C E 109. Computer Drafting Fundamentals
3 Credits (2+2P)
Same as DRFT 109, E T 109, SUR 109.

C E 151. Introduction to Civil Engineering
3 Credits (3)
Problem solving and use of computer software for civil engineering applications. May be repeated up to 3 credits.
Prerequisite(s)/Corequisite(s): MATH 1220G.

C E 198. Special Topics
1-3 Credits
May be repeated for a maximum of 6 credits.
Prerequisite: consent of department head.

C E 233. Mechanics-Statics
3 Credits (3)
Engineering mechanics using vector methods. May be repeated up to 3 credits.
Prerequisite(s): MATH 1521G or MATH 1521H, PHYS 1310G and cumulative GPA of 2.0.

C E 234. Mechanics-Dynamics
3 Credits (3)
Kinematics and dynamic behavior of solid bodies utilizing vector methods. May be repeated up to 3 credits. Crosslisted with: M E 234.
Prerequisite(s): C E 233, MATH 1521G or MATH 1521H , PHYS 1310G.

C E 256. Environmental Engineering and Science
3 Credits (3)
Principles in environmental engineering and science: physical chemical systems and biological processes as applied to pollution control. Crosslisted with: ENVS 2111
Prerequisite(s): CHEM 1215G and MATH 1511G.

C E 256 L. Environmental Science Laboratory
1 Credit (1P)
Laboratory experiments associated with the material presented in C E 256. Same as ENVS 2111L.
Corequisite(s): C E 256.

C E 298. Special Topics
1-3 Credits
May be repeated for a maximum of 6 credits.
Prerequisite: consent of department head.

C E 301. Mechanics of Materials
3 Credits (3)
Stress, strain, and elasticity of materials. May be repeated up to 3 credits.
Prerequisite(s): C E 233 or M E 236.

C E 311. Civil Engineering Materials
3 Credits (2+3P)
Introduction to the structure, physical properties, testing and mechanical behavior of civil engineering materials and components made from these materials.
Prerequisite: C E 301.

C E 315. Structural Analysis
4 Credits (3+3P)
Classical analysis of determinate and indeterminate structures; introduction to modern methods of structural analysis using computer programs.
Prerequisite(s): C E 301.

C E 331. Fluid Mechanics and Hydraulics
3 Credits (3)
Prerequisite(s): PHYS 1310G, C E 233.

C E 331 L. Fluid Mechanics and Hydraulics Laboratory
1 Credit (1P)
Fundamentals and Theory of Fluid Mechanic, compressible and incompressible flow of fluids in open and closed conduits.
Prerequisite(s)/Corequisite(s): C E 331. Restricted to: C E majors.

C E 355V. Technology and the Global Environment
3 Credits (3)
A scientific basis for understanding changes in the global environment that result through the complex interactions of natural phenomena and the impacts of the activities of man.
Prerequisites: junior or senior standing, and the general education requirements for math and natural sciences.

C E 356. Fundamentals of Environmental Engineering
3 Credits (3)
Introduction to water treatment and water pollution and the analysis and design of selected treatment processes.
Prerequisite(s): C E 256.

C E 357. Soil Mechanics
3 Credits (2+3P)
Engineering properties of soils, consolidation settlement, compaction, water flow through soils, geostatic stresses, soil shear strength, lateral earth pressure, and soil laboratory testing.
Prerequisite(s): C E 160 or GEOL 1110G, and C E 301.

C E 382. Hydraulic and Hydrologic Engineering
3 Credits (3)
Analysis and design of hydraulic systems, including pipe networks, open channels, regulating structures, and pumping systems. Surface water and groundwater hydrology, analysis and design. May be repeated up to 3 credits.
Prerequisite(s): C E 331 and C E 331 L.

C E 398. Special Topics
1-3 Credits
May be repeated for a maximum of 6 credits.
Prerequisite: consent of department head.

C E 444. Elements of Steel Design
3 Credits (3)
Analysis and design of tension members, beams, columns, and bolted and welded connections.
Prerequisite(s)/Corequisite(s): C E 311. Prerequisite(s): C E 315.

C E 445. Reinforced Concrete Design
3 Credits (3)
Design and mechanics of structural reinforced concrete members.
Prerequisite(s)/Corequisite(s): C E 311. Prerequisite(s): C E 315.

C E 452. Geohydrology
3-4 Credits (3+1P)
Origin, occurrence, and movement of fluids in porous media and assessment of aquifer characteristics. Development and conservation of ground water resources, design of well fields. Crosslisted with: ENVS 452 and GEOL 452.
Prerequisite(s): Junior or Senior.
C E 454. Wood Design
3 Credits (3)
Theory and design of wood structural members and systems subjected to gravity and lateral loads. Taught every other year, alternates with C E 455, Masonry Design.
Prerequisite(s)/Corequisite(s): C E 311. Prerequisite(s): C E 315.

C E 457. Foundation Design
3 Credits (2+3P)
Application of principles of classical soil mechanics to the design of shallow and deep foundations, and the fundamentals of geotechnical site investigation.
Prerequisite(s): C E 357.

C E 460. Site Investigation
3 Credits (2+2P)
Investigation and characterization of surficial and subsurface geologic materials and ground water for civil engineering projects. Includes exploration program, drilling and sampling, rock and soil classification and logging, groundwater monitoring, profiles, and preparation of geotechnical reports.
Prerequisite(s): C E 357.
Prerequisite(s)/Corequisite(s): C E 457.

C E 469. Structural Systems
3 Credits (3)
Design of structural systems for buildings and bridges. May be repeated up to 3 credits.
Prerequisite(s): C E 444 or C E 445.

C E 470. Design of Municipal and Hazardous Waste Landfills
3 Credits (3)
Solid waste and application of geotechnical engineering principles and methods to the site selection and design of municipal and hazardous waste landfills.
Prerequisite(s): C E 357 and C E 452, or consent of instructor.

C E 471. Transportation Engineering
3 Credits (3)
Highway and traffic design and systems.
Prerequisite(s): MATH 2530G.

3 Credits (3)
Engineering economics, construction and project management. May be repeated up to 3 credits.
Prerequisite(s)/Corequisite(s): MATH 371, C E 357.

C E 479. Pavement Analysis and Design
3 Credits (3)
Covers stresses and deflections in pavement layers, material characterization, flexible and rigid pavement design by AASHTO, and rehabilitation concepts.
Prerequisite(s): C E 357.

C E 481. Civil Engineering Capstone Design
3 Credits (3)
Culminating multidisciplinary project-oriented capstone design. Ethics, professional development, global issues.
Prerequisite(s)/Corequisite(s): C E 457, C E 471, C E 477. Prerequisite(s): C E 356, C E 382, and either C E 444 or C E 445.

C E 482. Hydraulic Structures
3 Credits (3)
Engineering design of water-regulating structures. Capstone design course. May be repeated up to 3 credits.
Prerequisite(s)/Corequisite(s): C E 477. Prerequisite(s): C E 382.

C E 483. Surface Water Hydrology
3 Credits (3)
Hydrologic cycle and relationships between rainfall and surface water runoff.
Prerequisite: C E 331 or consent of instructor.

C E 485. Design of Earth Dams
3 Credits (3)
Engineering design applied to site selection, foundation inspection and treatment, hydrology and hydraulics, stability, and seepage analysis. Economic and environmental factors. May be repeated up to 3 credits.
Prerequisite(s): C E 357, C E 382.

C E 498. Special Topics
1-3 Credits
May be repeated for a maximum of 9 credits.

C E 501. Advanced Mechanics of Materials
3 Credits (3)
Study of stress and strain in two and three dimensions, theories of failure, stress concentrations, unsymmetrical bending, curved beams, beams on elastic foundations, column theories, torsion, thick-wall cylinders. Same as M E 501.
Prerequisites: C E 301, MATH 392.

C E 503. Special Design and Analysis Program
3-6 Credits
Design and analysis covering subject matter of an approved 450 undergraduate departmental course plus an additional report or project. Course may be subtitled in the Schedule of Classes. May be repeated once for a total of 6 credits.
Prerequisite: consent of instructor/committee.

C E 504. Advanced Engineering Design
3 Credits (3)
Advanced engineering design covering subject matter of a selected capstone undergraduate design course plus an additional report or project. May be subtitled.
Prerequisite: consent of instructor/committee.

C E 505. Advanced Mechanics of Concrete
3 Credits (3)
Advanced structural mechanics applicable to concrete structures. Topics include: nonlinear-inelastic modeling and analysis of reinforced concrete structures, seismic behavior of reinforced concrete structures, and deformation of members under various loads. To be taught along with C E 605.
Prerequisite(s): C E 445.

C E 506. Advanced Soil Mechanics
3 Credits (3)
Stress and strain analyses in soil, stress paths; drained and undrained shear strengths of granular soils and clays, consolidation, liquefaction, soil improvement.
Prerequisite: C E 457 or consent of instructor.

C E 507. Design of Earth Retaining Structures
3 Credits (3)
Lateral earth pressure theory, soil-reinforcement interaction, and analysis and design of rigid and flexible earth retaining structures for support of fills and excavations, including retaining walls, mechanically stabilized earth (MSE) walls, sheet pile walls, anchored walls, tiebacks and soil nailing.
Prerequisite(s): C E 357.
Prerequisite(s)/Corequisite(s): C E 457.
C E 508. Advanced Soil Behavior  
3 Credits (3)  
The course covers particle-scale phenomena that govern the macro-scale behavior of soils. Topics covered in the class include classical concepts as well as contemporary advances in soil mechanics. The students will develop a fundamental understanding of soil-water interaction, theories of contact level deformation, and mass and energy transport through granular media. Consent of Instructor required.  
Prerequisite(s): C E 357 or Instructor Consent.

C E 509. Deep Foundations  
3 Credits (3)  
Behavior, analysis and design of pile and pier foundations subjected to axial and lateral loads.  
Prerequisite: C E 457 or consent of instructor.

C E 510. Introduction to Nondestructive Testing  
3 Credits (3)  
This course explores the application of different Nondestructive Testing (NDT) methods in material characterization and product qualification.  
Prerequisite(s): C E 311 or CHME 361 or Consent of Instructor.

C E 515. Finite Element Methods  
3 Credits (3)  
Introduces the finite element method. Topics may include beam, frame, plane stress, plane strain, axisymmetric, and 3-D stress elements. Includes static and dynamic analysis. Uses readily available finite-element software.  
Prerequisite: graduate standing or consent of instructor.

C E 531. Open Channel Hydraulics  
3 Credits (3)  
Theoretical and applied hydraulics of open channels, with emphasis on nonuniform flow, rapidly varied flow, and wave formation.  
Prerequisite: C E 382 or consent of instructor.

C E 544. Advanced Design of Steel Structures  
3 Credits (3)  
Connection design; beam, column, and beam-column stability and design; and seismic frame design.  
Prerequisites: C E 444 and C E 468.

C E 545. Advanced Concrete Design  
3 Credits (3)  
Prestressed concrete, ultimate strength theory, design of shell structures.  
Prerequisites: C E 445 and C E 468.

C E 554. Wood Design  
3 Credits (3)  
Theory and design of wood structural members and systems subjected to gravity and lateral loads. Design project required. Taught every other year, alternates with C E 555 - Masonry Design.

C E 557. Water Resources Development  
3 Credits (3)  
Students function as members of a consulting panel and prepare reports on major water resources development problems. Political, financial, and social aspects of water resources development are considered as well as scientific and technical details.

C E 571. Structural Dynamics  
3 Credits (3)  
Response of elastic structure to dynamic loading. Moving load, earthquake and blast loading.  
Prerequisite: C E 468 or consent of instructor.

C E 572. Earthquake Engineering  
3 Credits (3)  
Earthquake characteristics; seismic loads; elastic and inelastic response; analysis and design of buildings for earthquakes.  
Prerequisites: graduate standing and consent of instructor.

C E 573. Transportation Analysis  
3 Credits (3)  
Transportation analysis of land-based transportation modes. Crosslisted with: C E 473.  
Prerequisite(s): C E 471.

C E 579. Ground Improvement  
3 Credits (3)  
The objective of this course is to introduce common ground improvement techniques, including mechanical (compaction, soil reinforcement, preloading and accelerated consolidation) and chemical (cementing, ion-replacement, polymer bonding) stabilization methods, as well as seepage and dewatering. Emphasis will be placed on developing an understanding of the underlying physical and chemical processes involved in each case.  
Prerequisite(s): C E 357.

C E 581. Ground Water Hydrology  
3 Credits (3)  
Mathematical treatment of water flow in porous media. Emphasis on hydraulics of water movement, including pumping and recharge wells, drainage, and water quality.  
Prerequisites: MATH 392, G EN 452, and C E 382, or consent of instructor.

C E 582. Statistical Hydrology  
3 Credits (3)  
Application of statistical techniques to hydrologic data, including distributions, hypothesis testing, linear models, non-parametrics, and time-series and stochastic models. May be repeated up to 3 credits.

C E 596. Special Topics  
1-3 Credits  
May be repeated for a maximum of 6 credits.  
Prerequisite: consent of department head.

C E 598. Special Research Programs  
1-3 Credits  
Individual investigations either analytical or experimental. May be subtitled. Maximum of 3 credits per semester.

C E 599. Master’s Thesis  
1-15 Credits  
Thesis.

C E 600. Doctoral Research  
1-15 Credits  
Research.

C E 604. Advanced Engineering Topics  
3 Credits (3)  
In depth study of a topic at the forefront of environmental engineering & science. Journal papers will be critically reviewed and students will be asked to write an analysis of the topic and present their thoughts orally.

C E 615. Advanced Finite Element Methods  
3 Credits (3)  
Finite element method with emphasis on stress analysis. May include development and use of plane stress, plane strain, and 3-D and shell elements. Includes static, dynamic, and nonlinear analysis.  
Prerequisite: graduate standing.
C E 682. Topics in Hydrodynamics II
3 Credits (3)
Selected topics in flow-in open channels, flow-through porous media, and transport of sediments and contaminants. May be repeated for a maximum of 6 credits.
Prerequisite: consent of instructor.

C E 698. Special Research Programs
1-3 Credits
May be subtitled. May be repeated for a maximum of 9 credits.

C E 700. Doctoral Dissertation
15 Credits
Dissertation.