CIVIL ENGINEERING  CE

Department of Civil and Environmental Engineering
College of Engineering

271 Engineering Surveying
Fall, Spring. 4(3-3) P: (MTH 114 or MTH 116 or MTH 124 or MTH 152H or LBS 117 or LBS 118)
Application of surveying and error analysis to civil engineering problems. Earth work, Calculations, Layout and management of construction sites.

280 Introduction to Environmental Engineering
Fall, Spring. 3(3-0) P: (CEM 141 or CEM 151 or MTH 132 or concurrently or LBS 171) and (MTH 132 or concurrently or MTH 152H or concurrently or LBS 171 or concurrently)
Elements of hydrology. Groundwater and surface water supply and contamination. Treatment systems for drinking water, wastewater, air, and solid and hazardous waste. Noise and radiation pollution.

305 Introduction to Structural Analysis and Design
Fall, Spring. 4(3-2) P: (CEM 211) R: Open only to juniors or seniors in the Department of Civil and Environmental Engineering. Analysis and design of structural systems. Loads 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: (CEM 211) 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. 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(3-2) P: (MTH 234 or MTH 254H or LBS 220) and (ME 221) 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 ME 332. 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. 4(3-3) P: (MSM 211 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 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 operation. 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 or graduate students in the Department of Civil and Environmental 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
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(2-2) P: (CE 332) 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 Science. 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: (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: (CE 312 and CE 337) R: Open only to juniors or seniors or graduate students in the Department of Civil and Environmental Engineering. Highways and airfield pavement structural design. Performance measures. Failure mechanisms. Popularity thickness design procedures. Design considerations for surface friction, pavement joints, and drainage.

432 Pavement Rehabilitation
Spring. 3(3-0) P: (CE 312 and CE 337) RB: (CE 431) R: Open only to seniors or graduates 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 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 relationship. 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, analy-
sis/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) 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, form work, false work and other tempo-
rary structures. Relationship to a construction pro-
ject’s constructability, cost and schedule.

480 Water and Wastewater Analysis Laboratory
Fall. (10-3) 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 En-
vironmental 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, chemi-
cal complexion 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 con-
currently) 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. The-
ory and design of water treatment processes.

485 Solid and Hazardous Waste Management
Spring. 3(3-0) P: (CE 280) R: Open only to juniors or seniors or graduate students in the College of Engineering.
Design of solid waste collection and disposal sys-
tems. Definition of hazardous waste problems and selection of treatment alternatives.

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 stu-
dents in the College of Natural Science.
Use and control of microorganisms for the protection of public health and the environment. Thermody-
namics of microbial populations and microbial trans-
formations.

490 Independent Study
Fall, Spring, Summer. 1 to 3 credits. A stu-
dent may earn a maximum of 6 credits in all enroll-
ments 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 enroll-
ments for this course. R: Open only to jun-
iors or seniors in the Department of Civil and Environmental Engineering. Approval of department.
Planning, specification, and design of a civil engi-
neering 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 enroll-
ments for this course. R: Approval of de-
partment.
Selected topics related to construction engineering, environmental engineering, fluid mechanics, geo-
technical engineering, hydrology, pavements, struc-
tural engineering, 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 consid-
erations. Planning the design process. Design spec-
fications. Cost. Written and oral presenta-
tions.

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 only to graduate students in the College of Engineering or approval of department.
Design and analysis of bridge structures including bridge types, materials, load conditions, construc-
tion, methods, and rehabilitation. Analysis of beam-
labs, medium, curved, and skewed bridges. Con-
ceptual 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 481.

803 Structural Dynamics
Fall. 1(1-0) C: CE 802 concurrently.
Dynamic analysis of beams, frame and truss struc-
tures. Classical and finite element formulations. Model analysis and numerical integration tech-

804 Advanced Mechanics for Civil Infrastructure
Fall. 3(3-0) RB: (CE 400) Matrix structural analysis R: Open only to graduate stu-
dents in the College of Engineering.
Advanced linear mechanics. Potential energy princi-
ple. 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 gird-
ers, composite steel-concrete construction, connec-
tions.

806 Advanced Structural Concrete Design
Fall. 3(3-0) SA: CE 808
Analysis and design of prestressed and convention-
ally reinforced concrete structures.

810 Reliability-Based Design in Civil Engineering
Fall. 3(3-0)
Probabilistic treatment of live and dead loads: earth-
quakes, 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 Geo-
ological Sciences. Administered by Depart-
ment 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. Labo-
atory determination of soil properties including interpretation of experimental data.

813 Soil Dynamics
Fall. 1(1-0) SA: CE 803B C: CE 802 concur-
rently.
Wave propagation in visco-elastic media. Seismic site response analysis. Foundation vibrations. Dy-

815 Selected Topics in Geotechnical Engineering
Spring. 3(3-0) A student may earn a maxi-
mum 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)
Foundations and earth retaining structures. Bearing capacity, settlement, and lateral resistance of deep foundations. Advanced design of retaining structures using in-situ test data. Numerical solution of geo-
technical problems.

821 Groundwater Hydraulics
Fall. 3(3-0)