CIVIL ENGINEERING

Department of Civil and Environmental Engineering

College of Engineering

221 Statics
Fall, Spring. 3(3-0) Interdepartmental with Mechanical Engineering. Administered by Civil Engineering. P: (iPHY 183 or PHY 183B or PHY 183H) or (PHY 231 and PHY 233B)) and ((MTH 234 or concurrently) or (LB 220 or concurrently)) or (MTH 254H or concurrently)) SA: MSM 205


273 Civil and Environmental Engineering Measurements
Fall, Spring. 2(1-3) P: (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently) and (EGR 102 or concurrently) SA: CE 271

Measurements, surveying, and error analysis with applications to civil and environmental engineering problems.

274 Graphics for Civil and Environmental Engineers
Fall, Spring. 1(1-3) P: (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently) and (EGR 100 or concurrently) SA: CE 272

Basic operations in CAD software with applications in civil and environmental engineering.

280 Principles of Environmental Engineering and Science
Fall, Spring. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: (CEM 141 or CEM 151 or LB 171) and ((MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently))

Physical, chemical, and biological processes related to environmental science and engineering. Environmental systems analysis with application to air, water, and soil. Analysis of environmental problems and development of engineering solutions.

305 Introduction to Structural Analysis
Fall, Spring. 3(3-0) P: ME 222 and (CE 273 or concurrently) and (CE 274 or concurrently) R: Open to juniors or seniors in the Department of Civil and Environmental Engineering.


312 Soil Mechanics
Fall, Spring. 4(3-3) P: ME 222 and (CE 273 or concurrently) and (CE 274 or concurrently) R: Open to juniors or seniors in the Department of Civil and Environmental Engineering and open to juniors or seniors in the Biosystems Engineering major.


Principles of Traffic Engineering
Fall. 3(3-0) P: CE 341 R: Open to juniors or seniors or graduate students in the Civil Engineering Major.

Driver and vehicle characteristics affecting traffic flow and safety. Speed, density, capacity relationships. Signal control in street networks. Freeway management systems. Risk management and liability.

Transportation Planning
Spring. 3(3-0) P: CE 341


Highway Design
Fall. 3(3-0) P: CE 341 R: Open to juniors or seniors or graduate students in the College of Engineering.

Geometric design of highways. Operation, capacity, safety, and geometric features. Alignment, drainage and pavement design. Use of CAD systems in preparing contract plans.

Computational Methods in Civil Engineering
Spring. 3(3-0) P: (EGR 102 and CE 221) and (MTH 235 or MTH 340 or MTH 347H) R: Open to juniors or seniors or graduate students in the Civil Engineering Major. SA: CE 390 Not open to students with credit in ME 361.

Theoretical, numerical, and computational methods for civil engineering problems. Physical modeling, numerical techniques, and programming methods. Focus on civil engineering dynamics, solving systems of differential equations, and visualizing the results.

Construction Engineering - Equipment, Methods and Planning
Spring. 3(3-0) P: (CE 305 and CE 312 and CE 337) or (CMP 305 and CMP 322) R: Open to juniors or seniors or graduate students in the College of Engineering or in the Department of Management or in the Construction Management major.

Engineering and construction fundamentals of earthwork operations, moving of materials, concrete construction, formwork, false work, and other temporary structures. Relationship to a construction project's constructability, cost, and schedule.

Environmental Measurements Laboratory
Fall. 1(0-3) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: (CEM 161 or CEM 185H or LB 171L) and ENE 280 and (CEM 142 or CEM 152 or CEM 182H or LB 172) and (ENE 481 or concurrently) or (ENE 483 or concurrently) and Completion of Tier I Writing Requirement R: Open to juniors or seniors or graduate students in the College of Engineering.

Basic chemical and microbiological methods used in the analysis of environmental media. Laboratory safety, quality assurance, quality control, and statistics used in laboratory analysis. Related technical communication, laboratory report writing.

Environmental Chemistry: Equilibrium Concepts
Fall. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: (CEM 141 and CEM 142) or (CEM 151 and CEM 152) or (CEM 181H and CEM 182H) or (LB 171 and LB 172J) and (ENE 280 or BE 230 or GLG 201 or GLG 301 or approval of department) Chemistry of natural environmental systems and pollutants. Equilibrium concepts and calculations for acid-base, solubility, complexation, redox and phase partitioning reactions and processes. Applications to ecosystem analysis, pollutant fate and transport, and environmental protection.

Water and Wastewater Engineering
Fall. 4(3-2) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: (ENE 280 or BE 230) and (CE 321 or CHE 311) R: Open to juniors or seniors or graduate students in the College of Engineering.

Engineering and scientific basis and design of physical, chemical and biological methods for the treatment of drinking water and wastewater. Operation process selection and design. Field trips required.

Landfill Design
Spring. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Civil Engineering. P: ENE 280 and CE 312

Geotechnical and environmental design of solid waste landfills.

Microbiology for Environmental Science and Engineering
Spring. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: ENE 280

Fundamentals of microbiology. Application of these concepts to environmental processes such as wastewater treatment, human health and bioremediation.

Air Pollution: Science and Engineering
Spring. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: (CEM 141 or CEM 151 or LB 171) and (MTH 133 or MTH 153H or LB 119) and (ENE 280 or BE 230) and (CE 321 or CHE 311) R: Open to juniors or seniors or graduate students in the College of Engineering.

Basic physical and chemical principles governing indoor and atmospheric air pollution. Elements of air pollution meteorology, climate change, atmospheric transformations and transport. Air pollution sources and methods for their control. The role of local, state and federal government in air pollution control.

Independent Study
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to seniors in the College of Engineering. Approval of department.

Selected Topics in Civil Engineering
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.

Selected topics related to construction engineering, fluid mechanics, geotechnical engineering, hydrology, pavements, structural engineering, or transportation engineering.

Senior Design in Civil and Environmental Engineering
Fall, Spring. 4(2-3) P: (CE 274 and CE 371 and CE 372) and (ENE 421 or ENE 422 or ENE 483 or ENE 489 or CE 418 or CE 431 or CE 405 or CE 406 or CE 444 or CE 449) and (ENE 421 or ENE 422 or ENE 483 or ENE 489 or CE 405 or CE 406 or CE 444 or CE 449) and (ENE 421 or ENE 422 or ENE 483 or ENE 489 or CE 405 or CE 418 or CE 431 or CE 405 or CE 406 or CE 418 or CE 431 or CE 444 or CE 449) and (ENE 421 or ENE 422 or ENE 483 or ENE 489 or CE 405 or CE 406 or CE 418 or CE 431 or CE 444 or CE 449) R: Open to seniors in the Civil Engineering Major or in the Environmental Engineering Major.


Nonlinear Structural Mechanics
Spring of odd years. 3(3-0) RB: Basic knowledge on the design of steel (CE405) and concrete structures (CE406), matrix methods of structural analysis (CE400), background in differential equations. Theory and methods related to the nonlinear behavior and analysis of structures with focus on line-type elements in two dimensions. Inelastic behavior of structural materials. Stability of structures, Nonlinear behavior and analysis of members and structural systems. Methods for iterative solution strategies and use of special computer software.
802 Introduction to Dynamics and Earthquake Engineering
Fall. 2 credits. RB: MSM 306 Not open to students with credit in ME 461.

803 Structural Dynamics
Fall. 1(1-0) C: CE 802 concurrently.

804 Advanced Mechanics for Civil Infrastructure
Fall. 3(3-0) or CE 400 or matrix structural analysis R: Open only to graduate students in the College of Engineering. Advanced linear mechanics. Potential energy principle. Finite element formulations. Applications to problems in structural, geotechnical and pavement engineering.

805 Advanced Design of Steel Structures
Spring. 3(3-0) Flexural and torsional instability of columns and beams. Slender cross-sectional elements, design of beam-columns. Torsion, plastic design, plate girders, composite steel-concrete construction, connections.

806 Advanced Structural Concrete Design
Spring. 3(3-0) Analysis and design of prestressed and conventionally reinforced concrete structures.

807 Seismic Structural Design
Spring of even years. 3(3-0) RB: CE 400 and CE 405 and CE 406

808 Structural Fire Engineering
Spring of even years. 3(3-0) RB: CE 400 and CE 405 and CE 406
Fire safety, fire codes, and fire engineering design methods. High temperature material properties, and behavior of materials and structures exposed to fires. Fire resistance design of steel, concrete, composite and timber structures. Use of the computer program for thermal and structural analysis.

809 Advanced Composite Materials and Structures
Spring of even years. 3(3-0) RB: ME 222 and CE 490 and CSE 231 and MTH 235 and MTH 314

812 Properties of Soils
Fall of odd years. 3(2-3) Saturated and unsaturated hydraulic properties, consolidation and shear strength properties, thermal properties, and numerical modeling. Laboratory determination of soil properties including, interpretation of experimental data.

813 Soil Dynamics
Fall. 1(1-0) SA: CE 803B C: CE 802 concurrently.

815 Selected Topics in Geotechnical Engineering
Spring. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.
Selected topics related to soil stabilization, highway and airport soils, and frozen ground engineering.

818 Advanced Geotechnical Design

821 Groundwater Hydraulics
Fall. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering.

822 Groundwater Modeling
Spring of even years. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering.

829 Mixing and Transport in Surface Waters
Fall of odd years. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: ENE 801

831 Advanced Concrete Pavement Analysis and Design
Spring of odd years. 3(3-0) RB: CE 312 and CE 337 and CE 431

832 Advanced Asphalt Pavement Analysis and Design
Spring of even years. 3(3-0) RB: CE 312 and CE 337 and CE 431
Mechanical approach to asphalt pavement design. Analysis of asphalt pavement systems using theoretical models, asphalt material modeling, prediction, and performance. Formulation of improved mechanistic structural and mix design procedures.

835 Engineering Management of Pavement Networks
Spring of even years. 3(3-0) Theoretical and statistical analysis of pavement networks. Engineering monitoring. Determination of distress mechanisms and engineering solutions. Assignment of priorities to engineering actions.

836 Materials Science for Civil Engineers
Fall. 3(3-0) RB: CE 337 or equivalent Structure of materials and structure-property relationships. Principles and theories governing mechanical, physical, and durability characteristics of civil engineering materials. Material selection, production, and quality control.

837 Advanced Concrete Materials
Spring of odd years. 3(3-0) Microstructure, engineering characteristics and modeling of concrete materials. Structure-property relationships in concrete materials. Control of concrete structure and properties for different infrastructure applications.

838 Bituminous Materials
Fall of even years. 3(2-3) RB: CE 431 and CE 432 and CE 461
Superpave asphalt mix design, binder tests, hot mix asphalt performance tests, viscoelasticity, continuum damage models, image analysis methods.

841 Traffic Flow Theory
Spring. 3(3-0) Microscopic and macroscopic traffic flow models, Queueing theory. Gap acceptance. Simulation models for network analysis. Intelligent vehicle highway systems.

844 Highway and Traffic Safety
Fall of odd years. 3(3-0) Analysis of highway geometric design alternatives and operational-control strategies with respect to accident probabilities. Statistical methods of pattern identification. Countermeasure selection and evaluation methodology. Risk management.

847 Traffic Analysis and Control
Spring of odd years. 3(3-0) P: CE 444 RB: Graduate student in transportation engineering
Modern traffic control and traffic modeling using state-of-the-art algorithms and computer models. Practical implications.

849 Transportation Research Methods
Spring. 3(3-0) Application and interpretation of quantitative methods and design of experiments for transportation research. ANOVA, non-parametric, discriminant analysis, factor analysis, multivariate regression, SPSS.
850 Intelligent Transportation Systems (ITS)  
Fall of odd years. 3(3-0) RB: Traffic and Transportation engineering  
Technical and policy aspects emerging from the application of advanced technologies to transportation problems. Intelligent Transportation Systems (ITS) user services requirements, available and emerging technologies, case studies of ongoing operational tests, legal institutional and planning issues related to ITS development and deployment.

851 Transportation and the Environment  
Spring of even years. 3(3-0) RB: B.S. in Civil Engineering with emphasis on transportation or environmental engineering R: Open only to graduate students in the College of Engineering.  

872 Finite Element Method  
Fall, Spring. 3(3-0) Interdepartmental with Mechanical Engineering. Administered by Mechanical Engineering. SA: AE 809, MSM 809  
Theory and application of the finite element method to the solution of continuum type problems in heat transfer, fluid mechanics, and stress analysis.

880 Civil Engineering Seminar  
Fall, Spring. 1(1-0) A student may earn a maximum of 2 credits in all enrollments for this course. RB: Graduate student or undergraduate at senior level with a GPA of 3.0 or higher  
Current research in civil engineering.

890 Independent Study in Civil Engineering  
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to graduate students in the Department of Civil and Environmental Engineering. Approval of department.  
Research problems of limited scope not pertaining to thesis accomplished under CE 899 or CE 999.

891 Selected Topics in Civil Engineering  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 9 credits in all enrollments for this course.  
Selected topics in new or developing areas of civil engineering.

892 Master's Research Project  
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course. R: Open only to master's students in the Civil Engineering major. Approval of department.  
Master's degree Plan B individual student research project. Original research, research replication, or survey and reporting on a research topic.

899 Master's Thesis Research  
Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 24 credits in all enrollments for this course.  
Master's thesis research.

900 Research Strategies and Methods in Civil Engineering  
Spring. 1(1-0) R: Open to graduate students in the Department of Civil and Environmental Engineering. Not open to students with credit in ENE 900  
Criteria for quality research, scientific method, scientific arguments, statistical testing, critical thinking skills, reviewing journal articles, literature synthesis, writing proposals and papers, giving presentations, responsible conduct of research.

990 Independent Study in Civil Engineering  
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to doctoral students in the Civil Engineering major.  
Research problems of limited scope not pertaining to thesis accomplished under CE 999.

999 Doctoral Dissertation Research  
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course.  
Doctoral dissertation research.