CIVIL ENGINEERING  CE
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: (PHY 180 or PHY 183B or PHY 193H) or (PHY 231 and PHY 233B) and (MTH 234 or concurrently) or (LB 220 or concurrently) or (MTH 254H or concurrently)) or (CE 271 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently). Vector description of forces and moments. Two- and three-dimensional equilibrium of particles and rigid bodies. Analysis of trusses, frames, and machines. Coulomb friction.

271 Introduction to Civil and Environmental Engineering
Fall, Spring. 4(3-3) P: (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently) or (MTH 152H or concurrently) or (CE 271 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently). Measurement, analysis, and design with applications in civil engineering. Surveying and error analysis.

272 Civil and Environmental Engineering Analysis
Fall, Spring. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Civil Engineering. P: ((MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 118 or concurrently)) or (CE 271 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently). Basic operations in AutoCAD. Selected applications of probability and statistics to topics in civil and environmental engineering. Applications of engineering economics including interest, net present worth, benefit-cost analysis, comparison of economic alternatives, and life-cycle costing.

280 Principles of Environmental Engineering and Science
Fall, Spring. 3(3-0) Interdepartmental with Environmental Engineering. Administered by Civil 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)) or (CE 271 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 or concurrently) or (CE 272 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 271 or concurrently) or (CE 272 or concurrently). R: Open to juniors or seniors in the Department of Civil and Environmental Engineering. Theory of structural analysis for statically determinate structures. Qualitative structural analysis and behavior. Load estimation and placement. Introduction to structural analysis computer software. Introduction to statically indeterminate structures.

312 Soil Mechanics
Fall, Spring. 4(3-3) P: (ME 222 and (CE 271 or concurrently) or (CE 272 or concurrently)) and (CE 272 or concurrently). Open to juniors or seniors in the Department of Civil and Environmental Engineering. Engineering properties of soil and their measurement. Effective-stress concept. Permeability and seepage. Compaction, consolidation, shear strength, and stress-strain behavior.

321 Introduction to Fluid Mechanics
Fall, Spring. 4(3-3) P: (MTH 234 or MTH 254H or LB 220) and CE 221 and ((IBE 230 or concurrently) or (CE 271 or concurrently) or (CE 272 or concurrently)) and completion of Tier I writing requirement). R: Open to juniors or seniors in the Department of Civil and Environmental Engineering or in the Biosystems Engineering major. Fluid properties, fluid statics, fluids in motion. Conservation of mass, energy, and momentum. Dimensional analysis and similarity. Internal and external flows. Applications.

337 Civil Engineering Materials I
Fall, Spring. 3(3-0) P: (ME 222 or concurrently) or (CE 271 or concurrently) or (CE 272 or concurrently). 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 (LB 220 or concurrently) or (CE 272 or concurrently). R: Open to seniors or graduate students in the Department of Civil and Environmental Engineering. Overview of transportation system issues and problems. Fundamentals of highway design and operations. Planning and evaluation of transportation system alternatives.

400 Structural Mechanics
Fall, Spring. 3(3-0) P: CE 305 R: Open to juniors or seniors or graduate students in the College of Engineering. Matrix methods of structural analysis. Flexibility method. Direct stiffness method for plane structures. Elastic supports, inclined supports, member releases and non-prismatic members. Application software.

405 Design of Steel Structures
Spring. 3(3-0) P: CE 305. R: Open 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
Fall, Spring. 3(3-0) P: CE 305 and CE 337 R: Open to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering or in the College of Engineering. Design of reinforced concrete beams, slabs, columns and footings.

418 Geotechnical Engineering
Fall. 3(3-0) P: CE 312 and (GLG 201 or GLG 301) R: Open to juniors or seniors or graduate students in the College of 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(2-2) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: CE 321 and (GLG 201 or GLG 301) R: Open to juniors or seniors or graduate students in the College of Engineering. Fundamentals of open-channel flow. Rapidly and gradually varied nonuniform flow analysis. Confined flows past submerged bodies, in pipe networks, and in turbo machinery. Design applications.

422 Applied Hydraulics
Spring. 3(2-2) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: CE 321 and ME 332 R: Open to juniors or seniors or graduate students in the College of Engineering. Project-based work using HEC-RAS and geographic information systems (GIS) to analyze the impacts of land use changes in urban and rural watersheds; design of systems to mitigate specific impacts. Project-based work on water distribution networks, analysis using EPANET to study the use of water storage towers, pressure regulation devices, and cyclic demands.

431 Pavement Design and Analysis I
Fall. 3(3-0) P: CE 337 R: Open to juniors or seniors or graduate students in the College of Engineering. Highway and airfield pavement structural design. Performance measures. Failure mechanisms. Regional thickness design procedures. Design considerations for surface friction, pavement joints, and drainage.

432 Pavement Rehabilitation
Spring. 3(3-0) P: CE 337 RB: CE 431 R: Open to seniors or graduate students in the College of 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.
Civil Engineering—CE

444 Principles of Traffic Engineering
Fall. 3(3-0) P: STT 351 and CE 341 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 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. 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.

461 Computational Methods in Civil Engineering
Spring. 3(3-2) P: (CSE 131 or EGR 102) and (CE 221 and MTH 255) R: Open to juniors or seniors or graduate students in the Civil Engineering major. SA: CE 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.

471 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.

480 Environmental Measurements Laboratory
Fall. 1(0-3) Interdepartmental with Environmental Engineering. Administered by Environmental Engineering. P: CEM 161 or CEM 185H or LB 171. 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.

481 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 172). 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.

483 Water and Wastewater Engineering
Fall. 3(3-0) Interdepartmental with Environmental Engineering. P: (ENE 280 or BE 230) and (CE 321 or CHE 311). 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.

485 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.

487 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.

489 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). 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.

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.

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

495 Senior Design in Civil and Environmental Engineering

800 Bridge Design
Spring of odd years. 3(3-0) RB: CE 400 and CE 405 and CE 406 and CE 312 and CE 806 R: Open to graduate students in the College of Engineering or approval of department.

801 Nonlinear Structural Mechanics
Spring of odd years. 3(3-0) RB: Basic knowledge on the design of steel (CE 405) and concrete structures (CE 406), matrix methods of structural analysis (CE 400), 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. 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
Spring of even years. 3(3-0) SA: CE 808 Analysis and design of prestressed and conventionally reinforced concrete structures.
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 72 credits in all enrollments for this course.
Doctoral dissertation research.