CIVIL & ENVIRONMENTAL ENGR (CE)

Courses

CE 001. Statics. 0 or 3 Credits.
Fundamentals of statics; composition and resolution of forces; the analysis of force systems in two and three dimensions; and centroids and moments of inertia. Prerequisites: MATH 022 or MATH 023; PHYS 031.

CE 003. SU: Intro to Civil & Envir Engr. 0 or 2 Credits.
Introduction to Civil and Environmental Engineering, sustainability, ethics, systems thinking, teamwork in engineering, laboratories, computational exercises, and project-based.

CE 010. Geomatics. 0 or 4 Credits.
An introduction to surveying including distance and angle measurements, leveling, traverse surveys, error propagation, topographical mapping, global positioning systems (GPS), and geographic information systems (GIS). Project-based. Prerequisites: MATH 010, MATH 019, or MATH 021; Sophomore standing.

CE 090. Internship. 1-3 Credits.
On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

CE 092. Independent Study. 1-18 Credits.
A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

CE 095. Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles.

CE 100. Mechanics of Materials. 0 or 3 Credits.
Stress, strain, temperature relationships, torsion, bending stresses, and deflections. Columns, joints, thin-walled cylinders. Combined stresses and Mohr’s circle. Prerequisite: CE 001 with a grade of C- or better. Co-prequisite: MATH 121. Cross-listed with: ME 014.

CE 101. Materials and Structures Lab. 0 or 3 Credits.
Experimental stress analysis methods; experimental verification of static force-displacement relationship for beams, frames, and trusses; fundamental mechanical properties of metals, plastics, and wood; effects of size, shape, method, speed of loading and strain history on these properties. Co-requisites: CE 100 or ME 014, and CE 170.

CE 132. SU: Environmental Systems. 3 Credits.
Systems thinking and the systems approach as applied to environmental systems; sustainability, mass and energy balances, kinetics, ecosystem health and the public welfare, environmental risk, green engineering, water and wastewater treatment, air resources engineering, solid-waste management. Prerequisites: CHEM 031; MATH 019 or MATH 021.

CE 133. Transportation Systems. 3 Credits.
Transportation systems planning, analysis, and design with foci on safety, modeling, decision support, and environmental impacts. Co-requisite: CE 010.

CE 151. SU: Water & Wastewater Engr. 3 Credits.
Fundamentals and design of sustainable systems for water supply, domestic and industrial wastewater treatment, soil and groundwater remediation; energy and resource recovery; project-based. Prerequisite: CE 132 with a grade of C- or better.

CE 160. Hydraulics. 3 Credits.
Mechanics of incompressible fluids, flow meters, flow in closed conduits and open channels, elements of hydraulic machinery. Prerequisites: CE 001 with a grade of C- or better, MATH 121. Co-require: CS 020.

CE 162. Hydraulics Lab. 0-2 Credits.
Performing various laboratory studies of flow and hydraulic machinery determine index; computer modeling of hydraulic systems; associated laboratory and project report writing and presentations. Co-requisites: CE 160.

CE 170. Structural Analysis. 0 or 3 Credits.
Analysis of statically determinate beams, frames, and trusses; expected loads, reactions; influence lines; moving loads; geometric methods for displacement calculations; introduction to matrix analysis for trusses. Prerequisites: CS 020 or CS 021. Co-requisites: MATH 122 or MATH 124 and MATH 271; CE 100 or ME 014.

CE 172. Structural Steel Design. 3 Credits.
Theory and design of steel structures including flexural members, axially loaded members and combined stress members; design of composite members; plastic analysis and design; project-based. Prerequisite: CE 170.

CE 173. Reinforced Concrete. 3 Credits.
Analysis of stresses in plain and reinforced concrete members; design of reinforced concrete structures; theory of prestressed concrete; project-based. Prerequisite: CE 170.

CE 180. Geotechnical Principles. 3 Credits.
Characteristics and classification of soils; physical, mechanical and hydraulic properties of soils; seepage; the effective stress principle; stress distribution, consolidation, settlement; shear strength. Prerequisite: CE 100 or ME 014.

CE 182. Geotechnical Principles Lab. 0-2 Credits.
Performing various laboratory tests to determine index, hydraulic, and mechanical properties of soils; computer modeling of geotechnical systems; associated laboratory and project report writing and presentations; project-based. Prerequisite: CE 100 or ME 014. Co-requisite: CE 180.
CE 185. SU: Capstone Design I. 3 Credits.
Project-based. Integrate knowledge from multiple subdisciplines of Civil/Environmental Engineering in team-based contemporary design projects promoting sustainability under realistic constraints (economic, environmental, social, regulatory, safety, constructability); consider risk, uncertainty, life-cycle principles, and environmental impacts in the design; professional practice; ethics; effective communication. Prerequisite: Senior standing; Civil Engineering or Environmental Engineering major.

CE 186. SU: Capstone Design II. 3 Credits.
Project-based. Student teams will integrate the knowledge from multiple subdisciplines of Civil/Environmental Engineering in a contemporary design project involving realistic constraints such as economic, environmental, social, regulatory and sustainability; professional practice; ethics; written and oral presentations to professional review panels. Prerequisite: CE 185.

CE 190. Internship. 1-18 Credits.
On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is awarded. Offered at department discretion.

CE 192. Independent Study. 1-18 Credits.
A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion. Prerequisites: Senior standing; Department permission.

CE 193. College Honors. 1-6 Credits.
Honors studies leading to thesis. Prerequisite: CEMS 101.

CE 194. College Honors. 1-6 Credits.

CE 195. Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles. Prerequisites: Senior standing in Civil Engineering or Environmental Engineering.

CE 197. Teaching Assistantship. 1-3 Credits.
Undergraduate student service as a teaching assistant, usually in an introductory-level course in the discipline, for which credit is awarded. Offered at department discretion.

CE 198. Undergraduate Research. 1-18 Credits.
Undergraduate student work on individual or small team research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

CE 199. Cooperative Ed Experience. 12 Credits.
On-site, full-time, supervised work experience in civil or environmental engineering or related field appropriate for sophomore or junior levels that also satisfies the overall educational objectives defined by the CEMS Engineering Co-op Program. Prerequisites: Civil Engineering or Environmental Engineering major; Sophomore or Junior standing.

CE 201. Sustainable Eng Materials. 3 Credits.
Introduces the fundamentals of materials with a focus on sustainable engineering, including structure and bond, interatomic potential, metals, fracture, strength testing, cement chemistry, aggregates, composites, reinforced concrete, asphalt, bamboo and wood. Prerequisite: CE 100, ME 014, or Instructor permission.

CE 211. Sustainable Eng. Materials. 3 Credits.
Introduces the fundamentals of materials with a focus on sustainable engineering, including structural bonding, metals, fracture, strength testing, cement chemistry, aggregates, composites, reinforced concrete, asphalt, bamboo, wood, and bio-inspired materials and structures. Prerequisites: CE 100 or ME 014 or Instructor permission.

CE 218. Numerical Methods for Engineer. 3 Credits.
Foundational concepts of numerical integration, numerical differentiation, and numerical approximation and solution of differential and partial differential equations of the type encountered in the analysis of engineering problems and data processing; project-based. Prerequisites: MATH 271, CS 020; MATH 122 or MATH 124. Cross-listed with: ME 218.

CE 241. Traffic Operations & Design. 3 Credits.
Advanced concepts of traffic engineering and safety; human, vehicle and environment factors; simulation and statistical analysis software; transportation design manuals; project-based. Prerequisite: CE 133.

CE 243. Transportation Demand Models. 3 Credits.
Study of specific methods used to analyze travel demand, travel behavior and network flows; process of travel demand modeling; collection, analysis and expansion of survey data and travel data; mathematical methods common to travel modeling. Prerequisite: CE 133.

CE 247. Sustain Resource Recovery Dsgn. 3 Credits.
Environmental engineering strategies to create circular economies emphasizing the role of wastes as resources. Course topics include life cycle assessment, carbon and nutrient management, materials recycling, and waste-to-energy processes. Project-based. Prerequisite: CE 151.

CE 250. Fate/Transport Organic Chem. 3 Credits.
Chemical transfers between environmental media; molecular structure-reactivity models; chemical, photochemical and biochemical transformation rates; emphasis on predicting environmental concentrations and risk. Project-based. Prerequisites: CHEM 031, CHEM 032, CE 132.

CE 253. Transportation & Air Quality. 3 Credits.
Air pollution sources, measurement methods, legislation, vehicle emissions formation, control and transport processes. Emphasis on emission factor and dispersion multi-scale modeling using latest modeling tools. Project-based. Prerequisites: CE 132, CE 133.
CE 254. Environmental Quantitive Anyl. 0 or 4 Credits.  
Course focuses on chemical, biochemical and physical processes;  
diffusion, equilibria, reaction kinetics, acids/bases, colloids, air/  
water exchange; laboratories demonstrate standard environmental  
engineering techniques; project-based. Prerequisites: CHEM 032,  
CE 132, STAT 143.

CE 255. Phys/Chem Proc Water/Wstwater. 0 or 3 Credits.  
Theory of physical/chemical processes for treating waters and  
wastewaters; reactor dynamics, mass transfer, adsorption, ion  
exchange, precipitation; project-based. Prerequisite: CE 151.

CE 256. Biol Proc Water/Wastewater Tr. 0 or 3 Credits.  
Theory and application of biological processes for treating industrial  
and domestic wastewaters and contaminated ground water;  
microbiological considerations; aerobic and anaerobic processes;  
reactor design, in-situ bioremediation; bench-scale and pilot-scale  
experimentation. Prerequisite: CE 151.

CE 260. Hydrology. 3 Credits.  
Theory of precipitation, run-off, infiltration, and ground water;  
presentation and run-off data; and application of data for use in  
development of water resources. Pre/Co-requisite: CE 160.

CE 262. Advanced Hydrology. 3 Credits.  
Introduces computer modeling of hydrological systems. Project-  
based. Simple overland flow, flood routing, water quality, and  
groundwater models are developed using finite difference techniques.  
Stochastic hydrology and hydrologic time series analysis are also  
introduced. Prerequisite: CE 260.

CE 263. Applied River Engineering. 3 Credits.  
Application of fundamental principles of fluid dynamics and  
open channel flow to the design and retrofit of river-connected  
infrastructure, including road embankments, road drainage systems,  
berms, culverts, bridges and impoundments. Project-based.  
Prerequisite: CE 160.

CE 265. Ground Water Hydrology. 3 Credits.  
Principles of ground water hydraulics, well characteristics, aquifers,  
and use of numerical methods to solve ground water flow problems.  
Project-based. Prerequisite: CE 160.

CE 271. Advanced Structural Analysis. 3 Credits.  
Virtual work, energy theorems, analysis of structures by the  
displacement method and the finite element method, non-linear  
structural analysis. Project-based. Prerequisite: CE 170.

CE 272. Structural Dynamics. 3 Credits.  
Vibrations, matrices, earthquake engineering, stability and wave  
propagation. Project-based. Prerequisites: Senior standing in  
Engineering or Physical Sciences or Instructor permission. Cross-  
listed with: ME 270.

CE 273. Structural Design - Wood. 3 Credits.  
Analysis and design of solid and glue laminated timber members  
and structural systems including tension members, beams, columns,  
beam-columns, diaphragms, shear walls, and connections; LRFD  
and ASD design methods; application of IBC for timber systems;  
current developments in wood design/construction; project-based.  
Prerequisite: CE 170.

CE 285. Geo-energy Systems. 3 Credits.  
An introduction to Geoenergy technologies for subsurface energy  
extraction (shallow and deep geothermal systems, enhanced oil  
recovery, shale gas extraction) and secure storage of byproducts of  
energy production (carbon dioxide and nuclear wastes); project-  
based. Prerequisite: CE 180.

CE 286. Foundation Design. 3 Credits.  
Subsurface explorations; geotechnical analysis, design, construction,  
preservation, remediation, and monitoring aspects of shallow and  
deep foundations. Prerequisite: CE 180.

CE 288. Geoenvironmental Engineering. 3 Credits.  
Site characterization, site restoration, geotechnical aspects of waste  
disposal and containment, landfill design, geosynthetics. Project-  
based. Prerequisite: CE 180.

CE 290. Independent Study. 1-18 Credits.  
A course which is tailored to fit the interests of a specific student,  
which occurs outside the traditional classroom/laboratory setting  
under the supervision of a faculty member, for which credit is  
awarded. Offered at department discretion.

CE 292. Internship. 1-18 Credits.  
On-site supervised work experience combined with a structured  
academic learning plan directed by a faculty member or a faculty-staff  
team in which a faculty member is the instructor of record, for which  
academic credit is awarded. Offered at department discretion.

CE 295. Special Topics. 1-18 Credits.  
Content is dictated by expanding professional interest in newly  
developing, or recently developed, technical areas in which there  
is particular need or opportunity. Prerequisite: Minimum Senior  
standing.

CE 297. Teaching Assistantship. 1-3 Credits.  
Undergraduate student service as a teaching assistant, usually in  
an introductory-level course in the discipline, for which credit is  
awarded. Offered at department discretion.

CE 298. Undergraduate Research. 1-18 Credits.  
Undergraduate student work on individual or small team research  
projects under the supervision of a faculty member, for which credit is  
awarded. Offered at department discretion.

CE 299. Cooperative Ed Experience. 12 Credits.  
On-site, full-time, supervised work experience in civil or  
environmental engineering or related field appropriate for senior level  
that also satisfies the overall educational objectives defined by the  
CEMS Engineering Co-op Program. Prerequisites: Civil Engineering  
or Environmental Engineering major; Senior standing.