CIVIL AND ENVIRONMENTAL ENGINEERING (CEE)

# Course numbers with the # symbol included (e.g. #400) have not been taught in the last 3 years.

CEE 800 - Building Information Modeling
Credits: 3
Building Information Modeling (BMI) is the process of generating and managing project data during its life cycle by integrating 3D multidisciplinary drawings with dynamic scheduling and visualization. BIM provides a digital representation of project data to facilitate the exchange of information beyond the standard two-dimensional plan set. This course introduces students to the fundamentals of model creation, scheduling, material take-offs, visualizations, and animations that improve the communication of information to potential clients. Prereq: AUTOCAD Experience or by permission. 
Equivalent(s): CIE 880

CEE 804 - Transportation Engineering and Planning
Credits: 3
Fundamental relationships of traffic speed, density, and flow applied to public and private modes of transport. Principles of demand forecasting and urban systems planning. Prereq: permission.
Equivalent(s): CIE 854

CEE 805 - Introduction to Sustainable Engineering
Credits: 3
Course begins with exploration of the precept that we live in, and must design engineering works for, a world with a finite supply of natural resources and with limited life support capacity. Tools for sustainability engineering are the major focus of the course, which include life cycle analysis and life cycle impact analysis, the metrics and mass and energy flow analyses used in the field of industrial ecology, and environmental management systems.
Equivalent(s): CIE 851

CEE 806 - Environmental Life Cycle Assessment
Credits: 3
This course teaches knowledge and hands-on skills in conducting environmental life cycle assessment (LCA), which is a widely used technique by industries, academics, and governments. Students will learn to use popular LCA software (e.g., SimaPro), apply proper LCA techniques, critically analyze LCA results, and provide client-oriented suggestions during this course. Class time is primarily devoted to a combination of lectures and computer labs.

CEE 810 - Green Building Design
Credits: 3
This course gives an overview of green designs and sustainable practices in building construction. We cover technical topics and requirements of a nationally recognized rating system (LEED), with a specific focus on Green Building Design and Construction. Students are introduced to basic building designs and systems related to sustainability. Additionally, they learn about green design topics such as site plans, water and energy efficiency, material and resources usage, environmental quality and renewable energy source. As an outcome of the course, students are able to assess and incorporate green technologies and designs into building projects. They are prepared to contribute in building projects that target LEED certifications. Students are also capable to engage in green practices within their existing built environments.
Equivalent(s): CIE 881

CEE 820 - Solid and Hazardous Waste Engineering
Credits: 3
A thorough examination of the problems which exist in hazardous and solid waste management will be presented in terms of the current regulations and engineering approaches used to develop solutions. Topics will include risk-based decision making, transport and fate of contaminants, and the fundamental physical, chemical and biological concepts which make up the basis for technological solutions to these waste management problems. Case studies will be used throughout the course to highlight key concepts and provide real-world examples.
Equivalent(s): CIE 842

CEE 821 - Environmental Sampling and Analysis
Credits: 4
Theory of analytical and sampling techniques used in environmental engineering. Topics include potentiometry, spectroscopy, chromatography, automated analysis, quality control, sampling design, and collection methods. Methods discussed in lecture are demonstrated in labs.

CEE 822 - Introduction to Marine Pollution and Control
Credits: 4
Introduction to the sources, effects, and control of pollutants in the marine environment. Dynamic and kinetic modeling; ocean disposal of on-shore wastes, shipboard wastes, solid wastes, dredge spoils, and radioactive wastes; and oil spills. Prereq: CEE 620 or permission.
Equivalent(s): CIE 847

CEE 823 - Environmental Water Chemistry
Credits: 4
Emphasizes the use of chemical equilibrium principles and theory, calculations, and applications of ionic equilibrium stresses. Topics include thermodynamics, kinetics, acid/base, complexation, precipitation/dissolution, and redox equilibria. Computer equilibrium modeling is presented. Prereq: general chemistry or equivalent.
Equivalent(s): CIE 849

CEE 824 - Environmental Engineering Microbiology
Credits: 4
Concepts of environmental engineering microbiology including microbial metabolism, growth kinetics, bioremediation applications, mass transfer kinetics and effects of environmental parameters. Coursework includes reading and discussion of the microbial literature. Laboratories cover microbiological monitoring and biological treatment experiments. Prereq: CEE 620 or permission. Lab.
Equivalent(s): CIE 856

CEE 825 - Environmental Engineering for Rural and Developing Communities
Credits: 3
The design principles are to impart to the student specific information that can be used to design public health control facilities such as small water treatment systems and on-site wastewater disposal systems. The engineering control methods taught are particularly applicable to rural areas and developing countries. Prereq: permission.
Equivalent(s): CIE 840

CEE 830 - Public Health Engineering for Rural and Developing Communities
Credits: 3
The design principles are to impart to the student specific information that can be used to design public health control facilities such as small water treatment systems and on-site wastewater disposal systems. The engineering control methods taught are particularly applicable to rural areas and developing countries. Prereq: permission.
Equivalent(s): CIE 840

CEE 831 - Advanced Water Treatment Design
Credits: 4
Selection, design, and evaluation of advanced unit processes employed in the treatment of water, wastewater, and hazardous wastes. Emphasis given on treatment schemes based on experimental laboratory or pilot studies.
CEE 832 - Solid and Hazardous Waste Design  
Credits: 4  
Selection, design, and evaluation of unit processes employed in the treatment of solid wastes and hazardous wastes will be studied. Topics include design of materials recovery facilities, landfills, waste-to-energy facilities and hazardous waste site remedial technologies. A group term project taken from a real-world project will be required. An oral presentation by the group and preparation of a final written engineering report including alternative evaluation, permits, scheduling and economic analysis will be required from each group. Prereq: CEE 720. permission.  
Equivalent(s): CIE 848

CEE 833 - Public Infrastructure Asset Management  
Credits: 4  
The course provides a thorough examination of the growing engineering field of Public Infrastructure Assess Management (IAM). The course enables the student to design an IAM system. It touches upon all types of public infrastructure with a particular focus on water infrastructure for the semester design project. Students build upon their engineering economics and project engineering skills and use simple IAM software along with GIS applications. Practice leaders from the industry provide guest lectures throughout the semester. A focus on triple bottom line or the Societal, Environmental and Economic aspects of IAM are included. The format is a modified team base design learning experience providing practice in processing of technical lecture material, personal performance evaluation (frequent quizzes) and team based performance evaluation. Student groups will present their design to the class and provide a written engineering report. Pre- or Coreq: CEE 502 and CEE 620.  
Equivalent(s): CIE 839

CEE 835 - Properties and Production of Concrete  
Credits: 3  
Basic properties of hydraulic cements and mineral aggregates and their interactions in the properties of plastic and hardened concrete; modifications through admixtures; production handling and placement problems; specifications; quality control and acceptance testing; lightweight, heavyweight, and other special concretes. Prereq: CEE 635 or permission.  
Equivalent(s): CIE 822

CEE 836 - Asphalt Mixtures and Construction  
Credits: 3  
Specification of asphalt cements, aggregates and proportioning of mixture constituents for paving applications. Asphalt mixture design methods, production, construction, and quality control are discussed. Current and new material production and construction technologies are introduced. Prereq: CEE 635 or permission.  
Equivalent(s): CIE 823

CEE 837 - Pavement Rehabilitation, Maintenance, and Management  
Credits: 3  
This course covers the technical and financial strategies to extend the life of highway and airfield pavements. The course topics will include: Assessment of pavement functional and structural condition, suitability of pavement maintenance and repair techniques, use of pavement preservation processes, and application of asset management to extend the life of pavement infrastructure.

CEE 848 - Pavement Design Project  
Credits: 1  
Semester long design project accompanying CEE 849 Pavement Design Analysis. The design project will require weekly meetings (either online or in person) for the duration of the semester. Meeting times will be arranged based on student schedules.  
Co-requisite: CEE 849

CEE 849 - Pavement Design Analysis  
Credits: 3  
Introduction to flexible and rigid pavement design and analysis for highways and airports. Examines design inputs, materials, analysis methods, design tools, and maintenance treatments. Prereq: CEE 635 and CEE 665.  
Equivalent(s): CIE 821

CEE 850 - Echohydrology  
Credits: 3  
Introduction to ecosyntical concepts in terrestrial and riverine systems. Topics include the historical practices, resources management impacts, hydrologic variability and the relationships among water and ecology, vegetation, biology, geomorphology, and water quality. Prereq: CEE 854 or ESCI 805; or permission.  
Equivalent(s): CIE 850

CEE 851 - Open Channel Flow  
Credits: 3  
Energy and momentum principles in open channel flow; flow resistance; channel controls and transitions; unsteady flow concepts and dam failure studies. Modeling with HEC programs. Prereq: CEE 650 or permission.  
Equivalent(s): CIE 841

CEE 854 -設計 of Pressurized Water Transmission Systems  
Credits: 4  
Theory developed for individual components to large complex systems. Analysis and designs of components and systems. Topics include steady and unsteady closed conduit flow, valves and meters, pump requirements, pump selection, system planning and layout, water hammer, and system operation and maintenance. Pressure system modeling with program EPANET. Prereq: Fluid mechanics, or permission.  
Equivalent(s): CIE 855

CEE 856 - Coastal Engineering and Processes  
Credits: 3  
Introduction to small amplitude and finite amplitude wave theories. Wave forecasting by significant wave and wave spectrum method. Coastal processes and shoreline protection. Wave forces and wave-structure interaction. Design of coastal structures. Introduction to mathematical and physical modeling. Prereq: CEE 650 or permission. (Also offered as ME 857 and OE 857.)  
Equivalent(s): CIE 857, ME 857, OE 857
CIE 863 - Engineering Geology
Credits: 3
The study of the Earth's historical and physical processes, and their impact on the natural resource industry. Focus on the design and engineering of mechanical systems and the structural development of materials. Students measure field variables and then are challenged with actual designs. Examples of stream restoration issues include in-stream flow, dam removal, induced recharge, improvements to fish habitat, and channel stabilization. Prereq: CEE 650.
Equivalent(s): CIE 859

CIE 866 - Introduction to Geotechnical Earthquake Engineering
Credits: 3
Overview of earthquake source mechanisms; magnitude and intensity; seismicity of the U.S.A. Dynamics of simple structures; response spectra. Selection of design parameters; source, magnitude, input records. Measurement of dynamic characteristics of soils; site response, liquefaction, and ground deformation. Prereq: CEE 878 or permission.
Equivalent(s): CIE 862

CIE 867 - Geotechnical Engineering
Credits: 3
Equivalent(s): CIE 863

CIE 875 - Geotechnical Design
Credits: 3
Equivalent(s): CIE 858

CIE 881 - Dynamics of Structures
Credits: 3
Equivalent(s): CIE 887

CIE 885 - Design of Reinforced Concrete Structures
Credits: 3
Introduction to the design of reinforced concrete structures. Reinforcements and materials. Concrete and steel properties. Design of slabs, beams, columns, and shear walls. Prereq: CIE 865 and 875 or permission.
Equivalent(s): CIE 885

CIE 887 - Geoenvironmental Engineering
Credits: 3
Soil composition and structure; hydrogeology; attenuation and contaminant transport; containment design including landfills, geosynthetics for liners and covers, leachate collection systems, vertical cutoff walls, and stability analyses; geo-environmental site characterization and investigation using geotechnical and geophysical methods; ground water, soil and gas monitoring, and sampling; remediation including in-situ and ex-situ techniques and treatment methods. Prereq: CIE 665 or permission.
Equivalent(s): CIE 866

CIE 889 - Timber Design
Credits: 3
Equivalent(s): CIE 882

CIE 890 - Structural Design in Masonry
Credits: 3
Introduces the design of reinforced masonry structural members by the stress and strength method and considering deflection and other serviceability performance criteria. Includes development of wind and seismic load, curtain wall, shear wall, lintels and columns. Prereq: CIE 635, 680; or permission.
Equivalent(s): CIE 876
CEE 891 - Reinforced Concrete Design  
Credits: 4  
Introduction to the design of reinforced concrete structural members by the strength method and considering deflection performance. Includes loads, approximate analysis, slabs, beams, and columns. Prereq: CEE 635, 680; or permission.  
Equivalent(s): CIE 874

CEE 892 - Pre-stressed Concrete  
Credits: 3  
Analysis and design of pre-stressed and post-tensioned concrete sections in flexure and shear. Strength, deflection, and losses in flexural members. Optimization of section and pre-stressing force selection. Prereq: CEE 891 or permission.  
Equivalent(s): CIE 891

CEE 893 - Structural Design in Steel  
Credits: 4  
Introduction to steel member design, including horizontal and vertical members for design and analysis of buildings. Examines design inputs, material choice, analysis methods and design and construction methodologies. Prereq: CEE 635 and CEE 680.  
Equivalent(s): CIE 893

CEE 894 - LRFD Bridge Design  
Credits: 3  
AASHTO LRFD Bridge Design Specifications using SI units. Design objectives, loads, load case analysis and selection, load distributions, static analysis, and design for axial loads, flexure, and shear. Design of slender columns, composite beams, and plate girders. Prereq: senior-level structural design course or permission.  
Equivalent(s): CIE 894

CEE 895 - Independent Study  
Credits: 1-4  
A limited number of qualified graduate students will be permitted to pursue independent studies under faculty guidance. May be repeated.  
Equivalent(s): CIE 895

CEE 896 - Special Topics  
Credits: 1-4  
Advanced or specialized topics not normally covered in regular course offerings. May be repeated, but not in duplicate areas. Prereq: permission. Special Fee.  
Equivalent(s): CIE 896

CEE 897 - Masters Student Seminar  
Credits: 1  
Topics of interest to graduate students and staff; reports of research ideas, progress, and results; lectures by outside speakers. Continuing course: instructor may assign IA grade (continuous grading) at the end of one semester. Course held simultaneously with CEE 997.  
Repeat Rule: May be repeated for a maximum of 2 credits.  
Equivalent(s): CIE 900

CEE 898 - Master's Project Paper  
Credits: 3  
Concluding project paper required of Master's level students who utilize the non-thesis option. Prereq: permission. CEE majors only.  
Equivalent(s): CIE 888

CEE 899 - Master's Thesis  
Credits: 1-6  
May be repeated up to maximum of 6 credits. Cr/F.  
Repeat Rule: May be repeated for a maximum of 6 credits.  
Equivalent(s): CIE 899

CEE 934 - Advanced Bioenvironmental Engineering Design  
Credits: 4  
Theoretical and experimental examination of the fundamental parameters used in selection, design, and operation of biological treatment processes for waters, wastewaters, and hazardous wastes. Topics include design and evaluation of aerobic and anaerobic processes, suspended and fixed-film processes, and advanced biological water and wastewater treatment processes. Prereq: environmental engineering microbiology course, or permission.  
Equivalent(s): CIE 946

CEE 936 - Advanced Asphalt Materials  
Credits: 3  
Examination of chemical composition of asphalt cements, current technologies for modification, and inclusion of recycled materials to meet desired physical properties. Advanced characterization of asphalt materials, modelling, advanced mixture design tools. Prereq: CEE 836 or permission.  
Equivalent(s): CEE 923

CEE 949 - Advanced Pavement Design and Analysis  
Credits: 3  
Advanced flexible pavement design and analysis including rehabilitation/overlay design. Includes development of mechanistic-empirical methods, advanced pavement structural analysis, and advanced material characterization. Prereq: CEE 849 or permission.  
Equivalent(s): CEE 921

CEE 951 - Statistical Hydrology  
Credits: 3  
Course examines statistical methods used to address water resources planning and management problems involving uncertainty objectives and hydrologic inputs. Application of statistics and probability to uncertainty in the description, measurement, and analysis of hydrologic variables and processes, including extreme events, error models, simulation, and sampling. Prereq: A hydrology course, basic statistics, or permission.  
Equivalent(s): CIE 951

CEE 954 - Advanced Groundwater Topics  
Credits: 3  
Review of Darcy’s Law for confined and unconfined aquifers, linearization techniques, draw down computations under varying boundary conditions, solutions to the inverse problem, drainage theory, recharge theory, two-phase flow, succession of steady states modeling, and borehole geophysics. Prereq: ESCI 810.  
Equivalent(s): CIE 945

CEE 955 - Advanced Surface Water Hydrology  
Credits: 3  
Occurrence and distribution of water by natural processes including atmospheric thermodynamics, precipitation, runoff, infiltration, water losses, flood routing and catchment characteristics, analysis, and methods of runoff prediction. This course builds from a foundation of fluid mechanics in the environment to address essentials of modern hydrology. An emphasis is placed on fundamental concepts, first principles, and the scientific basis of approximations. Prereq: Calculus and Fluid Mechanics.  
Equivalent(s): CIE 955

CEE 959 - Advanced Stream Restoration Topics  
Credits: 3  
Course focuses on: stream crossing analysis and design, dam removal, and designs for aquatic species passage. Pre- or Coreq: CEE 759 or equivalent.  
Equivalent(s): CIE 959
CEE 965 - Advanced Soil Mechanics
Credits: 4
Numerical and physical modeling of the mechanical behavior of soils. Cam-clay and other predictive models. Laboratory studies of mechanical behavior and measurement of input parameters to soil models. Prediction of soil behavior based on laboratory results. Applications to numerical modeling of soil masses. Prereq: soil mechanics, and foundation design, or permission.
Equivalent(s): CIE 960

CEE 966 - Laboratory Geotechnical Testing
Credits: 4
Introduction to geotechnical modeling, soil constitutive modeling, introduction to numerical modeling and applications, physical modeling, centrifuge modeling, and theoretical modeling. Prereq: CEE 665, CEE 778, or equivalent, or permission.
Equivalent(s): CIE 962

CEE 967 - In Situ Geotechnical Testing
Credits: 3
In situ geotechnical testing methods for site characterization; theory and practice. Geotechnical testing methods include the piezocone, the pressuremeter, the flat plate dilatometer, the field vane, and the standard penetration test. Includes sampling techniques, geophysical exploration, and recent innovations in site and soil characterization. Prereq: CEE 965 or equivalent.
Equivalent(s): CIE 961

CEE 968 - Soil-Structure-Interaction
Credits: 3
Introduction to soil-structure-interaction, elastic and plastic analyses, serviceability calculations, relative foundation stiffness, Pile-soil-interaction, flexible retaining walls, tunnel lining, bridge abutments, dynamic soil-structure-interaction, case studies, and modeling techniques. Prereq: CEE 665 and 778, or permission.
Equivalent(s): CIE 963

CEE 980 - Nonlinear Structural Analysis
Credits: 3
This course deals with the theory, implementation, and application of methods of geometric and material nonlinear analysis. Geometric nonlinear analysis entails solving for equilibrium on the deformed configuration on the structure. Material nonlinear analysis involves inelastic behavior of materials. Practical design implications include problems of structural stability and inelastic static/dynamic analysis. Emphasis is on methods applied to frame structures comprised of line-type elements; however, the basic concepts also apply to general finite element methods. Prereq: CEE 780/CEE 880 or equivalent.
Equivalent(s): CIE 935

CEE 993 - Advanced Structural Steel Design
Credits: 3
Advanced design of structural steel elements according to the AISC Load and Resistance Factor Method as applied to advanced topics in steel design. Emphasis will be placed on theory involved in the development of the design code requirements. Course design project will expand on these topics and include experimental work as appropriate. Prereq: CEE 793/CEE 893 or permission.
Equivalent(s): CIE 993

CEE 995 - Problems
Credits: 2-4
The study and investigation of problems selected to meet the needs of the students.
Equivalent(s): CIE 995

CEE 997 - Doctoral Student Seminar
Credits: 1
Topics of interest to graduate students, faculty, and staff; requires two presentations from doctoral students on their research ideas, progress, and results; lectures by outside speakers. Continuing course: instructor may assign IA grade (continuous grading) at the end of one semester. Course held simultaneously with CEE 897.
Equivalent(s): CIE 901

CEE 999 - Doctoral Research
Credits: 0
Cr/F.
Equivalent(s): CIE 999