

CIVIL ENGINEERING (CIV-ENGR)

Courses

CIV-ENGR 5500 Problems Credits: 1-6

Supervised investigation in civil engineering to be presented in the form of a report.

Prerequisites: Graduate standing and must be a civil engineering student.

CIV-ENGR 5501 Advanced Topics in Civil Engineering Credits: 1-3

Current technical developments in civil engineering.

Prerequisites: You must be a civil engineering student to take this course.

CIV-ENGR 5504 Project Management of Integrated Design and Construction Credits: 3

Provide a body of knowledge that includes the principles, knowledge areas, skills, and tools applicable to successful project management for the performance of integrated design and construction of capital projects, specifically as applicable to the post-award period. This post-award period is the time from the formal Project award by the owner through Project design and construction, testing, commissioning, close-out and completion of the Project warranties.

CIV-ENGR 5505 Capital Project Delivery Methods Credits: 3

Provide a body of knowledge that acquaints students with the capital project delivery methods in both public and private business sectors of the U.S design – construction industry. Project delivery means how a capital project comprising both design and construction is planned, procured, contracted and implemented by an owner to achieve desired objectives. Delivery methods include traditional design – bid- build, design – build, design-build plus added services such as operations and maintenance, CM @ Risk and other approaches. Roles and responsibilities of owners, owner consultants, and design and construction firms are presented and discussed. Owner procurement approaches, project risk.

CIV-ENGR 5506 Construction Project Risk Management Credits: 3

Risk management skill sets are necessary tools for the successful project manager. Project Management Institute's (PMI) 6 steps of project risk management constitute the basis of the content, which includes an expanded knowledge of risk identification, qualitative and quantitative risk analysis, risk control, contract risks, and risk transfer options. Business and project risks such as client selection, project planning, and project execution, will be considered as well as legacy risks that remain with the business and participants beyond the project completion. Different risk management strategies will be discussed, including risk avoidance, risk mitigation, and risk transfer.

CIV-ENGR 5515 Engineering Leadership & Ethics Credits: 3

Analysis of leadership, including 360-degree assessment of students' leadership. Discussion of leadership cases and application to engineering careers. Frequent analysis of engineering ethics cases using the NSPE Code.

Prerequisites: Graduate status.

CIV-ENGR 5516 Advanced Engineering Mathematics Credits: 3

The class is a review of and introduction to advanced mathematical theories and methods for graduate students in Civil and Mechanical Engineering. The basic topics include 2nd-order ODE/PDEs, advanced linear algebra, continuous and discrete Fourier transform, advanced probability and statistics methods, and commonly numerical methods (e.g. linear and generalized linear regression, iterative methods, and maximum likelihood estimation. Successful completion of Calculus III and working knowledge of a mathematical software package (Matlab preferred) is recommended.

CIV-ENGR 5517 Advanced Structural Analysis Credits: 3

The course is designed as a continued study of structural analysis methods with emphases on indeterminate structures (trusses, beam/columns, and frames), advanced analysis methods, and introduction to nonlinear structural effects including geometric nonlinearity and inelasticity. Advanced structural analysis methods including force, displacement, matrix, energy, and limit analysis methods will be introduced and practiced. Both computer based and hands on analysis will be involved.

Prerequisites: Undergraduate coursework in structural analysis strongly recommended.

CIV-ENGR 5521 Matrix Methods of Structural Analysis Credits: 3

An introduction to the fundamentals of stiffness and flexibility methods for analysis of truss and frame structures. Application of the computer programs to three dimensional structures.

Prerequisites: CIV-ENGR 321.

CIV-ENGR 5523 Advanced Structural Steel Design Credits: 3

Design of steel building structures. Topics include composite deck and beam design, stability design, plastic design, plate girder design, simple and eccentric shear connections, and partial and fully restrained moment resistant connections.

Prerequisites: CIV-ENGR 323.

CIV-ENGR 5526 Prestressed Concrete Credits: 3

Design and behavior of prestressed concrete structures; material and system or pretensioned and post tensioned systems; prestress losses; flexure, shear, bond, deflections and partial prestress in determinate structures; indeterminate beams-introduction.

Prerequisites: CIV-ENGR 422WI.

CIV-ENGR 5527 Advanced Reinforced Concrete Design Credits: 3

Advanced Topics in the design of footings, retaining walls two way floor slabs, torsion and continuous structures, shear friction, strut and tie design, precast design.

Prerequisites: CIV-ENGR 422WI.

CIV-ENGR 5529 Advanced Design of Structures for Blast and Fire Credits: 3

General overview of Blast Design; risk assessment and design criteria; simplified Blast Effects Analysis; ground shock, material response; antiterrorism design considerations; weapons effects and mitigation; internal explosions; progressive collapse analysis; and introduction to Fire Design.

CIV-ENGR 5531 Fund of Geomaterial Characterization Credits: 3

A geomaterial is any construction material comprised primarily of soil. This course overviews state-of-the-art instrumental techniques for analysis of the physio-chemical properties of soils, aggregates, hydraulic concrete, and asphaltic concrete. Evaluation techniques will be applied to determining beneficial reuse opportunities for industrial by-product materials from the Kansas City region. Prerequisites are CE 335 Soil Mechanics and CE378 Civil Engineering Materials, or equivalent. 3 credit hours.

Prerequisites: CIV-ENGR 335, CIV-ENGR 378WI.

CIV-ENGR 5532 Foundation Engineering Credits: 3

Design of basic foundation structures, footings, retaining walls, pile foundations, dams.

Prerequisites: CIV-ENGR 335.

CIV-ENGR 5536 Advanced Soil Mechanics Credits: 3

Theoretical soil mechanics as applied to solution of specific engineering problems.

Prerequisites: CIV-ENGR 335.

CIV-ENGR 5542 Hydraulic Structures Credits: 3

A review of the history and hydraulic design procedures for a variety of hydraulic structures including spillways, water measurement structures, canal structures and energy dissipation structures.

Prerequisites: CIV-ENGR 452 (or CIV-ENGR 5552).

CIV-ENGR 5544 Unit Processes in Environmental Engineering Credits: 3

Typical chemical and physical relationships are applied to unit processes of water and wastewater. Troubleshooting for operation problems is emphasized.

Prerequisites: CIV-ENGR 342.

CIV-ENGR 5545 Environmental Engineering Microbiology Credits: 3

Theory and application of fundamental principles of microbiology, toxicology, ecology, and aquatic biology of the microorganisms of importance to environmental engineers.

Prerequisites: CE342.

CIV-ENGR 5546 Limnology Credits: 3

A survey of the physical, biological, and chemical issues important in surface fresh waters. Includes carbonate chemistry, algal assay and Thermocline analysis.

Prerequisites: CHEM 211, MATH 345.

CIV-ENGR 5547 Legal Topics for Engineers Credits: 3

This course covers a broad range of substantive legal topics giving the student a grounding in the legal implications of certain situations that they may encounter during their careers. The course includes coverage of basic contract law, environmental regulations and compliance, construction law, antitrust law, intellectual property law, civil procedure, employment law, business entities (corporate law) product liability and criminal law and procedure. The objective of the course is to provide students with a fundamental understanding of the wide range of federal and state laws governing behavior in our complicated and rule of law driven society.

CIV-ENGR 5549 Environmental Compliance, Auditing, & Permitting Credits: 3

This course provides a high level overview of the most important statutes that have been enacted to protect the environment. The course covers regulation of hazardous waste, the Clean Air and Clean Water Acts, the Resource Conservation and Recovery Act, the All Appropriate Inquiry Rule and the law addressing sites contaminated with hazardous substances and the technology options employed to remediate those sites. In addition, the course provides coverage of environmental audits and emergency planning for extremely hazardous substances, the regulation of underground storage tanks, safe drinking water and the National Environmental Policy Act among other statutes.

CIV-ENGR 5552 Hydraulics of Open Channels Credits: 3

This is a first course in the fundamentals of open channel (free surface) water flow. Over ninety-nine percent of all the water that is moved on the planet's surface is by free surface flow. Study of free surface flow is essential to the study of storm water drainage systems, flood control, water and wastewater treatment and the study of the form and processes of river evolution. This class provides the fundamental physical principles of free surface flow as a prelude to a significant number of other topics that pertain to engineering and geomorphic analysis.

Prerequisites: CIV-ENGR 351.

CIV-ENGR 5553 Hydraulics and Variability of Rivers Credits: 3

This course introduced concepts of alluvial channel behavior, evolution and change due to natural and man-induced modifications to streams and watersheds. Numerous case studies of river behavior are studied from the perspective of hydraulics, geomorphology and sediment transport.

Prerequisites: CIV-ENGR 357.

CIV-ENGR 5554 River Stability and Scour Credits: 3

Bridge hydraulics, stream stability, scour at bridge piers and abutments, hydraulic modeling of floods, countermeasures for protection of bridge infrastructure.

Prerequisites: CIV-ENGR 351 (or MEC-ENGR 351).

CIV-ENGR 5556 Urban Hydrology Credits: 3

Analysis of urban drainage systems in accordance with published municipal criteria. This course is an in-depth, follow on course for senior undergraduate students interested in the hydrological sciences and for graduate students specializing in water resources. Specifically this course will focus on the engineering procedures and techniques specified by municipalities to design and maintain efficient, safe, storm drainage systems. This course also focuses on the unique issues associated with estimating and designing for rainfall/runoff in urban metropolitan areas, including channel and reservoir routing of floods through stream channels, retention structures, culverts, and storm sewers.

Prerequisites: CIV-ENGR 357.

CIV-ENGR 5563 Construction Law Credits: 3

This course introduces professional, ethical, and legal concepts of the professional practice of engineering, and the role of the consulting engineer, specifically in the A/E/C industry during the design, procurement, and construction processes. A conceptual framework is developed for understanding the industry standard agreements (AIA, EJCDC, ConCensus) and the various participants roles and duties in project execution. The engineer's "professional standard of care" is examined and revisited throughout the semester, specifically what it means to be a "Professional Engineer". Emphasis is placed on project and contract management and the applicable law. Skills are developed in finding online resources of law, legal, and practice advice relevant to the practice of engineering and the construction industry

CIV-ENGR 5565 Project Finance Credits: 3

This class introduces students to the financial concepts faced by engineers in the businesses in which they work and for the projects to which they are assigned. Throughout the course students are reminded of the impact of two key variables – money and time – on their work. While not attempting to turn good engineers into mediocre accountants, the course includes a strong emphasis on managerial accounting. Students will learn how to read and apply financial statements and how to use these same financial concepts in developing pro formas to evaluate and support major capital investments. The effect of time on the value of money, appropriate discount factors, and the internal rate of return will be explored in the class. Students will learn to combine these financial factors with electronic spreadsheets to evaluate business opportunities and practices. All students will be required to develop a comprehensive financial model to evaluate/justify a real world capital project.

CIV-ENGR 5566 Green Building and Sustainable Infrastructure Credits: 3

This course provides a broad overview of what sustainability means to construction and our built environment. Specific green infrastructure rating systems of LEED and Envision will be discussed in detail to quantify the "greenness" of construction of buildings residential subdivisions, highways, roads, and airports. Upon completion of this course students will have a substantial background and understand the aspects needed for the LEED Green Associates and Envision ISI exams. Two major additional aspects of green building important to sustainable infrastructure include stormwater management using "green" techniques and methods to mitigate the urban heat island. The course will also discuss infrastructure project sustainability from a life cycle cost perspective and determining the life cycle inventory of various materials. Upon completion of the course, students will better understand what sustainability means and how it applies in the context of our built environment and have a good idea of how technology will impact our sustainable future.

CIV-ENGR 5567 Introduction to Construction Management Credits: 3

This course will introduce the students to basic construction management related topics including structure of the construction industry, construction drawings and specifications, estimating and bidding, construction contracts, bonds and insurance, planning and scheduling of construction operations, project management, computer techniques.

CIV-ENGR 5568 Construction Planning and Scheduling Credits: 3

This course is intended to provide an in-depth examination of the construction planning and scheduling process, as it relates to civil engineering projects. Topics will include planning and scheduling of construction operations by the critical path method, Network diagramming, scheduling computations, and time-cost trade-offs. Manpower and equipment leveling. Computer and noncomputer techniques.

Prerequisites: CIV-ENGR 467 or CIV-ENGR 5567.

CIV-ENGR 5569 Construction Methods and Equipment Credits: 3

Introduction to methods used to plan, construct and manage heavy civil projects. Topics will include development, project control, equipment productivity, earthmoving fundamentals, formwork design, and other issues in heavy civil projects.

Prerequisites: CIV-ENGR 467 or CIV-ENGR 5567.

CIV-ENGR 5570 Corrosion Engineering Credits: 3

This course will cover the physical interaction of metallic materials with their environments, called corrosion. Corrosion is an electrochemical process and the thermodynamics and kinetics of corrosion processes will be discussed. Students will be expected to identify different forms of corrosion and be able to select appropriate materials for their working environment to prevent corrosion related problems. Second half of the class will concentrate on corrosion of metals in concrete and prevention methods.

Prerequisites: CHEM 211, CHEM 211L, CIV-ENGR 378WI.

CIV-ENGR 5571 Advanced Portland Cement Concrete Credits: 3

This course will cover topics such as cement chemistry, concrete proportioning, aggregates, mineral and chemical admixtures, fresh and hardened properties of concrete, and durability of concrete. Design and proportioning of concrete mixtures for desired fresh and hardened properties will be emphasized. Specialty concrete types such as high strength/high performance concrete, lightweight concrete, pervious concrete, high volume fly ash concrete, and fiber reinforced concrete will also be covered.

Prerequisites: CHEM 211, CHEM 211L, CIV-ENGR 378WI.

CIV-ENGR 5573 Durability of Civil Engineering Materials Credits: 3

This course will explore the identification, causes of, and remediation of material-related durability deterioration in civil engineering projects. The primary focus will be on reinforced concrete, plain concrete, and soil for a variety of applications. Course content will be delivered primarily through laboratory activities and handouts. Lab activities will use advanced analysis techniques and help the students identify and measure deterioration mechanisms. Various non-destructive evaluation techniques will be discussed. Students have hands on experiences with samples production, data collection, and data analysis for all of the lab activities.

Prerequisites: CIV-ENGR 335, CIV-ENGR 378WI.

Cross Listings: CIV-ENGR 473.

CIV-ENGR 5575 Seismic Design of Structures Credits: 3

Introduction to basic analysis and design principles for the seismic design of buildings (concrete, steel, wood). General seismic principles, codes and loads, static lateral force procedure, dynamic lateral force procedure, topics in rigidities of buildings.

Prerequisites: CIV-ENGR 323 (or CIV-ENGR 422WI), MEC-ENGR 285.

CIV-ENGR 5582 Advanced Traffic Engineering Credits: 3

This course covers the review of traffic flow characteristics, the field survey practices and studies, traffic signal designs, freeway operation, and the introduction to Intelligent Traffic Systems (ITS).

Prerequisites: CIV-ENGR 319.

CIV-ENGR 5584 Pavement Materials, Design, Maintenance, and Rehabilitation Credits: 3

This course will explore the identification, causes of, and remediation of material-related durability deterioration in civil engineering projects. The primary focus will be on reinforced concrete, plain concrete, and soil for a variety of applications. Course content will be delivered primarily through laboratory activities and handouts. Lab activities will use advanced analysis techniques and help the students identify and measure deterioration mechanisms. Various non-destructive evaluation techniques will be discussed. Students have hands on experiences with samples production, data collection, and data analysis for all of the lab activities.

Prerequisites: CIV-ENGR 378WI.

CIV-ENGR 5585 Principles of Railroad Engineering Credits: 3

The engineering analysis and design of railroad systems including the study of the dynamics of track/trains; wheel/rail interaction related to acceleration and braking; horizontal and vertical geometric design of railroads and rail-bed design, rail structures; freight and passenger operations; and, rail-highway interaction and safety.

CIV-ENGR 5588 Applied Artificial Intelligence Credits: 3

This course serves as an introduction to Artificial Intelligence and data analytics with an emphasis on the application of natural and built environment engineering and sciences. Students will learn introductory AI concepts and fundamentals, and will apply commonly used discriminative and generative machine learning (ML) models for supervised and unsupervised learning. Advanced deep/large models, such as CNNs, Transformers, and Large Language Models (LLM's) will be presented in non-technical lectures as AI-learning assistants for programming. Python-based examples will be discussed for preparing homework and projects.

CIV-ENGR 5599 Thesis Research Credits: 1-6

Independent investigation in the field of civil engineering to be presented in the form of a thesis.

Prerequisites: You must be a civil engineering student to take this course.

CIV-ENGR 5602 Directed Reading in Civil Engineering Credits: 1-3

Faculty supervised readings course.

Prerequisites: Graduate standing and must be a civil engineering student.

CIV-ENGR 5607 Numerical Methods in Engineering Credits: 3

Classification and numerical solution of engineering problems—ordinary and partial differential equations, algebraic equations. Includes initial, boundary, eigen-# and characteristic-value problems.

Prerequisites: MATH 345.

CIV-ENGR 5622 Theory of Elasticity Credits: 3

Stress and strain at a point. General equations of elasticity. Plane stress, plain strain problems; torsion of prismatic bars. Energy methods.

Prerequisites: You must be a civil engineering student to take this course.

CIV-ENGR 5623 Theory of Plates and Shells Credits: 3

Bending of plates with various loading and boundary conditions. Deformations, stresses in thin shells.

Prerequisites: CIV-ENGR 5622.

CIV-ENGR 5624 Theory of Elastic Stability Credits: 3

Buckling of columns, beams, rings, curved bars, thin plates, shells.

Prerequisites: CIV-ENGR 5622.

CIV-ENGR 5625 Advanced Prestressed Concrete Credits: 3

Design and behavior of prestressed concrete structures; material and system of pretensioned and post tensioned systems; prestress losses; flexure, shear, bond, deflections and partial prestress in determinate structures; indeterminate beams-introduction.

Prerequisites: CIV-ENGR 422WI.

CIV-ENGR 5629 Adv. Design of Structures for Blast and Fire Credits: 3

General overview of Blast Design; risk assessment and design criteria; simplified Blast Effects Analysis; ground shock, material response; antiterrorism design considerations; weapons effects and mitigation; internal explosions; progressive collapse analysis; and introduction to Fire Design.

CIV-ENGR 5645 Water Quality Modeling Credits: 3

Derivation and application of models for describing oxygen budget, nutrient exchange, and biological productivity in streams, lakes and estuaries.

Prerequisites: CIV-ENGR 342.

CIV-ENGR 5646 Physiochemical Treatment Processes Credits: 3

Fundamental principles, analysis and modeling of physical and chemical processes for water and wastewater treatment.

Prerequisites: CIV-ENGR 342.

CIV-ENGR 5647 Biochemical Treatment Processes Credits: 3

Biochemical principles, kinetic models and energy considerations in the design of biological wastewater treatment processes.

Prerequisites: CIV-ENGR 342.

CIV-ENGR 5648 Environmental Engineering Practicum Credits: 3

Numerical water quality modeling of actual site data for wasteload allocation.

Prerequisites: CIV-ENGR 5645.

CIV-ENGR 5649 Design of Water and Wastewater Treatment Facilities Credits: 3

Development of design criteria and their application to the design of water and wastewater treatment facilities.

Prerequisites: CIV-ENGR 5646 or CIV-ENGR 5647.

CIV-ENGR 5651 Fundamentals of Fluid Mechanics Credits: 3

Fundamentals of fluid motion, lecture and laboratory. Instrumentation, technique and analysis for experimental studies in fluid mechanics.

Prerequisites: You must be a civil engineering student to take this course.

CIV-ENGR 5655 Sediment Transport Credits: 3

The study of sediment transport in rivers: the relationship between sediment transport and the fundamentals of fluvial geomorphology. Computation of sediment transport and sediment transport modeling.

Prerequisites: CIV-ENGR 452 (or CIV-ENGR 5552).

CIV-ENGR 5656 Advanced Hydraulic Engineering Credits: 3

Rapidly varied flow and design of transition structures. Hydraulic design of spillways, reservoirs and related structures.

Prerequisites: You must be a civil engineering student to take this course.

CIV-ENGR 5675 Advanced Seismic Design of Structures Credits: 3

Introduction to basic analysis and design principles for the seismic design of buildings (concrete, steel, wood). General seismic principles, codes and loads, static lateral force procedure, dynamic lateral force procedure, topics in rigidities of buildings.

Prerequisites: CIV-ENGR 323 (or CIV-ENGR 422WI), MEC-ENGR 285.

CIV-ENGR 5679 Dynamics of Structures Credits: 3

Study of the dynamic behavior of structures. Analysis of equivalent lumped parameter systems for the design of structures in a dynamic environment.

Prerequisites: CIV-ENGR 276 (or CIV-ENGR 421), MEC-ENGR 484 (or MATH 345, MEC-ENGR 285).

Cross Listings: MEC-ENGR 5679.

CIV-ENGR 5681 Traffic Flow Theory Credits: 3

This course covers the review of macroscopic and microscopic traffic flow characteristics, the traffic flow models, and the traffic simulation applications.

Prerequisites: CIV-ENGR 319.

CIV-ENGR 5682 Transportation Network Modeling Credits: 3

This course is about modeling, solving, and understanding network flow problems, especially in the transportation discipline. This course covers equilibrium traffic assignment, network design, fleet assignment, fleet routing, and crew scheduling.

Prerequisites: CIV-ENGR 319.

CIV-ENGR 5699 Research and Dissertation Credits: 1-9

Doctoral dissertation research.

Prerequisites: You must be a civil engineering student to take this course.