CIVIL ENGINEERING

Department of Civil and Environmental Engineering
College of Engineering

221 Statics
Fall, Spring, Summer. 3(3-0) Interdepartmental with Mechanical Engineering. Administered by Civil Engineering. P.M.: (PHY 183 or PHY 183B or PHY 193H) and (MTH 234 or concurrently) or (LBS 220 or concurrently) or (MTH 254H or concurrently) SA: MSM 205


271 Introduction to Civil Engineering
Fall, Spring. 4(3-3) P.M.: (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LBS 118 or concurrently)

Measurement, analysis and design with applications in civil engineering. Surveying and error analysis.

280 Principles of Environmental Engineering and Science
Fall, Spring. 3(3-0) P.M.: (CEM 141 or CEM 151 or LBS 171) and ((MTH 132 or concurrently) or (MTH 152H or concurrently) or (LBS 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 and Design
Spring. 4(3-2) P.M.: (ME 222 and CE 271 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.M.: ME 222 and CE 271 or concurrently) R: Open to juniors or seniors in the Department of Civil and Environmental Engineering.


321 Introduction to Fluid Mechanics
Fall, Spring. 4(3-2) P.M.: (MTH 234 or MTH 254H or LBS 220) and (ME 221 and (CE 271 or concurrently) R: Open only to juniors or seniors in the Department of Civil and Environmental Engineering or in the Biosystems Engineering major. Not open to students with credit in ME 322.


337 Civil Engineering Materials I
Fall, Spring. 4(3-3) P.M.: (ME 222 or concurrently) and (CE 271 or concurrently) R: Open only to juniors or seniors in the Department of Civil and Environmental Engineering.

Common civil engineering construction and paving materials: aggregates, inorganic cements, asphalt, concrete, wood, and steel. Composition, structure, physical and mechanical properties, tests, and production mix design.

341 Transportation Engineering
Fall, Spring. 3(3-0) P.M.: (MTH 234 or concurrently) or (MTH 254H or concurrently) or (LBS 220 or concurrently) and (CE 271 or concurrently) and completion of Tier I writing requirement) RB: STT 351 R: Open only to juniors or seniors in the Department of Civil and Environmental Engineering or in the Urban and Regional Planning major. SA: CE 346

Overview of transportation system issues and problems. Fundamentals of highway design and operations. Planning and evaluation of transportation system alternatives.

390 Computational Methods in Civil Engineering
Fall. 3(3-2) P.M.: CSE 131 and CE 221 R: Open to juniors or seniors in the Civil Engineering major.

Computational techniques for civil engineering problem solving. Data storage, graphical user interfaces, numerical solution techniques, and numerical visualization. Realistic physical computational modeling. Examples will be taken from rigid body dynamics, structural mechanics, fluid mechanics, and transportation engineering.

400 Structural Mechanics
Spring. 3(3-0) P.M.: CE 305 R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering.


405 Design of Steel Structures
Fall. 3(3-0) P.M.: CE 305 R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering.

Design of steel beams, columns, tension members and connections. Stability and plastic strength.

406 Design of Concrete Structures
Spring. 3(3-0) P.M.: CE 305 and CE 337 R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering.

Design of reinforced concrete beams, slabs, columns and footings.

418 Geotechnical Engineering
Fall, Spring. 3(3-0) P.M.: CE 312 R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering.


421 Engineering Hydrology
Fall. 3(2-2) P.M.: CE 321 RB: STT 351 R: Open only to juniors or seniors or graduate students in the Department of Civil Engineering or College of Natural Science or Department of Crop and Soil Sciences.

Hydrologic design of stormwater systems. Equilibrium hydrograph analysis, unit hydrographs, infiltration, hydrograph synthesis, and reservoir routing.

Groundwater: Darcy's law, flow nets, well hydraulics, design of capture wells.

422 Applied Hydraulics
Spring. 3(2-2) P.M.: CE 321 or ME 332 R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering or Department of Mechanical Engineering or in the Biosystems Engineering major.


431 Pavement Design and Analysis I
Fall. 3(3-0) P.M.: CE 312 and CE 337 R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering.


432 Pavement Rehabilitation
Spring. 3(3-0) P.M.: CE 312 and CE 337 RB: CE 431 R: Open only to seniors or graduate students in the Department of Civil and Environmental Engineering.

Engineering concepts and information needed to rehabilitate pavements. Network and project survey and evaluation: design of rigid and flexible overlays, other methods of rehabilitation, selection of rehabilitation alternatives. Initial and life cycle cost analysis of various rehabilitation alternatives.

444 Principles of Traffic Engineering
Fall. 3(3-0) P.M.: STT 351 and CE341 R: Open only to juniors or seniors or graduate students in the Civil Engineering major.

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

448 Transportation Planning
Spring. 3(3-0) P.M.: CE 341 and STT 351 Transportation planning process and procedures. Estimation of travel demand using traditional models of trip generation, trip distribution, modal split, and traffic assignment. Use of "quick-response" procedures. Traffic impact of new facilities.

449 Highway Design
Fall, Spring. 3(3-0) P.M.: CE 341 R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering.

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

462 Technical Communication
Spring. 3(3-0) RB: Junior status in a degree program in the College of Engineering. Major modes of technical communication such as letters, memoranda, research reports, analysis/decision papers, presentations, information graphics, procedures. Communication planning, audience analysis, and information design. Case studies, exercises and writing workshops.

471 Construction Engineering - Equipment, Methods and Planning
Spring. 3(3-0) P: (CE 305 and CE 312 and CE 337) or (BCM 305 and BCM 322) R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering and the Building Construction Management program. 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.

480 Water and Wastewater Analysis Laboratory
Fall. 1(0-3) P: (CEM 161 or CEM 185H or LBS 171L) and (CE 481 or concurrently) R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering. Chemical and microbial analysis of water and wastewater.

481 Environmental Engineering Chemistry
Fall. 3(3-0) P: (CEM 151 and CEM 152) or (CEM 181H and CEM 182H) or (LBS 171 and LBS 172) and (CEM 251 or CEM 351) Chemistry of environmental processes including alkalinity, precipitation-dissolution reactions, chemical complexation and redox reactions. Engineering applications to processing plants for water and wastewater.

483 Unit Operations and Processes in Environmental Engineering
Fall. 3(3-0) P: CE 280 and (CE 321 or concurrently) R: Open to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering or in the College of Engineering. Scientific basis and design of physical, chemical and biological treatment methods for the control of water and air pollution. Operation and process selection.

485 Landfill Design
Spring. 3(3-0) P: CE 280 and CE 312 R: Open only to juniors or seniors or graduate students in the the Department of Civil and Environmental Engineering. Geotechnical and environmental design issues for solid waste landfills.

487 Microbiology for Environmental Health Engineering
Spring. 3(3-0) P: CHE 201 R: Open only to juniors or seniors or graduate students in the College of Engineering or graduate students in the College of Natural Science. Use and control of microorganisms for the protection of public health and the environment. Thermodynamics of microbial populations and microbial transformations.

490 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 only to juniors or seniors in the Department of Civil and Environmental Engineering. Approval of department. Civil engineering problem of specific interest to the student and a faculty member. May be analysis or design.

491 Civil Engineering Design Project
Fall. Spring. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to juniors or seniors in the Department of Civil and Environmental Engineering. Approval of department. Planning, specification, and design of a civil engineering project or facility.

492 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, environmental engineering, fluid mechanics, geotechnical engineering, hydrology, pavements, structural engineering, or transportation engineering.

495 Senior Design in Civil Engineering
Fall, Spring. 3(1-3) R: approval of department. Preliminary design. Application of design concepts in civil engineering. Integrated design solutions for situations with geotechnical, hydrological, pavement, structural, environmental, and transportation considerations. Planning the design process. Design specifications. Cost. Written and oral presentations.

800 Bridge Design
Fall. Spring. 3(3-0) RB: CE 400 and CE 405 and CE 406 and CE 312 and CE 400 and CE 405 and CE 406 and CE 312 and CE 400 and CE 405 and CE 406. Open to graduate students in the College of Engineering or approval of department. Design and analysis of bridge structures including bridge types, materials, load conditions, construction, methods, and rehabilitation. Analysis of beam, slab, box girder, curved, and skewed bridges. Conceptual or preliminary design of a bridge project.

802 Introduction to Dynamics and Earthquake Engineering
Fall. 2 credits. RB: MSM 306 Not open to students with credit in ME 461. Dynamic response of single degree-of-freedom systems. Damping in structures and soils. Time domain and frequency domain methods. Analytical and numerical solution techniques. Earthquake response spectra.

803 Structural Dynamics

804 Advanced Mechanics for Civil Infrastructure
Fall. 3(3-0) RB: (CE 400) or matrix structural analysis R: Open only to graduate students in the College of Engineering. Advanced linear mechanics. Potential energy principles. 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
Fall. 3(3-0) SA: CE 808 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.

810 Reliability-Based Design in Civil Engineering
Fall. 3(3-0) Probabilistic treatment of live and dead loads: earthquakes, floods, material properties, and capacity. Reliability basis of design specifications, reliability index, probability of failure, design for reliability. Reliability of engineering systems.

811 Advanced Hydrogeology
Spring. 3(3-0) Interdepartmental with Geological Sciences. Administered by Geological Sciences. RB: CE 821 Processes influencing groundwater flow and solute transport. Mathematical equations and numerical methods to describe these processes.

812 Mechanical Properties of Soils
Fall. 3(3-0) Permeability, consolidation theory, stress-strain behavior, conditions of failure, shear strength. Laboratory determination of soil properties including interpretation of experimental data.

813 Soil Dynamics

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
Spring, 3(3-0)

821 Groundwater Hydraulics
Fall, 3(3-0)

829 Mixing and Transport in Surface Waters
Fall of odd years, 3(3-0) P:M: ENE 801

831 Pavement Design and Analysis II
Spring, 3(3-0)
Theoretical models for analysis of pavement systems. Evaluation and application of current design practices related to elastic and plastic theory. Formulation of improved design procedures.

835 Engineering Management of Pavement Networks
Spring of even years, 3(3-0)

837 Civil Infrastructure Materials
Fall, 3(3-0)
Elastic and inelastic behavior and modeling of materials for civil infrastructure; design for desired properties and response of infrastructure components and systems. Constituents, manufacturing, stiffness, strength, failure, and durability of pavements, structural concrete, and fiber reinforced polymer composites.

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.

843 Simulation and Optimization of Urban Traffic Flow
Fall of even years, 3(3-0) RB: CE 444 and CE 841
Assumptions behind and use of traffic signal optimization models as tools for the development of signal timing plans for isolated intersections and coordinated networks. Principles of vehicle actuation and design of actuated timing plans using signal optimization models. Simulation studies. Calibration issues with the use of microscopic traffic simulation models.

844 Highway and Traffic Safety
Fall of odd years, 3(3-0)

846 Transportation Policies and Decision-Making
Fall of even years, 3(3-0)
National transportation issues, policy formulation, and decision-making. Highway needs assessment, urban and statewide planning, revenue sources, cost allocation, and transportation funding programs.

847 Simulation Models for Transportation Applications
Fall of even years, 3(3-0)
Simulation models for analysis and optimization of transportation systems. Experimentation with planning and traffic simulation models for signal timing and capacity analysis.

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.

890 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 master's students in the Civil Engineering major. 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. 2 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.

893 Master's Design Project
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 3 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 civil engineering design project.

899 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 72 credits in all enrollments for this course.
Doctoral dissertation research.