CIVIL ENGINEERING

Professors Descoteaux, Houghtalen, Jones, McKinney, Sutterer, and Thomas

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  Introduction to Civil Engineering Computer Applications  2R-0L-2C  W  Pre: None

Covers the creation of algorithms useful to civil engineering computation and design. Introduction to computer hardware systems.

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 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. (Same as ME 330)

CE 305  Civil Engineering Practice I  0R-0L-4C  Pre: Co-op Program Selection

Cooperative Education Program students only. Requires written report and oral presentation of industrial experience.

CE 306  Civil Engineering Practice II  0R-0L-4C  Pre: CE 305

Cooperative Education program students only. Requires written report and oral presentation of industrial experience.

CE 310  CE Computer Applications I  2R-0L-2C  S  Pre: CS 100

Covers use of application programs (e.g., AutoCAD, Excel, MathCAD, etc.) useful to engineering computation and design.

CE 311  CE Computer Applications II  2R-0L-2C  S  Pre: CE 310

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 Material Science  3R-3L-4C  S
A study of the origin, nature, performance and selection criteria of various materials used in the practice of civil engineering. These include aggregates, portland cement, concrete, bituminous materials, timber and metals. 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. Stability, determinacy, trusses, frames, external reactions and internal forces of two- and three-dimensional statically determinate and indeterminate structures.

**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 361 Environmental Issues 4R-0L-4C W Pre: Junior class standing**

Presents information on the interrelated issues of population, land and food resources, water resources, energy resources and human health in the environment. The course will provide the background necessary for the citizen engineer to make informed decisions on matters of public policy issues dealing with the environment.

**CE 371 Hydraulic Engineering 3R-3L-4C F Pre: EM 301**

Deals with the application of basic fluid mechanics principles to the field 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 405 Civil Engineering Practice III 0R-0L-4C Pre: 306**

Cooperative Education Program students only. Requires written report and oral presentation of industrial experience.

**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 student’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; seminars presented by practicing consulting engineers.
CE 421  Structural Mechanics II  4R-0L-4C  W  Pre: CE 321


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  W  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  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  4R-0L-4C  Pre: CE 432

Deals with the analysis and design of continuous reinforced concrete structures using the Ultimate Strength Design approach. Includes biaxial bending, torsion, two-way slabs, and shear wall design.

CE 435  Bridge Engineering  4R-0L-4C  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 construction planning and scheduling techniques, contracts, specifications, and legal aspects.

**CE 442 Cost Engineering  4R-0L-4C  F**  
Pre: Junior 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  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  Pre: Junior class standing**

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 361, 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

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: CE 371
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, the design of hydraulic structures, and wetlands issues.

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  On Demand  Pre: Junior 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; techniques of transportation system planning, design and operation.

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  3R-9L-6C  F,W,S  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 introduce 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.

Offered through the fall, winter, and spring at a rate of two credits per term. No credit will be granted for the fall and/or winter terms alone. Six credits will be granted after completion of the entire course in the spring term.

CE 490-1  Directed Research  F,W,S  Pre: Approval of faculty adviser and course instructor

Provides the opportunity for the senior C.E. student to do a selected project of current interest in civil engineering. Credit is assigned up to 4 credits per term with a maximum of 8 credits toward graduation. Offered on demand.

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  S  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 201**

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 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 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, shearwalls, 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 434**

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. This course is closed to students who have successfully completed CE 434 Structural Design in Concrete II.

**CE 535 Structural Design in Prestressed Concrete 4R-0L-4C Pre: CE 432**

Analysis and design of prestressed concrete structures. Beams, columns, 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.

CE 562 Treatability Studies  2R-6L-4C  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  W  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.

CE 564 Aquatic Environmental Chemistry  4R-0L-4C  Pre: CHEM 113

Emphasis on 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 Environmental Systems Modeling I  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, water quality, groundwater, and systems engineering.

CE 568 Environmental Systems Modeling II  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 in a peer-reviewed professional journal. The final report to the sponsor and the manuscript prepared by the team must be approved by the student’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.