

## **Civil & Environmental Engrg**

### **CE 5101 - Advanced Bituminous Materials**

Applications and properties of asphalt binder, aggregates for bituminous mixtures, and analysis and design of asphalt concrete mixtures. Includes asphalt cement production, rheology, chemistry, and grading, aggregate grading and blending, and mixture design and characterization. Also discusses asphalt mixture production, construction, and recycling.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-2-2)

**Semesters Offered:** Fall

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**Pre-Requisite(s):** CE 3101

### **CE 5102 - Advanced Concrete Materials**

Properties and applications of portland cement and portland cement concrete. Includes cement production, chemistry and hydration, concrete admixtures, and the properties of fresh and hardened concrete. Presents concrete microstructure and durability. Other topics include high-strength and high early-strength concrete, fiber-reinforced concrete, and advanced cement-based materials.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-2-2)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**Pre-Requisite(s):** CE 3101

### **CE 5190 - Special Topics in Civil Engineering Materials**

Advanced study of materials related topics, including discussions of recent research developments at an advanced level.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

### **CE 5201 - Advanced Structural Analysis**

Energy methods in structural analysis. Elastic buckling of beams, beam-columns, and frames, including numerical methods for buckling analysis. Introduction to finite element analysis, including one- and two-dimensional elements.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2003-2004 academic year

**Pre-Requisite(s):** CE 4201

**CE 5202 - Finite Element Analysis**

Introduction to the use of finite element methods in structural analysis. Covers the finite element formulation, 1- and 2-D elements, including isoparametric elements, axisymmetric analysis, plate and shell elements, dynamics, buckling, and nonlinear analysis.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring

**Pre-Requisite(s):** CE 4201

**CE 5211 - Advanced Reinforced Concrete Design**

Advanced topics in behavior of reinforced-concrete structures and relationships with element design. Code requirements, reasoning behind theoretical and experimental studies for understanding structural behavior, and applications to design. Other topics include deep beams, corbel design, and yield-line analysis.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring - Offered alternate years beginning with the 2001-2002 academic year

**Pre-Requisite(s):** CE 4211

**CE 5212 - Prestressed Concrete Design**

Theory of prestressed and post-tensioned members. Covers analysis and design of prestressed concrete beams, slabs, box girders, and bridge girders by elastic and ultimate strength methods. Precast and cast-in-place system construction techniques will be included.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring

**Pre-Requisite(s):** CE 3201

**CE 5221 - Advanced Structural Steel Design**

Critical analysis of behavior of steel and thin-walled metal structural elements. Introduction to basic concepts of structural stability. P-delta effect as used in structural design. Torsional behavior of prismatic beams, including St. Venant and warping torsion. Torsional buckling.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2000-2001 academic year

**Pre-Requisite(s):** CE 4221

**CE 5231 - Advanced Timber Design**

Design of glulam members, including tapered beams, tapered and curved beams, and arches. Covers use of timber connectors as well as design of wood shear walls and diaphragms.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2001-2002 academic year

**Pre-Requisite(s):** CE 4201 and CE 4231

**CE 5241 - Structural Dynamics I**

Free and forced vibration of undamped and damped single degree of freedom systems. Generalized coordinates and Rayleigh's method. Multiple degree- of-freedom systems, including shear buildings and frames. Frequency response analysis.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall

**Pre-Requisite(s):** CE 4201

**CE 5242 - Structural Dynamics II**

Earthquake engineering and advanced dynamic analysis. Includes time history response of multiple degree-of-freedom systems, seismicity, equivalent static force method, modal analysis, base isolation, soil-structure interaction, and an introduction to random vibrations.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring - Offered alternate years beginning with the 2004-2005 academic year

**Pre-Requisite(s):** CE 5241

**CE 5243 - Probabilistic Analysis and Reliability in Civil Engineering**

Basic probability and statistics, including random variables, moments, probability distributions, and regression analysis. Also examines time-to-failure analysis, capacity/demand reliability analysis, first-order reliability methods, Monte Carlo simulation, and system reliability in a civil and environmental engineering context.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall

**Pre-Requisite(s):** MA 3710

**CE 5250 - Special Topics in Structural Engineering**

Advanced study of structural engineering topics, including discussions of recent research developments at an advanced level. Topics might include loading analysis, advanced topics in steel design, composite materials for structures, and behavior of a variety of reinforcements for concrete applications.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 5332 - Productivity Planning and Improvement**

Analysis of current trends in productivity, factors that affect productivity, and techniques to identify and improve areas of low productivity.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2001-2002 academic year

**Pre-Requisite(s):** CE 3332 or (BA 3610 and BA 3700)

**CE 5337 - Project Delivery Systems**

A study of project delivery, from feasibility through design and construction, focusing on the three contemporary systems: general contracting, design-build, and construction management.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Graduate

**Pre-Requisite(s):** CE 3331

**CE 5338 - Project Management and Administration**

Exploration of the essential elements of project management and construction administration for the design and construction industry. This includes project planning, organization, budgeting, monitoring, control, life cycle, organizational structure and characteristics, and responsibilities of project managers.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Graduate

**Pre-Requisite(s):** CE 3331

**CE 5390 - Special Topics in Construction Engineering**

Advanced study of construction engineering topics including discussion of recent research developments.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

**CE 5401 - Advanced Pavement Design**

Advanced analysis, behavior, performance, and structural design of highway and airport pavements. Focuses on mechanistic characterization of pavement structures and approaches used to characterize existing structures for the purpose of rehabilitation. Subjects include advanced materials characterization, mechanistic modeling, nondestructive testing, and pavement rehabilitation. Also includes airport pavement design and rehabilitation.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring

**Pre-Requisite(s):** CE 4401

**CE 5402 - Highway Design**

Advanced highway design, including horizontal and vertical alignment, cross-section elements, super elevation, and other road design topics. Includes extensive use of highway design computer software with a complete roadway design project using software.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring

**Pre-Requisite(s):** CE 3401

**CE 5403 - Pavement Management Systems**

Principles of pavement management, including inventory, condition assessment, needs determination, and budget analysis. Emphasis on field condition assessment techniques. Presents database design to illustrate data handling techniques and introduces several software packages.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring

**CE 5404 - Transportation Planning**

Introduction to urban transportation planning, travel characteristics, demand forecasting techniques, corridor studies, traffic impact studies, and public transit planning and operations.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring

**CE 5405 - Environmental Impacts of Transportation**

Introduction to environmental legislative and regulatory history. Understanding of the basic elements of environmental impact analysis for transportation facilities. Topics include noise, air quality, wetlands, cultural, historic, community, and socioeconomic aspects, and public participation techniques.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2006-2007 academic year

**CE 5406 - Airport Planning and Design**

Introduction to the air transportation system, airport planning studies, demand forecasting, aircraft characteristics, runway requirements, airport layout and design. Also includes environmental impacts, airport capacity and operations, terminal and ground access planning and analysis.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring

**CE 5407 - Advanced Airport Planning and Design**

Airport capacity and delay analysis, terminal and ground access planning, security, environmental aspects, noise and land use planning, airport management and operations. Includes extensive use of airport computer simulation software packages.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** On Demand

**Restrictions:** Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** CE 5406

**CE 5408 - Public Transit**

An introduction to public transit, user characteristics, management, transit modes, data collection and surveys, planning, operations, scheduling, transit finances, and future trends.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** On Demand

**Restrictions:** Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**CE 5410 - Intelligent Transportation Systems**

Introduction to ITS, concepts, technologies, activities, and deployment issues. Topics include advanced traffic management, traveler information systems, commercial vehicle operations, vehicle control systems, ITS applications in public transit, and rural ITS.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** On Demand

**Restrictions:** Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** CE 4402

**CE 5490 - Special Topics in Transportation Engineering**

Topics of special interest in transportation engineering.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required

**CE 5501 - Environmental Process Engineering**

Review of mass transfer, kinetics, reactor design, and mathematical modeling principles. Includes illustration by application to several important natural systems and environmental engineering unit processes. Mathematical models of selected environmental engineering systems are developed and solved using PCs.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 5502 - Biological Treatment Processes**

Application of kinetics, reactor theory, and microbiology to modeling and design of aerobic and anaerobic wastewater treatment systems. Topics include activated sludge process models and application of these models to process design and operation.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-2-3)

**Semesters Offered:** Fall, Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**Pre-Requisite(s):** CE 4502

**CE 5503 - Physical-Chemical Treatment Processes**

Advanced theory, fundamentals, and application of physical and chemical processes employed in design and operation of drinking water treatment systems.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**Pre-Requisite(s):** CE 5501

**CE 5504 - Surface Water Quality Modeling**

Mathematical models are applied in the solution of water quality management problems. The spatial and temporal variation of conservative and reactive substances is simulated in lakes, rivers, and embayments. Kinetic representations of natural phenomena are developed, including mass transport, biogeochemical cycling of nutrients and toxics and food web dynamics.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-2-1)

**Semesters Offered:** Spring

**Pre-Requisite(s):** CE 4505

**CE 5508 - Biogeochemical Processes**

To define what constitutes sustainable human activities, one must understand linkages among physical, chemical, and biological structures and processes that comprise our biosphere. Examine interactions between physical, chemical, and biological processes on earth; model these interactions; and identify areas where knowledge is insufficient for modeling.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall, Spring

**Pre-Requisite(s):** CE 4501

**CE 5509 - Transport and Transformation of Organic Pollutants**

Assessment of factors controlling environmental fate, distribution, and transformation of organic pollutants. Thermodynamics, equilibrium, and kinetic relationships are used to quantify organic pollutant partitioning and transformations in air, water, and sediments. Use of mass balance equations to quantify pollutant transport.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2005-2006 academic year

**Pre-Requisite(s):** CE 4501 or CH 3510

**CE 5510 - Practical Applications and Analytical Techniques for Environmental Measurements**

Develop methods and skills for laboratory work required for experimental research in environmental engineering. Topics include laboratory safety, quality control/quality assurance, purchasing, and use of analytical equipment. Students select one or more of the following topics for specialized study: GC, AA, carbon analysis, HPLC, UV/Visspectroscopy, liquid scintillation counting.

**Credits:** variable to 3.0

**Semesters Offered:** Summer

**Restrictions:** Permission of instructor required

**CE 5511 - Air Quality and the Built Environment**

Investigates the complex interaction between the engineered environments in developed and developing nations and air quality. Major topics include: air pollutant health impacts and epidemiology, indoor air quality, urban design and air quality, infrastructure and air quality, and atmospheric sustainability.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-2-1)

**Semesters Offered:** Spring

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**CE 5512 - Applied Boundary Layer Meteorology**

Study of how forcing phenomena affect transport of water and chemicals in the atmospheric boundary layer and how this transport is measured in the field, including relevant aspects of fluid dynamics, boundary layer structure, surface energy balance, and flux measurement.

**Credits:** 3.0

**Lec-Rec-Lab:** (2-1-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2006-2007 academic year

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**CE 5515 - Atmospheric Chemistry**

Study of the photochemical processes governing the composition of the troposphere and stratosphere, with application to air pollution and climate change. Covers radical chain reaction cycles, heterogeneous chemistry, atmospheric radiative transfer, and measurement techniques for atmospheric gases.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**Pre-Requisite(s):** CE 4501 or CH 3520

**CE 5560 - Advanced Topics in Air Quality Engineering**

Advanced study of topics related to atmospheric chemistry and/or modeling the transformation and transport of atmospheric pollutants.

**Credits:** variable to 4.0; Repeatable to a Max of 8

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required

**CE 5561 - Advanced Topics in Biological Processes**

Advanced study of biological processes associated with natural and engineering systems.

**Credits:** variable to 4.0; Repeatable to a Max of 8

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required

**CE 5562 - Advanced Topics in Physical-Chemical Processes**

Advanced study of physical and chemical processes that occur in natural and engineered systems.

**Credits:** variable to 4.0; Repeatable to a Max of 8

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required

**CE 5563 - Advanced Topics in Surface Water Quality Engineering**

Advanced topics related to understanding the biogeochemistry of surface waters (lakes, rivers, wetlands) and the mathematical modeling of those systems.

**Credits:** variable to 4.0; Repeatable to a Max of 8

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required

**CE 5590 - Special Topics in Environmental Engineering**

Advanced study of environmental engineering topics including discussion of recent research developments.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

**CE 5610 - Civil and Environmental Engineering Systems Analysis**

Operations research theory with application to civil and environmental engineering problems. Decision theory and optimization techniques, including linear programming, nonlinear programming, and dynamic programming. Computer based applications will be included.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** Fall - Offered alternate years beginning with the 2005-2006 academic year

**Pre-Requisite(s):** MA 2160

**CE 5620 - Stochastic Hydrology**

Application of statistics to problems in surface hydrology. Topics include the flood flow and streamflow frequency analysis, goodness-of-fit tests, model selection, treatment of historical and censored data, regionalization and regression, time series analysis, Bayesian inference, sensitivity and uncertainty analysis methods.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** On Demand

**Pre-Requisite(s):** MA 3710 and CE 3620

**CE 5661 - GIS Applications**

Application of a Geographical Information Systems (GIS) to hydrologic modeling. While the application centers on hydrologic modeling, the experiences gained are applicable to a wide variety of situations. Learn the processes of obtaining, manipulating, and generating data via ArcInfo and ArcView.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** On Demand

**Pre-Requisite(s):** CE 3620

**CE 5664 - Water Resources Modeling**

Application of fundamental principles to develop mathematical models of water resources systems. Includes application of numerical methods, programming to develop simple water resources models, and application of state-of-the-art models for hydrology and river analysis.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** On Demand

**Pre-Requisite(s):** CE 3620

**CE 5665 - Sediment Transport**

Basin mechanics of the transport of sediments in natural systems, including tractive forces and geomorphic functions.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall, Spring

**Pre-Requisite(s):** CE 3620

**CE 5666 - Water Resources Planning and Management**

Economic and environmental aspects of water use. Topics include flood damage reduction, water demand and hydrologic forecasting, water supply planning, and water resource systems operation.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** On Demand

**Pre-Requisite(s):** CE 3620 and (EC 3402 or ENT 3402 or EC 3400)

**CE 5668 - Cold Regions Hydrology**

Analysis of the effects of fresh water ice and snow engineering projects. Topics include snow hydrology, formation, melt, transport distribution, and loading; ice formation, mechanics, bearing capacity, hydraulic effects on rivers, ice jams, and ice control.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-3-0)

**Semesters Offered:** On Demand

**Restrictions:** May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

**Pre-Requisite(s):** CE 3620

**CE 5690 - Special Topics in Water Resources**

Advanced study of water resources topics including discussion of recent research developments.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

**CE 5810 - Advanced Soil Mechanics**

Provides advanced studies in the topics of soil compressibility and soil strength. Develop advanced procedures for determining stress distribution and stress changes from a fundamental basis. Students are strongly advised to take CE5820 concurrently.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall

**Pre-Requisite(s):** CE 3810

**CE 5820 - Geotechnical Engineering Laboratory**

Hands-on experimental lab course intended to develop understanding of soil behavior and the subtle variables that influence testing results. Tests studied include cyclic and monotonic triaxial drained and undrained strength, triaxial and one-dimensional compression, and as-compacted vs. long-term behavior of fill materials.

**Credits:** 3.0

**Lec-Rec-Lab:** (0-1-4)

**Semesters Offered:** Fall

**Pre-Requisite(s):** CE 3810

**CE 5830 - Advanced Geotechnical Engineering**

Applies soil mechanics to the design of foundations and earth-retaining structures. Proper input parameters are stressed, and elements include the design of conventional retaining walls, reinforced earth walls, caissons, piles, shallow foundations, de-watering systems, and the support of temporary excavations.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Pre-Requisite(s):** CE 5810 and CE 5820

**CE 5840 - Frozen Ground Engineering**

Stresses the problems and their solutions in seasonally frozen ground. Topics include definition of detrimental frost action, frost susceptibility criteria, mechanism of frost action, frost-resistant design, and the use of insulation. Studies both pavements and light building foundations. Take field trips during the spring thaw period.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Spring

**Pre-Requisite(s):** CE 3810

**CE 5850 - Stability of Earth Structures**

Investigates the stability of both natural and anthropogenic derived structures. Studies include the application of engineering geology to slope issues, slope stability analysis procedures, computational methods. Also covers the design and analysis of soil nail walls.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall

**Pre-Requisite(s):** CE 3810

**CE 5860 - Fundamentals of Soil Behavior**

Develop an understanding of the factors determining and controlling the engineering properties of a soil. Topics include crystal structure and surface characteristics, soil mineralogy, soil formation, rock weathering, soil composition, soil water, clay-water electrolyte systems, soil structure and stability, volume change behavior, and strength and deformation behavior.

**Credits:** 3.0

**Lec-Rec-Lab:** (3-0-0)

**Semesters Offered:** Fall

**Pre-Requisite(s):** CE 3810

**CE 5890 - Special Topics in Geotechnical Engineering**

Advanced study of geotechnical engineering topics including discussion of recent research developments.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 5920 - Civil Engineering Independent Study**

Approved research or design project in civil engineering, originating with an individual student or assigned by the instructor.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 5930 - Environmental Engineering Independent Study**

Approved research or design project in environmental engineering, originating with an individual student or assigned by the instructor.

**Credits:** variable to 3.0; Repeatable to a Max of 6

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 5990 - Civil Engineering Graduate Seminar**

Detailed study and group discussions of current literature and graduate research projects related to the broad field of civil engineering. Topics will be combined to address the student's area of interest, including construction, environmental, geotechnical, structures, transportation, and water resources. External speakers discuss current related issues.

**Credits:** 1.0

**Lec-Rec-Lab:** (0-1-0)

**Semesters Offered:** Fall, Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 5991 - Environmental Engineering Graduate Seminar I**

Presentations and discussion of current literature and research related to the broad field of environmental engineering.

**Credits:** 1.0

**Lec-Rec-Lab:** (0-1-0)

**Semesters Offered:** Fall

**CE 5992 - Environmental Engineering Graduate Seminar II**

Presentations and discussion of current literature and research related to the broad field of environmental engineering.

**Credits:** 1.0

**Lec-Rec-Lab:** (0-1-0)

**Semesters Offered:** Spring

**CE 5993 - Field Engineering in the Developing World**

Study of applying appropriate and sustainable engineering solutions and technology in the developing world. Concepts of sustainable development are covered. Topics are drawn from several areas of engineering, including water supply/treatment, wastewater treatment, materials, solid waste, construction, and watersheds.

**Credits:** 2.0

**Lec-Rec-Lab:** (0-1-2)

**Semesters Offered:** Spring

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 5994 - International Civil & Environmental Engineering Field Experience**

Field work and reporting from students in the Peace Corps Master's International Program in Civil & Environmental Engineering.

**Credits:** 1.0; May be repeated

**Lec-Rec-Lab:** (0-0-2)

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required; Must be enrolled in one of the following Level(s): Graduate

**CE 5995 - International Engineering Master's Research**

An original investigation in theoretical or experimental engineering and submission of a thesis or report in partial fulfillment of the requirements of the Master of Science degree conducted while in the Peace Corps Master's International Civil & Environmental Engineering program.

**Credits:** variable to 9.0

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Permission of instructor required; Must be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Major(s): Civil Engineering, Environmental Engineering

**CE 5998 - Engineering Design Practicum**

Advanced independent study for students in the Master of Engineering program. In consultation with student's advisor, develop and execute a project demonstrating capabilities in problem solving, communications, and decision making. The practicum can be done on campus or at the site of a Michigan Tech corporate partner.

**Credits:** variable to 4.0; Repeatable to a Max of 4

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 5999 - Master's Research**

Study of an acceptable civil or environmental engineering problem and preparation of a report or thesis.

**Credits:** variable to 10.0; May be repeated; Graded Pass/Fail Only

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate

**CE 6999 - Doctoral Research**

Original research leading to the preparation of a dissertation in partial fulfillment of the requirements for the PhD degree.

**Credits:** variable to 10.0; May be repeated; Graded Pass/Fail Only

**Semesters Offered:** Fall, Spring, Summer

**Restrictions:** Must be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Major(s): Civil Engineering, Environmental Engineering, Engineering - Environmental

**Graduate Course Descriptions Effective Fall 2007**

[https://www.banweb.mtu.edu/pls/owa/stu\\_ctg\\_utils.p\\_online\\_all\\_courses\\_gr](https://www.banweb.mtu.edu/pls/owa/stu_ctg_utils.p_online_all_courses_gr)

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