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Course Descriptions - Civil Engineering

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CE 101 Engineering Surveying I 0R-6L2C S Pre: None
Covers basic principles and practices of surveying. Mensuration through the application of surveying techniques; theory of errors and their analysis; concepts of horizontal, vertical and angular measurement; basic surveying operations and computations; reading and interpretation of building and construction plans.

CE 110 Computer Applications and GIS 4R-0L-4C W Pre: None
An introduction to problem solving, structured programming, and spatial analysis using spreadsheets, databases, and geographical information systems (GIS). Students will develop algorithms useful to civil engineering computation and design using these tools. This will include the development of programmed spreadsheets functions using structured programming concepts. Students will perform various spatial analysis techniques using GIS software including the use, collection, creation, and analysis of spatial data.

CE 111 Geographical Information Systems 2R-0L-2C W Pre: None
The course covers introductory concepts of geographical information systems and related technologies. Topics covered will relate to the use, collection, creation, and analysis of spatial data in applying GIS and related technologies to civil engineering projects. Not open to students with credit for CE 110.

CE 201 Engineering Surveying II 0R-6L-2C F Pre: CE 101
Covers special applied topics of surveying. Horizontal and vertical control systems and datums for engineering surveys; traverse computations; location of man-made structures; development and use of topographic maps; reading and interpretation of building, highway and bridge plans, land surveys and state plane coordinate systems; construction and route surveying.

CE 210 Civil Engineering Computer Applications 2R-0L-2C S Pre: CE 110 or equivalent and EM 104
Covers use of application programs (e.g., AutoCAD, Excel, MathCAD, etc.) useful to engineering computation and design.

CE 303 Engineering Economy 4R-0L-4C W Pre: Senior class standing
Emphasizes time value of money and factors related thereto. Familiarizes students with concepts of annual cost, present worth, and minimum rate of return as tools for consideration of economic factors pertinent to the selection of alternate solutions to engineering problems.

CE 310 Civil Engineering Numerical Methods 2R-0L-2C S Pre: CE 210 or equivalent and MA 222
Covers numerical methods used in solution of engineering problems. Typical topics include root finding, numerical integration, numerical differentiation, curve fitting, and numerical solution of ordinary differential equations.

CE 320 Civil Engineering Materials 3R-3L-4C S
A study of the origin, nature, performance and selection criteria of various basic materials used in the practice of civil engineering. These include aggregates, portland cement, concrete, and bituminous materials. Emphasis will be placed on standard methods of testing and characterization as related to the mechanical behavior of materials.

CE 321 Structural Mechanics I 4R-0L-4C F Pre: EM 203
Classical structural analysis. Idealizations, stability, reactions and internal forces, influence lines, approximate analysis, and displacements.

CE 336 Soil Mechanics 3R-3L-4C F Pre: EM 203 and EM 301
Introduces the student to the fundamental concepts of soil mechanics. Covers types and properties of soils, lateral and vertical pressures, settlement and consolidation, strength and seepage studies. Includes laboratory investigation of soil properties.

CE 371 Hydraulic Engineering 3R-3L-4C F Pre: EM 301 or equivalent
Application of basic fluid mechanics principles to the fields of hydraulics and water resources. Topics covered include: open channel flow, closed conduit flow, flow measurement, and turbomachinery. Stresses practical applications in the laboratory.

CE 400 Career Preparation Seminar 1R-0L-0C S Pre: CE 489
Preparation for the student to become a practicing engineer. Topics include Civil Engineering job expectations, continuing education, legal considerations, professionalism, consumer topics, and financial considerations.

CE 410 Senior Project 0R-8L-4C On Demand Pre: Senior class standing
Gives the student the opportunity to work on a civil engineering design or research project of the stu-dent's own choice, but which has met the approval of the staff prior to the start of the quarter. Requires presentation of oral and written reports. Not a regular elective offering.

CE 420 Consulting Engineering Seminar 2R-0L-2C S Pre: Junior class standing
Discusses problems in the field of consulting engineering; includes seminars presented by practicing consulting engineers and a suitable project to practice consulting skills.

CE 421 Structural Mechanics II 4R-0L-4C W Pre: CE 321
Matrix methods of structural analysis for two- and three- dimensional indeterminate structures. Force method, stiffness method, introduction to finite element analysis for civil engineers.

CE 424 Composite Material Mechanics 4R-0L-4C On Demand Pre: CE 321
Introduces various laminated composite materials such as reinforced plastics, laminated glass, plywood, laminated timber, and fiber-structural sandwich. Emphasis is on beam theory and plane stress analysis for such materials.

CE 430 Structural Design in Timber I 4R-0L-4C On Demand Pre: CE 321
Presents the analysis and design of modern structures constructed of timber. Considers fasteners and their significance in design. Develops design criteria and their application to plane and three dimensional structures.

CE 431 Structural Design in Steel I 3R-0L-3C S Pre: CE 321
Covers the analysis and design of the basic elements of a steel structure using Load and Resistance Factor Design specifications. Includes tension and compression members, beams, beam-columns and connections.

CE 432 Structural Design in Concrete I 3R-0L-3C W Pre: CE 321
Deals with the analysis and design of reinforced concrete beams, floor slabs, and columns using the Ultimate Strength Design procedure.

CE 433 Structural Design in Steel II 4R-0L-4C On Demand Pre: CE 431
Covers the analysis and design of the various elements of a steel structure within the framework of the total structure. Includes composite design, plate girders, and multi-story building frames.

CE 434 Structural Design in Concrete II 3R-3L-4C Pre: CE 432
Advanced topics in reinforced concrete analysis and design such as strut-and-tie modeling, and strengthening with fiber reinforced polymers.

CE 435 Bridge Engineering 4R-0L-4C On Demand Pre: CE 321
Deals with the various types of bridge structures, the materials of which they are constructed and the manner in which loads are transmitted to the foundation. Includes methods and procedures for the analysis and design of bridge structures. Considers standards and procedures for inspections and ratings of bridges and methods to increase the load capacity of existing bridges. Includes field inspections.

CE 436 Foundation Engineering 4R-0L-4C S Pre: CE 336, CE 432
Covers the application of soil mechanics principles to foundation problems. Includes design of building foundations and retaining walls, stability analysis of open cuts and slopes, dewatering methods, and a study of the influence of local geology.

CE 441 Construction Engineering 2R-0L-2C W Pre: Junior class standing or consent of instructor
Covers planning and scheduling techniques for construction engineering: Gantt charts, critical path method, precedence diagramming method, activity on arrow and PERT methods, resource allocation, and time-cost tradeoffs.

CE 442 Cost Engineering 4R-0L-4C F Pre: Senior class standing
An investigation of some of the cost accounting, cost management and estimating techniques which are used in the construction industry. Various types of estimates will be

considered, as will their multiple applications for project management. Special attention will be given to the preparation of detailed estimates based on quantity take-offs and to analyses of production productivity.

CE 444 Pavement Design and Highway Construction 4R-0L-4C On Demand Pre: CE 320
Introduction to analysis and design of rigid and flexible pavement systems; subgrade, subbase, base and surfaces; specifications, material testing and construction methods for soil stabilization, flexible and rigid pavements; pavement evaluation, maintenance and reconstruction.

CE 445 Construction Methods and Equipment 4R-0L-4C F Pre: CE 201 and CE 336, Co: CE 442
A study of economics, fundamental concepts and functional applications of major categories of construction equipment. Operational characteristics, capability and applicability of equipment to heavy, highway and major building construction projects.

CE 450 Civil Engineering Codes & Regulations 4R-0L-4C F Pre: CE 431 & CE 432
Examination of typical codes and regulations in the civil engineering profession. Local, state, and national building codes; Americans with Disabilities Act (ADA); zoning regulations; etc. Will also look at environmentally safe and renewable building materials, energy efficient construction techniques, indoor air quality and moisture problems, etc. Includes major building code evaluation and site development exercises.

CE 460 Introduction to Environmental Engineering 4R-0L-4C S Pre: EM 301 or CHE 301 or ES 202
Introduction to water pollution control, air pollution control, and solid and hazardous waste management. Topics include water treatment, wastewater treatment, impacts of pollutants on lakes and streams, and stream and air quality modeling.

CE 461 Environmental Engineering laboratory 1R-3L-2C S Co: CE 460
Emphasizes laboratory methods and interpretation of laboratory results for chemical analysis of water and wastewater.

CE 471 Water Resources Engineering 4R-0L-4C W Pre: EM 301 or CHE 301 or ES 202
Presents an overview of the engineering, planning, design, and operation of various water resources projects. Topics include surface and groundwater hydrology, sanitary and storm sewer design, dams and reservoirs, water law, wetlands, and nonpoint source pollution.

CE 480 Transportation Planning 4R-0L-4C On Demand Pre: Junior class standing
Analyzes the transportation planning process. Stresses goals and approaches to solutions as related to the urban transportation problem. Includes a class project.

CE 481 Transportation Engineering 4R-0L-4C W Pre: Senior class standing
Study of transportation functions and transportation systems including land, air and marine modes; transportation system elements including travel way, vehicle, controls and terminals; emphasis on highway geometric design.

CE 482 Urban Planning 4R-0L-4C On Demand Pre: Junior class standing
Applies general principles of systems analysis and control to urban and regional planning. Covers human settlements, location theory, simulation, plan formulation, selection and implementation. Includes a class project.

CE 489 Civil Engineering Design & Synthesis 5R-9L-8C F,W,S (1 R-3L-2C, fall; 3R-3L- 4C, winter; and 1R-3L-2C spring) Pre: RH 330, CE 460 Co-Req: CE 450
Civil engineering projects submitted by corporate and governmental sponsors will be undertaken by small teams of students to implement principles used in planning, design, and synthesis. Final recommendations and engineering designs will be presented to the sponsors with due attention to the social, economic, and environmental constraints of the project. The course is offered through the fall, winter, and spring at a rate of two credits per term for the fall and spring and four credits for the winter. No credit will be granted for the fall and/or winter terms alone. Eight credits will be granted after completion of the entire course in the spring term.

CE 490 Directed Studies F,W,S 1-4 C Arranged. Pre: Approval of department head, adviser, and course instructor
Provides the opportunity for the civil engineering students to do a selected project of mutual interest to them and a faculty member or make up for deficiencies in transfer credit hours and topics. Credit is assigned up to 4 credits per term with a maximum of 8 credits toward graduation.

UNDERGRADUATE-GRADUATE COURSES

CE 520 Plates and Shells 4R-0L-4C On Demand Pre: CE 421 and MA 222
Development of classical plate equation and boundary conditions; solution of problems in rectangular and polar coordinates. Development of membrane and bending theories for shells of revolutions; solution to domes and storage tanks.

CE 522 Advanced Finite Element Analysis 4R-0L-4C On Demand Pre: CE 421
Development of finite element methods for solving plane strain, plane stress and field problems. Utilizes readily available finite element computer programs. Requires additional development of user computer programs.

CE 523 Structural Dynamics 4R-0L-4C On Demand Pre: CE 321
Presents the analysis and design of structures subjected to dynamic loads. Covers elastic and inelastic responses with applications to earthquake design, blast-resistant structures and bridge vibration.

CE 525 Buckling Strength of Structures 4R-0L-4C On Demand Pre: CE 321
Discusses the buckling phenomenon of prismatic bars subjected to combined axial and transverse loads. Considers elastic and inelastic instability. Includes buckling of beams, columns, curved bars, rings, plates, trusses and rigid frames.

CE 530 Structural Design in Timber II 4R-0L-4C On Demand Pre: CE 430
Presents the analysis and design of structures constructed of timber. Tapered beams, curved beams, box beams, stressed-skin panels, tapered columns, built-up columns, laminated arches, plate connected trusses, pole structures, diaphragms, shearwalls.

CE 531 Structural Design in Masonry 4R-0L-4C S Pre: CE 432
Presents the analysis and design of structures constructed of masonry. Material properties, beam design, unreinforced and reinforced walls, columns and pilasters, seismic provisions, diaphragms, shear-walls, connections, other masonry units - stone, marble, etc.

CE 533 Behavior of Metal Structures 4R-0L-4C On Demand Pre: CE 433
Discusses the behavior of metal connectors, members and structures. Studies the significance of this behavior in terms of design and the development of specifications. This course is closed to students who have successfully completed CE 433 Structural Design in Steel II.

CE 534 Behavior of Concrete Structures 4R-0L-4C On Demand Pre: CE 432
Studies the behavior of beams, slabs, and columns of reinforced concrete, prestressed concrete and composite construction from the standpoint of design and the development of specifications.

CE 535 Structural Design in Prestressed Concrete 4R-0L-4C On Demand Pre: CE 432
Analysis and design of prestressed concrete structures. Beams, slabs, loss of prestress, deflections, precast construction.

CE 536 Advanced Soil Mechanics 4R-0L-4C On Demand Pre: CE 436
Presents a comprehensive treatment of principles of soil mechanics in relation to soil compaction, effective stress, influence of fluid flow on soil behavior, pore pressure development in undrained loading, consolidation, settlement problems, lateral soil pressures, shear strength and stability problems.

CE 561 Air Pollution 4R-0L-4C W Pre: Grad or consent of Instructor
Fundamentals of meteorology, air pollution health impacts, particulate control mechanisms and devices, and gaseous pollutant control mechanisms and devices. Course includes detailed design projects involving major air pollution control devices. Cross-listed with CHE450.

CE 562 Treatability Studies 2R-6L-4C On Demand Pre: CE 563 or CHE 461
Emphasizes use of laboratory bench scale evaluations of unit operations and processes important in the treatment and disposal of specific types of organic and inorganic wastes of significance in industrial and site remediation situations. Student laboratory projects and presentations.

CE 563 Unit Operations in Environmental Engineering 4R-0L-4C F Pre: CE 460
Covers the physical, chemical, and biological operations and processes of interest to water and wastewater treatment systems. Topics include sedimentation, mixing, activated sludge coagulation, flocculation, granular filtration and adsorption. Cross-listed with CHE461.

CE 564 Aquatic Environmental Chemistry 4R-0L-4C F Pre: Senior or Graduate student standing
Emphasis equilibrium relationships of importance in understanding both natural waters

and wastewaters. The carbonate system and the concept of pH as a master variable are stressed.

CE 565 Solid & Hazardous Waste Regulation & Treatment 4R-0L-4C On Demand Pre: CE 460
Covers solid and hazardous waste management, including characterization, collection system design, waste minimization, design of landfills and incinerators, and remediation principles.

CE 566 Environmental Management 4R-0L-4C On Demand Pre: Graduate student standing
Environmental management at an industrial facility is examined in detail. Topics include the determination of environmental impacts, summaries of main environmental laws and standards, decision-making tools, and case studies of various industries.

CE 567 Applied Hydrologic Modeling 4R-0L-4C Pre: CE 471
Environmental planning and management strategies are examined using computer simulation models. Students will be introduced to some of the most widely used models in the fields of hydrology, hydraulics, and stormwater quality (nonpoint source pollution).

CE 568 Applied Contaminant Transport Modeling 4R-0L-4C On Demand Pre: CE 460 or consent of instructor
Environmental planning and management strategies are examined using computer simulation models. Emphasis is on pollutant transport in various media and emerging pollution issues. Students are introduced to some of the most widely used models in the field of environmental engineering. Students also develop at least one pollutant transport model using common software such as EXCEL, MATHCAD.

CE 569 Environmental Systems Optimization 4R-0L-4C Pre: Senior or Graduate class standing
Application of the principles of operations research to constrained optimization of environmental systems. Typical topics include strategies for non-linear searches, linear programming, dynamic programming, etc.

CE 570 Fluid Mechanics in Water Resources Engineering 4R-0L-4C On Demand Pre: CE 371
Presents steady and unsteady flow problems in open channels and pipes, problems dealing with laminar and turbulent boundary layers, and problems including diffusion and dispersion. There will be occasional laboratory work to demonstrate physical modeling in water resources engineering.

CE 573 Groundwater Analysis 4R-0L-4C Pre: CE 471
Covers hydrodynamics of flow through porous media. The primary emphasis is on the analysis of steady and unsteady flow in confined and unconfined aquifers. Groundwater modeling is introduced.

CE 589 Environmental Engineering Design and Synthesis 4R-12L-8C Pre: Graduate Standing F,W,S,F
Environmental engineering projects submitted by external sponsors are undertaken by small teams of students to develop advanced principles used in planning, design, and synthesis. Final recommendations and engineering designs are presented to the sponsors with due attention to the social, economic, and ethical constraints of the project. Each student team also prepares a manuscript of the completed project that is suitable for publication n a peer-reviewed professional journal. The final report to the sponsor and the manuscript prepared by the team must be approved by the team's graduate committee comprised of at a minimum, the course instructor, a faculty mentor from the CE department, and a faculty external to the CE department.

CE 590 Special Problems 2/4R-0L-2/4C F,W or S Pre: Consent of instructor
Special problems or reading by special arrangement with the faculty.

CE 597 Special Projects in Civil Engineering F,W,S Pre: Permission of instructor
A special project, or series of problems, or research problem is assigned to or selected by the student. A comprehensive report must be submitted at the conclusion of the project. Not to be used as a substitute for CE 599, Thesis Research. Variable credit. May be repeated up to a maximum of eight credits.

CE 598 Special Topics in Civil Engineering
Studies in advanced topics of current interest.

CE 599 Thesis Research F,W,S
Graduate students only. Credits as assigned; however, not more than 12 credits will be applied toward the requirements of the M.S. degree.

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