CIVIL ENGINEERING  CE

Department of Civil and Environmental Engineering
College of Engineering

221 Statics
Fall, Spring, Summer. 3(3-0) Interdepartmental with Mechanical 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: M3 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: (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
Fall, Spring. 4(3-2) P: (ME 222 and CE 271 or concurrently) R: Open only to juniors or seniors in the Department of Civil and Environmental Engineering. Analysis and design of structural systems. Load estimation and placement. Structural analysis theory. Manual and computer analysis methods and validation of results from computer analysis methods. Proportioning of structural members in steel and reinforced concrete. Applications including bridges and building frames.

312 Soil Mechanics
Fall, Spring. 4(3-3) P: (ME 222 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.

321 Introduction to Fluid Mechanics
Fall, Spring. 4(3-2) P: (MTH 234 or MTH 254H or LBS 220) and (ME 221) and (CE271 or concurrently) and completion of Tier I writing requirement. 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 M3 332.

337 Civil Engineering Materials I
Fall, Spring. 4(3-3) P: (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, asphalts, concretes, wood, and steel. Composition, structure, physical and mechanical properties, tests, and production mix design.

341 Transportation Engineering
Fall, Spring. 3(3-0) P: (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. R: 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.

375 Cost Engineering and Engineering Ethics
Fall, 3(3-0) R: Open only to juniors or seniors in the College of Engineering. SA: CE 370
Cost engineering concepts and applications. Time value of money, alternative definitions and decision criteria. Equivalent cash flows. Cost benefit analysis, rate of return, depreciation. Moral foundations, engineering codes of ethics and case studies.

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

405 Design of Steel Structures
Fall. 3(3-0) P: (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: (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: (CE 312) R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering. Shallow foundation design: bearing capacity, stress distribution, and settlement analysis. Pile foundations. Design of retaining structures, including rigid walls, braced excavations, and sheet-pile walls. Stability of slopes and embankments.

421 Engineering Hydrology
Fall. 3(2-5) P: (CE 321) RB: STT 351 R: Open only to juniors or seniors or graduate students in the College of 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 hydraulic design of capture wells.

422 Applied Hydraulics
Spring. 3(2-2) P: (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
Fall. 3(3-0) P: (CE 312 and CE 337) R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering. Pavement design and analysis. Highway and airfield pavement structural design. Performance measures. Failure mechanisms. Pavement thickness design procedures. Design considerations for surface friction, pavement joints, and drainage.

432 Pavement Rehabilitation
Fall. 3(3-0) P: (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: (STT 351 and CE431) 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 relationships. Signal control in street networks. Freeway management systems. Risk management and liability.

448 Transportation Planning
Spring. 3(3-0) P: (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: (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.
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/descriptions, 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 Water and Wastewater Treatment
Fall. 3(3-0) P: (CE 280 and CE 321 or concurrently) R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering. Distribution of water and collection of sewage. Theory and design of water treatment processes.

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) P: (CE 321 or CE 341) and (CE 280 or CE 337) and (CE 305 and CE 312) and (CE 405 or CE 406 or CE 485 or CE 418 or CE 421 or CE 422 or CE 431 or CE 444 or CE 448 or CE 449 or CE 483) 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.

498 Advanced Mechanics of Structures
Fall. 3(3-0) R: (CE 400) 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.

804 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 Analysis and design of prestressed and conventionally reinforced concrete structures.

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 Department of 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(2-3) 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

821 Groundwater Hydraulics
Fall. 3(3-0) Physical properties of porous media. Equations of flow in saturated media. Flow nets, well flow and parameter measurement. Transport processes and the advective-dispersion equation for conservative contaminants.
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 concretes, and fiber reinforced polymer composites.

841 Traffic Flow Theory
Spring. 3(3-0)

843 Simulation and Optimization of Urban Traffic Flow
Fall of even years. 3(3-0) RB: (CE 841)
Statistical analysis of highway geometric designs and operational-control strategies with respect to the optimal flow of traffic. Intersection, arterial, network design and control models. Traffic simulation. System management and optimization.

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

846 Statewide Transportation Network Evaluation
Spring of odd years. 3(3-0)
Transportation system measures, needs studies, sufficiency ratings. Cost allocation models, programming and budget constraints. Corridor analysis, transportation economics, demand elasticity.

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 Department of 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 Civil Engineering master's students. 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. 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. 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 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.

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 Civil Engineering doctoral students.
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 72 credits in all enrollments for this course.
Doctoral dissertation research.

CLASSICAL STUDIES

Department of French, Classics, and Italian
College of Arts and Letters

120 Latin and Greek Roots of English Words
Spring. 3(3-0)
Prefixes, suffixes, and roots of English vocabulary from Greek and Latin word elements.

122 Latin and Greek Roots of Medical Terminology
Fall. 3(3-0)
Prefixes, suffixes, and roots of medical vocabulary from Greek and Latin word elements.

140 Greek and Roman Mythology
Fall. 3(3-0)
Introduction to Greek and Roman myths, with emphasis on myth as social discourse and as an influence on ancient poets and thinkers.

150 Myth, Legend, and J.R.R. Tolkien
Spring. 3(3-0)
Myth and myth-making in Tolkien's The Lord of the Rings and his other works. Ways of reading myth and legends that served as Tolkien's sources and inspiration.

160 Introduction to Classics
Fall of odd years. 3(3-0)
Introduction to classical Greek and Roman culture and to the methods of studying the ancient world. Topics from history, literature, epigraphy, papyrology, medicine, religion, and technology.

201 The Greek and Roman World in Film
Spring of even years. 3(3-0)
Portrayals of Greek and Roman cultures in film with emphasis on the interactions between the ancient and modern worlds.

292 Introduction to Ancient Studies
Fall. 2(1-2) Interdepartmental with Arts and Letters; History of Art; History. Administered by College of Arts and Letters.
Methods and current trends in the study of the Greek and Roman world. Visits to library and museum collections.

309 Greek Civilization
Fall. 3(3-0) SA: CLA 210
Survey of salient aspects of ancient Greek civilization and modern approaches to its study.