gages. Methods of photoelasticity including photostress. Data acquisition systems and their use.

Term Offered: Spring

CIVE 5430 Structural Steel Design II

[3 credit hours]

Study of local failure in beams, biaxial bending, plate girders, composite beams, semi-rigid composite connections and beam columns.

Term Offered: Spring

CIVE 5440 Reinforced Concrete Design II

[3 credit hours]

Analysis and design of columns under axial compression and biaxial bending. Consideration of bar cutoff, development lengths. Design of two-way slabs and building frames in reinforced concrete. Deflection of beams. Shear design provisions for deep beams.

CIVE 5450 Bridge Design I

[3 credit hours]

Design of the three most common types of short span bridges: concrete slabs, steel stringers and prestressed concrete. Additional topics are bearings, rehabilitation and retrofit and design to minimize maintenance.

Term Offered: Spring, Summer, Fall**CIVE 5480 Reinforced Masonry Design**

[3 credit hours]

Study of the design of reinforced and unreinforced masonry design, beams and walls and columns. Working stress design, strength design and empirical design are studied.

Term Offered: Spring, Fall**CIVE 5550 Traffic Control**

[3 credit hours]

To provide a detailed understanding of the basic concepts of traffic engineering together with driver-roadway-vehicle system characteristics. Capacity analysis of freeways, rural highways, multilane and two lane highways. Traffic control devices and traffic signal design and capacity. Traffic studies and data collections; volume, speed and travel time, accident and parking studies. Introduction to other tools to mitigate traffic congestion.

Term Offered: Fall**CIVE 5610 Water Resources And Hydrology**

[3 credit hours]

Aspects of Hydrology. Stream gauging. Common and rare event analysis. Hydraulic and hydrologic routing. Irrigation, navigation, flood control and urban drainage. Resource demand conflicts and multiple use planning.

Term Offered: Spring, Fall**CIVE 5630 Indoor Air Quality**

[3 credit hours]

Characterization of the indoor air pollutants, predictions of indoor air quality levels and indoor air quality control. Four to five design problems involving indoor air quality will be discussed/solved in the class. Special emphasis on indoor radon and asbestos problems in the United States. Use of USEPA program.

Term Offered: Fall**CIVE 5650 Industrial Ventilation**

[3 credit hours]

Industrial ventilation as related to need of industrial hygiene engineer, including principles of air flow, natural and power ventilation, supply and exhaust, characteristics and design of systems, fans, collectors, testing instruments. Construction guidelines for local exhaust systems.

CIVE 5670 Solid Waste Management And Disposal

[3 credit hours]

A basic study of solid waste management concepts including origin, quantities, qualities, collection and disposal of solid waste materials. The course focuses upon municipal wastes and introduces the student to hazardous waste technologies. The primary course objective is to develop environmentally sound landfill design technologies and other ultimate disposal techniques.

CIVE 5680 Environmental Law

[3 credit hours]

An overview of the major federal environmental statutes: Clean Air Act, Clean Water Act, RCRA, CERCLA, etc. and legal perspective of why they were developed. Exposure to some basic legal principles which will be integrated into the overall study of environmental law. Provides a practical perspective on how the law can be applied to situations encountered by environmental engineers and scientists in the real world.

Term Offered: Fall**CIVE 5690 Sustainability Engineering**

[3 credit hours]

Course develops students' abilities to apply the principles of sustainability to engineered systems. Course topics include sustainability definition and data, life cycle assessment based design, planetary boundaries, greenhouse gas emissions, green construction.

Term Offered: Spring, Fall**CIVE 5710 Advanced Engineering Systems Modeling**

[3 credit hours]

A systematic approach to the analysis of complicated engineering system involving uncertain and probabilistic phenomena. Decision-making with multiple objectives, monte carlo simulation, reliability based design, and Markov process are studied.

Term Offered: Fall**CIVE 5930 Graduate Seminar In Civil Engineering**

[1-3 credit hours]

An opportunity for qualified graduate students to pursue a relevant area of Civil Engineering of particular personal interest under the supervision of a faculty member.

Term Offered: Spring, Fall**CIVE 6280 Environmental and Energy Geotechnology**

[3 credit hours]

This course is designed for engineering and geoscience students who want to explore a broad range of engineering challenges that emerge at the interface of materials, environment and energy. This course is aimed to provide advanced students with fundamental knowledge for understanding and modelling many complex phenomena involved in a variety of engineering applications. These include technologies of nuclear and hazardous waste disposal, unconventional petroleum and gas extraction, CO2 sequestration and geothermal energy.

Term Offered: Spring**CIVE 6310 Finite Element Methods**

[3 credit hours]

Study of direct stiffness method, introduction to the minimum potential energy method and the Galerkin method, formulation of truss, beam, triangular and rectangular elements, applications to the analyses of space trusses, building frames, folded plates, fluid flow and seepage problems. Applications of modern computer software.

Term Offered: Spring, Fall**CIVE 6340 Mechanics Of Stability**

[3 credit hours]

Differential equations. Buckling of centrally and eccentrically loaded compression members; variational methods of determining critical loads; lateral and torsional buckling of beams; introduction to dynamic stability; parametric excitations; nonconservative stability problems; buckling of plates.

CIVE 6360 Dynamics Of Structures

[3 credit hours]

Evaluation of dynamic response of structures to arbitrary time-varying loadings; single degree-of-freedom, multi-degree-of-freedom and distributed-parameter systems; partial differential equation formulations of simple systems; mode superposition and wave propagation solutions; time history analysis and estimation of maximum response by spectral analysis; effects of nonlinearities on the structural response.

Term Offered: Spring, Fall**CIVE 6460 Advanced Composite Materials In Infrastructure**

[3 credit hours]

Introduction to fiber composites and their applications in repair and retrofit of infrastructure. Strengthening of bridges, buildings, pavements. Understanding of basic concepts involved in design of concrete members reinforced with fiber reinforced polymer.

Term Offered: Spring**CIVE 6480 Prestressed Concrete Structures**

[3 credit hours]

Structural behavior and failure modes of prestressed concrete structures; design in prestressed concrete, including long-span structures, bridges and precast systems.

Prerequisites: CIVE 5440 with a minimum grade of D-**Term Offered:** Spring, Fall**CIVE 6490 Nonlinear Modeling of Reinforced Concrete**

[3 credit hours]

Theories of elasticity and plasticity as applied to reinforced concrete, mechanical properties of concrete and reinforcing bars, linear and nonlinear elastic models, shear response, compression field and smeared crack models, their implementation and application into nonlinear finite element analysis, and performance assessment of plane frame structures.

Prerequisites: CIVE 3420 with a minimum grade of C and CIVE 6310 with a minimum grade of C or CIVE 8310 with a minimum grade of C or MIME 4280 with a minimum grade of C or MIME 5280 with a minimum grade of C**CIVE 6630 Dispersion And Risk Modeling**

[3 credit hours]

Treatment of atmospheric dispersion problems, development of air quality models, components of a physical model, selection and evaluation of air pollution software, evaluation of models, risk modeling, EPA models and recent topics.

CIVE 6670 Physicochemical Processes for Water Quality Control

[3 credit hours]

The course will discuss theories and designs for water treatment processes.

Term Offered: Fall**CIVE 6690 Dispersion Modeling Laboratory**

[1 credit hour]

Use of USEPA network, use of ten computer programs from the USEPA network, use of Internet and environmental BBS, search for environmental data bases using search engines.

Prerequisites: CIVE 6630 with a minimum grade of D-**Term Offered:** Spring, Summer**CIVE 6900 Civil Engineering Problems**

[3 credit hours]

Special assignment of civil engineering problems of various types at the graduate level.

Term Offered: Spring, Summer, Fall**CIVE 6960 Graduate Research And Thesis - Masters**

[1-9 credit hours]

MS student should register their adviser's section number.

Term Offered: Spring, Summer, Fall**CIVE 6970 Graduate Engineering Internship**

[1 credit hour]

Faculty advisor approved industry, government, or agency internship to provide an experiential learning component to the Master's/doctoral degree program.

Term Offered: Spring, Summer, Fall**CIVE 6980 Graduate Research and Project - Masters**

[1-6 credit hours]

MS student should register their advisor's section number.

Term Offered: Spring, Summer, Fall**CIVE 6990 Special Topics - Independent Study**

[1-3 credit hours]

An opportunity for a qualified graduate student to pursue a relevant area of Civil and Environmental Engineering under the supervision of a faculty member. Course may be repeated.

Term Offered: Spring, Summer, Fall**CIVE 7340 Experimental Mechanics**

[3 credit hours]

CIVE 7430 Structural Steel Design II

[3 credit hours]

CIVE 7450 Bridge Design I

[3 credit hours]

Design of the three most common types of short span bridges: concrete slabs, steel stringers and prestressed concrete. Additional topics are bearings, rehabilitation and retrofit and design to minimize maintenance.

Term Offered: Spring, Fall**CIVE 7900 Independent Problems**

[1-6 credit hours]

CIVE 8280 Environmental and Energy Geotechnology

[3 credit hours]

This course is designed for engineering and geoscience students who want to explore a broad range of engineering challenges that emerge at the interface of materials, environment and energy. This course is aimed to provide advanced students with fundamental knowledge for understanding and modelling many complex phenomena involved in a variety of engineering applications. These include technologies of nuclear and hazardous waste disposal, unconventional petroleum and gas extraction, CO₂ sequestration and geothermal energy.

Term Offered: Spring

CIVE 8310 Finite Element Methods

[3 credit hours]

Study of direct stiffness method, introduction to the minimum potential energy method and the Galerkin method, formulation of truss, beam, triangular and rectangular elements, applications to the analyses of space trusses, building frames, folded plates, fluid flow and seepage problems. Applications of modern computer software.

Term Offered: Spring, Fall**CIVE 8340 Mechanics Of Stability**

[3 credit hours]

Differential equations. Buckling of centrally and eccentrically loaded compression members; variational methods of determining critical loads; lateral and torsional buckling of beams; introduction to dynamic stability; parametric excitations; nonconservative stability problems; buckling of plates.

CIVE 8360 Dynamics Of Structures

[3 credit hours]

Evaluation of dynamic response of structures to arbitrary time-varying loadings; single degree-of-freedom, multi-degree-of-freedom and distributed-parameter systems; partial differential equation formulations of simple systems; mode superposition and wave propagation solutions; time history analysis and estimation of maximum response by spectral analysis; effects of nonlinearities on the structural response.

Term Offered: Spring, Fall**CIVE 8460 Advanced Composite Materials In Infrastructure**

[3 credit hours]

Introduction to fiber composites and their applications in repair and retrofit of infrastructure. Strengthening of bridges, buildings, pavements. Understanding of basic concepts involved in design of concrete members reinforced with fiber reinforced polymer.

Term Offered: Spring**CIVE 8480 Prestressed Concrete Structures**

[3 credit hours]

Structural behavior and failure modes of prestressed concrete structures; design in prestressed concrete, including long-span structures, bridges and precast systems.

Prerequisites: CIVE 7440 with a minimum grade of D-**Term Offered:** Spring, Fall**CIVE 8490 Nonlinear Modeling of Reinforced Concrete**

[3 credit hours]

Theories of elasticity and plasticity as applied to reinforced concrete, mechanical properties of concrete and reinforcing bars, linear and nonlinear elastic models, shear response, compression field and smeared crack models, their implementation and application into nonlinear finite element analysis, and performance assessment of plane frame structures.

Prerequisites: CIVE 3420 with a minimum grade of C and CIVE 6310 with a minimum grade of C or CIVE 8310 with a minimum grade of C or MIME 4280 with a minimum grade of C or MIME 5280 with a minimum grade of C

CIVE 8630 Dispersion And Risk Modeling

[3 credit hours]

Treatment of atmospheric dispersion problems, development of air quality models, components of a physical model, selection and evaluation of air pollution software, evaluation of models, risk modeling, EPA models and recent topics.

CIVE 8670 Physicochemical Processes for Water Quality Control

[3 credit hours]

The course will discuss theories and designs for water treatment processes.

Term Offered: Fall**CIVE 8690 Dispersion Modeling Laboratory**

[1 credit hour]

Use of USEPA network, use of ten computer programs from the USEPA network, use of Internet and environmental BBS, search for environmental data bases using search engines.

Prerequisites: CIVE 8630 with a minimum grade of D-**Term Offered:** Spring, Summer, Fall**CIVE 8900 Independent Problems**

[1-6 credit hours]

Ph.D. student should register their adviser's section number.

Term Offered: Spring, Summer, Fall**CIVE 8960 Doctoral Graduate Research & Dissertation**

[1-16 credit hours]

Graduate research towards the completion of a Doctoral degree.

Term Offered: Spring, Summer, Fall**CIVE 8970 Graduate Engineering Internship**

[1 credit hour]

Faculty advisor approved industry, government, or agency internship to provide an experiential learning component to the Master's/doctoral degree program.

Term Offered: Spring, Summer, Fall**CIVE 8990 Special Topics - Independent Study**

[1-3 credit hours]

An opportunity for a qualified graduate student to pursue a relevant area of Civil and Environmental Engineering under the supervision of a faculty member.

Term Offered: Spring, Summer, Fall