

# 2012-2013 Civil Engineering Design Electives

The 2012-13 catalog introduces a “civil engineering design elective” in place of one of the senior design courses required by prior catalogs. Students on this catalog may choose from the list below to satisfy the CE design elective. CE 485 (taken along with construction engineering students in ConE 487) will remain as the only senior design or “capstone” course in the civil engineering program and is expected to be taken in the student’s final semester. Students graduating under any prior catalog that have not yet taken CE 486 will replace it with one of these courses in order to graduate. Any course chosen to satisfy this requirement, or as a replacement for CE 486, may not also be used to satisfy engineering topics elective requirements. The student is responsible for making sure the appropriate course prerequisites have been met for any course(s) attempted.

Technical Area	Course Options
Structures	10
Geotechnical/Materials	6
Environmental/Water Resources	6
Transportation	1
Construction	1
Multidisciplinary (ME)	1

## STRUCTURES (10 each)

### **C E 436. Masonry and Timber Design.**

(Dual-listed with 536). (2-2) Cr. 3. Alt. F., offered 2011. *Prereq: 334*

Behavior and design of clay and concrete masonry beams, columns, walls, and structural systems. Behavior and design of timber and laminated timber beams, columns, connections, and structural systems. Nonmajor graduate credit.

### **C E 446. Bridge Design.**

(Dual-listed with 546). (2-2) Cr. 3. Alt. S., offered 2013. *Prereq: 333, 334*

Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches. Nonmajor graduate credit.

### **C E 448. Building Design.**

(Dual-listed with 548). (2-2) Cr. 3. Alt. S., offered 2012. *Prereq: 333, 334*

Building design in structural steel and reinforced concrete. Investigation of structural behavior of frameworks. Lateral load resisting systems. Application of current building codes and design specifications. Review of building designs. Preliminary designs include investigating alternative structural systems. Final designs include preparation of design calculations and sketches. Nonmajor graduate credit.

### **C E 533. Structural Steel Design II.**

(3-0) Cr. 3. *Prereq: 333*

Every third semester, offered F 2012. Development of the AISC design equations for and the design of tension members, columns, beams, beam-columns, and plate girders for Load and Resistance Factor Design. Elastic and inelastic buckling of members and member elements. Torsion of W-shapes.

### **C E 534. Reinforced Concrete Design II.**

(2-2) Cr. 3. *Prereq: 334*

Every third semester, offered S 2012. Design of reinforced concrete long columns, floor slabs, building frames, isolated footings and combined footings. Design and behavior considerations for torsion, biaxial bending, structural joints and shear friction. Introduction to cold-formed composite steel and composite floor slab design.

**C E 535. Prestressed Concrete Structures.**

(3-0) Cr. 3. *Prereq:* 334

Every third semester, offered F 2012. Design of prestressed concrete structures, review of hardware, stress calculations, prestress losses, section proportioning, flexural design, shear design, deflections, statically indeterminate structures.

**C E 536. Masonry and Timber Design.**

(Dual-listed with 436). (2-2) Cr. 3. Alt. F., offered 2011. *Prereq:* 334

Every third semester, offered S 2010. Behavior and design of clay and concrete masonry beams, columns, walls, and structural systems. Behavior and design of timber and laminated timber beams, columns, connections, and structural systems. Two additional design problems.

**C E 545. Seismic Design.**

(3-0) Cr. 3. *Prereq:* 333, 334

Every third semester, offered S 2012. Seismic hazard in the United States. Engineering characteristics of ground motions. Structural damage in past earthquakes. Capacity design philosophy for seismic resistant design. Conceptual design of structures. Capacity design process including design of structural members.

**C E 546. Bridge Design.**

(Dual-listed with 446). (2-2) Cr. 3. Alt. S., offered 2013. *Prereq:* 333, 334

Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches. Supervisory role to assist students in 446. An additional design project or more in-depth analysis and design.

**C E 548. Building Design.**

(Dual-listed with 448). (2-2) Cr. 3. Alt. S., offered 2012. *Prereq:* 333, 334

Building design in structural steel and reinforced concrete. Investigation of structural behavior of frameworks. Lateral load resisting systems. Application of current building codes and design specifications. Review of building designs. Preliminary designs include investigating alternative structural systems. Final designs include preparation of design calculations and sketches. Supervisory role to assist students in 448. An additional design project or more in-depth analysis and design.

## GEOTECHNICAL/MATERIALS (6 each)

**C E 460. Foundation Engineering.**

(3-0) Cr. 3. F.S. *Prereq:* [C E 360](#)

Fundamentals of foundation engineering. Exploration, sampling, and in-situ tests. Shallow and deep foundations. Settlement and bearing capacity analyses. Stability of excavations and earth retaining structures. Nonmajor graduate credit.

**C E 467. Geomaterials Stabilization.**

(Dual-listed with 567). (2-2) Cr. 3. F. *Prereq:* [C E 360](#)

Soil and aggregate physical and chemical stabilization procedures. Soil stabilization analysis and design. Ground modification methods. Geosynthetics application and design. Nonmajor graduate credit.

**C E 483. Pavement Analysis and Design.**

(Dual-listed with 583). (3-0) Cr. 3. *Prereq:* 360 and 382

Analysis, behavior, performance, and structural design of pavement systems. Topics include climate factors, rehabilitation, life cycle design economics, material and system response, pavement foundations and traffic loadings. Development of models for and analysis of pavement systems. Use of transfer functions relating pavement response to

pavement performance. Evaluation and application of current and evolving pavement design practices and procedures. Mechanistic-based pavement design techniques and concepts. Analysis of the effects of maintenance activities on pavement performance and economic evaluation of pavement systems. Nonmajor graduate credit.

**C E 484. Advanced Design of Concretes.**

(Dual-listed with 584). (2-2) Cr. 3. F. *Prereq:* 382

Asphalt binder characterization, fundamentals of asphalt rheology, asphalt materials behavior under loading and temperature effects. Portland cement concrete admixtures, cements and admixture compatibility, environmental effects on concrete performance, advanced performance testing. Nonmajor graduate credit.

**CE 584. Advanced Design of Concretes.**

(Dual-listed with 484). (2-2) Cr. 3. F. *Prereq:* 382

Asphalt binder characterization, fundamentals of asphalt rheology, asphalt materials behavior under loading and temperature effects. Portland cement concrete admixtures, cements and admixture compatibility, environmental effects on concrete performance, advanced performance testing. A term project is required.

**C E 583. Pavement Analysis and Design.**

(Dual-listed with 483). (3-0) Cr. 3. *Prereq:* 360 and 382

Analysis, behavior, performance, and structural design of pavement systems. Topics include climate factors, rehabilitation, life cycle design economics, material and system response, pavement foundations and traffic loadings. Development of models for and analysis of pavement systems. Use of transfer functions relating pavement response to pavement performance. Evaluation and application of current and evolving pavement design practices and procedures. Mechanistic-based pavement design techniques and concepts. Analysis of the effects of maintenance activities on pavement performance and economic evaluation of pavement systems.

**ENVIRONMENTAL/WATER\_RESOURCES** (6 each)

**C E 428. Water and Wastewater Treatment Plant Design.** (General Option Only)

(2-2) Cr. 3. S. *Prereq:* 326

Physical, chemical and biological processes for the treatment of water and wastewater including coagulation and flocculation, sedimentation, filtration, adsorption, chemical oxidation/disinfection, fixed film and suspended growth biological processes and sludge management.

**C E 427X/527X. Solid and Hazardous Waste Management**

CE Cr. 3. S. *Prereq:* CE326; CHEM 178 or equivalent; Junior or higher classification in engineering. Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems; includes characterization and collection of domestic, commercial, and industrial waste residuals, waste minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Regulatory requirements for the classification, transport, storage and treatment of solid and hazardous wastes. Analysis and design of alternatives for treatment and disposal technologies, including physical, chemical, and biological treatment, solidification, incineration, and secure landfill design. Regulatory requirements and procedures for hazardous waste contaminated site investigations and risk analysis. Analysis and design of remedial action alternatives for site restoration.

**C E 473 / CE 573 Groundwater Hydrology.**

(Dual-listed with 473 and 573). (3-0) Cr. 3. F. *Prereq:* [CE 372](#)

Principles of groundwater flow, hydraulics of wells, super-position, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Nonmajor graduate credit.

**CE 488X & CE 588X: Sustainable Infrastructure Systems**

CE Cr. 3. S. *Prereq:* CE 326; Junior or higher classification in engineering. Sustainable planning, life cycle analysis, appropriate engineering design, and overall rating assessment of infrastructure systems. Primary emphasis on highway,

pavement, and bridge systems, with secondary coverage of water and wastewater plus power generation facilities. Course readings, final project/design report.

**C E 522. Water Pollution Control Processes.**

(Cross-listed with ENSCI). (2-2) Cr. 3. Prereq: [C E 521](#)

Fundamentals of biochemical processes, aerobic growth in a single CSTR, multiple events in complex systems, and techniques for evaluating kinetic parameters; unit processes of activated sludge system, attached growth systems, stabilization and aerated lagoon systems, biosolids digestion and disposal, nutrient removal, and anaerobic treatment systems.

**C E 570. Applied Hydraulic Design.**

(2-2) Cr. 3. Prereq: 372

Flow characteristics in natural and constructed channels; principles of hydraulic design of culverts, bridge waterway openings, spillways, hydraulic gates and gated structures, pumping stations, and miscellaneous water control structures; pipe networks, mathematical modeling. Design project.

## TRANSPORTATION (1 each)

**C E 453. Highway Design.** [NOTE: CE 453 is a core CE class requirement but could be used as an design course elective for Environmental Emphasis CE majors]

(2-2) Cr. 3. F.S. Prereq: 306, 355, 372, 382

Introduction to traffic engineering and highway planning. Design, construction, and maintenance of highway facilities; earthwork, drainage structures; pavements. Preparation of environmental impact statement. A complete design project is required. Oral and written reports. Computer applications. Nonmajor graduate credit.

## CONSTRUCTION (1 each)

**C E 505. Design of Construction Systems.**

(3-0) Cr. 3. Prereq: 334, 360, [CON E 322](#) and 340

Advanced design of concrete formwork and falsework systems. Design for excavation and marine construction including temporary retaining structures and cofferdams. Aggregate production operations, including blasting, crushing, and conveying systems. Rigging system design.

## MULTIDISCIPLINARY (1 each)

**M E 466. Multidisciplinary Engineering Design.**

(Cross-listed with A E, AER E, CPR E, E E, ENGR, I E, MAT E). (1-4) Cr. 3. Repeatable. F.S. Prereq: *Student must be within two semesters of graduation and permission of instructor*

Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing and life cycle considerations. Application of design tools such as CAD, CAM and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations, computer models and engineering drawings.