CIVIL ENGINEERING, BACHELOR OF SCIENCE

Description

Website: https://cee.unl.edu/

The Department of Civil and Environmental Engineering offers a complete undergraduate program to students on the Lincoln and Omaha campuses of the University of Nebraska. Curriculum requirements are nearly identical on both campuses. The goal is to prepare students for entry into the civil engineering profession immediately after graduation or to pursue graduate-level studies.

The general educational objectives of the University of Nebraska–Lincoln civil engineering undergraduate program are to prepare our graduates so that, with a University of Nebraska–Lincoln BSCE degree, a few years beyond graduation, alumni will:

- Be employed in civil and environmental engineering or a closely related field; or, graduates will be pursuing an advanced degree in civil and environmental engineering or a closely related field.
- Contribute to society and address societal and environmental needs through engagement in professional, community, or service organizations.
- Agree that the civil engineering program prepared them for success in their careers in terms of knowledge and skillsets as embodied in the program and the Complete Engineer ™ Initiative.

As a professional discipline, civil engineering is closely related to the total human environment. In all professional endeavors, the civil engineer must consider ecological effects as well as the social, economic, and political needs of people. The civil engineer designs systems to control and manage our water resources to provide electric power, agricultural irrigation, flood control, recreation, water supplies, and wastewater treatment systems for our urban and industrial needs.

The civil engineer plans, designs, and constructs our transportation systems—including highways, railroads, waterways, and airports—to connect rural, urban, and industrial areas. The civil engineer also designs and constructs housing and facilities for recreational, industrial, and commercial complexes, which comprise the urban environment. It is the responsibility of civil engineering to minimize air, water, and land pollution and protect the environment.

Instructional emphasis is placed on fundamental engineering principles derived from mathematics, chemistry, physics, and engineering science. These subjects provide a sound background for the subsequent introductory courses in environmental, geotechnical, structural, transportation, and water resources engineering. Students are introduced to design concepts in the freshman year. Design is incorporated throughout the curriculum that culminates in two senior-level courses, CIVE 401 (https://nextcatalog.unl.edu/search/?P=CIVE%20401) Civil Engineering Design I and CIVE 402 (https://nextcatalog.unl.edu/search/?P=CIVE%20402) Civil Engineering Design II.

Instructional laboratories in environmental engineering, hydraulics, geotechnical engineering, structures, and surveying provide each student with an opportunity to learn, through individual participation, the operation of the testing equipment used to establish engineering design criteria and to monitor and model engineering facilities such as water and wastewater treatment plants, river control systems, and structural systems.

The Department of Civil and Environmental Engineering also offers a major and a minor in Environmental Engineering.

Learning Outcomes

Graduates of the civil engineering program will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

The above student outcomes have been approved by the ABET Engineering Area Delegation for use beginning with the 2019-20 academic year, and have been adopted by the faculty of the Department of Civil and Environmental Engineering.

Professional Admission to Civil Engineering

Criteria for Professional Admission to the Civil Engineering Degree Program

Pre-professionally admitted College of Engineering students majoring in civil engineering must have their academic records reviewed for professional admission to the civil engineering degree program during the fall, spring or summer immediately following the term in which:

- At least 12 credits (one semester) have been completed after admission to the College of Engineering;
- At least 43 credits applicable to the degree have been earned; and
- PHYS 2110 General Physics I, MECH 223 Engineering Statics, MECH 325 Mechanics of Elastic Bodies and MECH 373 Engineering Dynamics have been completed.

Additionally, the student can have no more than two declined professional admission requests to other engineering majors. It is likely a student may need to complete four full semesters of credits applying to the program before these requirements are able to be completed.

Professional admission approval to the civil engineering degree program also requires that all of the following departmental-specific criteria must be met:

- Earn a C letter grade or better in PHYS 2110, MECH 223, MECH 325, AND MECH 373
- Earn a cumulative grade point average of 2.4 or greater; and
- Earn a C letter grade or better in ALL math, science and engineering courses required for the bachelor of science in civil engineering degree if the cumulative grade point average is less than 2.700.

Students approved for professional admission to the program are then allowed to take 400-level civil engineering courses to complete their degree.

Requirements

(City Campus in Lincoln and Scott Campus in Omaha)

This document represents a SAMPLE 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should

be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

Students must have completed the equivalent of the fourth semester before admission to the civil engineering program. Transfer students must have all transfer hours accepted before being considered for the degree program.

Course	Title	Credits
First Semester		
CIVE 101	INTRODUCTION TO CIVIL ENGINEERING	3
CHEM 1180	GENERAL CHEMISTRY I	3
CHEM 1184	GENERAL CHEMISTRY I LABORATORY	1
MATH 1950	CALCULUS I	5
ACE 2 Communication Skills Elective		3
ENGR 10	FRESHMAN ENGINEERING SEMINAR	0
	Credits	**15**
Second Semester		
CIVE 102	GEOMATICS FOR CIVIL ENGINEERING	3
CIST 1600	INTRODUCTION TO PROGRAMMING USING PRACTICAL SCRIPTING	3
PHYS 2110	GENERAL PHYSICS I - CALCULUS LEVEL	4
MATH 1960	CALCULUS II	4
ACE 1 Writing Elective		3
	Credits	**17**
Third Semeseter		
CIVE 201	CIVIL ENGINEERING ANALYSIS I	2
MECH 223	ENGINEERING STATICS	3
PHYS 2120	GENERAL PHYSICS-CALCULUS LEVEL (or CHEM 1190 and CHEM 1194)	4
MATH 1970	CALCULUS III	4
ACE 5 Humanities Elective		3
ENGR 20	SOPHOMORE ENGINEERING SEMINAR	0
	Credits	**16**
Fourth Semester		
CIVE 202	CIVIL ENGINEERING ANALYSIS II	2
CIVE 371	Materials of Construction	3
MECH 325	MECHANICS OF ELASTIC BODIES	3
MECH 373	ENGINEERING DYNAMICS	3
MATH 2350	DIFFERENTIAL EQUATIONS	3
ACE 6 Social Science Elective		3
	Credits	**17**
Fifth Semester		
CIVE 301	CIVIL ENGINEERING SYNTHESIS I	1
CIVE 310	FLUID MECHANICS	3
CIVE 310L	Hydraulics Laboratory	1
CIVE 341	STRUCTURAL ANALYSIS FUNDAMENTALS	3
CIVE 342	STRUCTURAL DESIGN FUNDAMENTALS	1
CIVE 361	PRINCIPLES OF TRANSPORTATION ENGINEERING	3
STAT 3800	APPLIED ENGINEERING PROBABILITY AND STATISTICS	3
	Credits	**15**
Sixth Semester		
CIVE 302	CIVIL ENGINEERING SYNTHESIS II	1
CIVE 321	PRINCIPLES OF ENVIRONMENTAL ENGINEERING	3
CIVE 321L	ENVIRONMENTAL ENGINEERING LABORATORY	1
CIVE 331	Introduction to Geotechnical Engineering	4
CIVE 351	Introduction to Water Resources Engineering	3
ACE 7 Arts Elective		3
	Credits	**15**
Seventh Semester		
CIVE 401	CIVIL ENGINEERING DESIGN I	3
CIVE Depth Elective (Environmental Water)		3
Choose 1 from CIVE 420, CIVE 425, CIVE 427, CIVE 419, CIVE 452		
Science Elective		4
BIOL 1020 or BIOL 1450 or GEOL 1170 or (PHYS 1350 and PHYS 1354) or (GEOG 3510 and GEOG 3514) or (CHEM 2210 and CHEM 2214)		
Technical Elective		3
Work with your advisor to correctly select this elective.		
ACE 8 Ethics Elective		3
	Credits	**16**
Eighth Semester		
CIVE 402	CIVIL ENGINEERING DESIGN II	3
CIVE Depth Elective (Geotech/Materials, Structures, and Transportation)		3
Choose 1 from CIVE 436, CIVE 440, CIVE 441, CIVE 462, CIVE 463		
CIVE Depth Elective (Choose one that was not used to fulfill another requirement		3
CIVE 419, CIVE 420, CIVE 425, CIVE 427, CIVE 436, CIVE 440, CIVE 441, CIVE 462, CIVE 463		
Technical Elective		3
Work with your advisor to correctly select this elective		
ACE 9 Global Awareness and Human Diversity Elective		3
	Credits	**15**
	Total Credits	**126**

A list of approved ACE courses offered on the Omaha campus can be found here (https://tes.collegesource.com/publicview/TES_publicview03_group_report.aspx?sid=12214&rid=1d4a5187-e01b-4f1f-aaa6-b0040e957167&aid=e4ff42df-9ddc-4416-a5dd-18e971d1c0e4&cgrid=5508)

For more information, call 402-554-2462 or visit www.engineering.unl.edu/civil/ (http://www.engineering.unl.edu/civil/)

Major Requirements

Requirements for the Degree of Bachelor of Science in Civil Engineering

The BS degree in civil engineering is offered on both the Lincoln and Omaha campuses. Degree Requirements - 126 hours

Code	Title	Credits
CIVIL ENGINEERING CORE		
CIVE 101	INTRODUCTION TO CIVIL ENGINEERING	3
CIVE 102	GEOMATICS FOR CIVIL ENGINEERING	3
CIVE 201	CIVIL ENGINEERING ANALYSIS I	2
CIVE 202	CIVIL ENGINEERING ANALYSIS II	2
CIVE 301	CIVIL ENGINEERING SYNTHESIS I	1

CIVE 302	CIVIL ENGINEERING SYNTHESIS II	1
CIVE 401	CIVIL ENGINEERING DESIGN I	3
CIVE 402	CIVIL ENGINEERING DESIGN II	3
Credit Hours Subtotal:		18
CIVIL ENGINEERING BREADTH		
CIVE 310	FLUID MECHANICS	3
CIVE 310L	Hydraulics Laboratory	1
CIVE 321	PRINCIPLES OF ENVIRONMENTAL ENGINEERING	3
CIVE 321L	ENVIRONMENTAL ENGINEERING LABORATORY	1
CIVE 331	Introduction to Geotechnical Engineering	4
CIVE 341	STRUCTURAL ANALYSIS FUNDAMENTALS	3
CIVE 342	STRUCTURAL DESIGN FUNDAMENTALS	1
CIVE 351	Introduction to Water Resources	3
CIVE 361	PRINCIPLES OF TRANSPORTATION ENGINEERING	3
CIVE 371	Materials of Construction	3
Credit Hours Subtotal:		25
CIVIL ENGINEERING DEPTH ELECTIVES		
Depth Electives in Environmental and Water Resources Engineering		3
Choose one from:		
CIVE 420	ENVIRONMENTAL ENGINEERING PROCESS DESIGN	
CIVE 427	DESIGN OF WASTEWATER TREATMENT AND DISPOSAL FACILITIES	
CIVE 426		
CIVE 419	FLOW SYSTEMS DESIGN	
CIVE 452	WATER RESOURCES DEVELOPMENT	
Depth Electives in Geotechnical, Structural and Transportation Engineering		3
Choose one from:		
CIVE 436	FOUNDATION ENGINEERING	
CIVE 440	REINFORCED CONCRETE DESIGN I	
CIVE 441	STEEL DESIGN I	
CIVE 462	HIGHWAY DESIGN	
CIVE 463	TRAFFIC ENGINEERING (General Civil Engineering Depth Electives)	
General Civil Engineering Depth Electives		3
Choose three credits from the following that were not used to fulfill another requirement:		
CIVE 420, CIVE 426, CIVE 427, CIVE 419, CIVE 436, CIVE 440, CIVE 441, CIVE 462, CIVE 463		
Credit Hours Subtotal:		9
GENERAL ENGINEERING		
CIST 1600	INTRODUCTION TO PROGRAMMING USING PRACTICAL SCRIPTING	3
MECH 223	ENGINEERING STATICS	3
MECH 325	MECHANICS OF ELASTIC BODIES	3
MECH 373	ENGINEERING DYNAMICS	3
Credit Hours Subtotal:		12
ENGR 10	FRESHMAN ENGINEERING SEMINAR	0
ENGR 20	SOPHOMORE ENGINEERING SEMINAR	0
TECHNICAL ELECTIVES		
Choose a total of six credits from:		6
Any 400-level CIVE course not taken to fulfill another requirement		
Any 200-, 300- or 400-level course in any engineering major not used to fulfill another requirement		
Any 200-, 300- or 400-level course in Biology, Chemistry, Public Administration (including PA 1010), Geology, GEOG 2620, Mathematics, Statistics, or Physics not used to fulfill another requirement.		
Any course in the following list: ACCT 2000, ANTH 3910, ANTH 3920, BIOL 1020, BIOL 1450, BIOL 1750, BIOS 4940, CHEM 1190, ECON 2200, ENTR 3710, GEOG 1030, (GEOG 3510 and GEOG 3514), GEOL 1170, GEOL 1180, GEOL 1010, MKT 3310 not used to fulfill another requirement.		
Credit Hours Subtotal:		6
SCIENCE		
CHEM 1180 & CHEM 1184	GENERAL CHEMISTRY I and GENERAL CHEMISTRY I LABORATORY	4
PHYS 2110	GENERAL PHYSICS I - CALCULUS LEVEL	4
Select one fo the following:		4
PHYS 2120	GENERAL PHYSICS-CALCULUS LEVEL	
CHEM 1190 & CHEM 1194	GENERAL CHEMISTRY II and GENERAL CHEMISTRY II LABORATORY	
Science Elective-Select one of the following:		
BIOL 1020	PRINCIPLES OF BIOLOGY	
CHEM 2210 & CHEM 2214	FUNDAMENTALS OF ORGANIC CHEMISTRY and FUNDAMENTALS OF ORGANIC CHEMISTRY LABORATORY	
GEOL 1170	INTRODUCTION TO PHYSICAL GEOLOGY	
PHYS 1350 & PHYS 1354	PRINCIPLES OF ASTRONOMY and INTRODUCTORY ASTRONOMY LAB	
GEOG 3510 & GEOG 3514	METEOROLOGY and INTRODUCTION TO METEOROLOGY LABORATORY	
BIOL 1450	BIOLOGY I	
Credit Hours Subtotal:		16
MATHEMATICS		
MATH 1950	CALCULUS I	5
MATH 1960	CALCULUS II	4
MATH 1970	CALCULUS III	4
MATH 2350	DIFFERENTIAL EQUATIONS	3
STAT 3800	APPLIED ENGINEERING PROBABILITY AND STATISTICS	3
Credit Hours Subtotal:		19
ACE REQUIREMENTS		
ACE 1: Writing		3
Choose from the list of approved ACE 1 courses [1]		
ACE 2: Communication Skills		3
Choose from the list of approved ACE 2 courses [1]		
ACE 3: Math/Stat Reasoning		
This requirement is satisfied by MATH 1950, MATH 1960, MATH 1970, MATH 2350, or STAT 3800		
ACE 4: Science		
This requirement is satisfied by CHEM 1180, CHEM 1190, PHYS 2110, PHYS 2120, BIOL 1020, PHYS 1350, or GEOL 1170		
ACE 5: Humanities		3
Choose from the list of approved ACE 5 courses [1]		
ACE 6: Social Sciences		3

Choose from the list of approved ACE 6 courses [1]	
ACE 7: Arts	3
Choose from the list of approved ACE 7 courses [1]	
ACE 8: Ethics	3
Choose from the list of approved ACE 8 courses [1]	
ACE 9: Global Awareness and Human Diversity	3
Choose from the list of approved ACE 9 courses [1]	
ACE 10: Capstone Experience	
This requirement is satisfied by CIVE 402	
Credit Hours Subtotal:	21
Total Credit Hours	**126**

[1] A list of approved ACE courses offered on the Omaha campus can be found here (https://tes.collegesource.com/publicview/TES_publicview03_group_report.aspx?sid=12214&rid=1d4a5187-e01b-4f1f-aaa6-b0040e957167&aid=e4ff42df-9ddc-4416-a5dd-18e971d1c0e4&cgrid=5508).

CIVE 101 INTRODUCTION TO CIVIL ENGINEERING (3 credits)
Introduction to engineering design process through hands-on projects supported by instruction of underlying engineering science and fundamentals, model development, and the required tools. Exploration of civil engineering disciplines and introduction to civil engineering profession with focus on ethics and professional skills.

CIVE 102 GEOMATICS FOR CIVIL ENGINEERING (3 credits)
Introduction to the theory and application of measurements and geospatial data for civil engineering. This includes error theory, measurements of elevation, distance, direction, and location using optical, mechanical, electronic, and global navigation satellite systems, and applications in geographic information systems (GIS). Project based.
Prerequisite(s): CIVE 101 or CIVE 131

CIVE 112 OVERVIEW OF CIVIL ENGINEERING (1 credit)
Overview of civil engineering as a career by use of case studies; alternate approaches to engineering designs illustrated by use of engineering principles.
Prerequisite(s): Prerequisites: Permission of the instructor

CIVE 131 CIVIL ENGINEERING GRAPHICS (2 credits)
Use of computer-aided design software to communicate engineering ideas. Specifications, dimensioning, toleracing, 2- and 3-D model development, topographic mapping, and process layout with environmental, bioprocess, and biomedical emphases.
Prerequisite(s): Permission of the instructor

CIVE 201 CIVIL ENGINEERING ANALYSIS I (2 credits)
Incorporating programming logic into spreadsheet solutions in the context of authentic civil engineering projects; emphasis on integrating professional skills, data analysis and management, and technical skills. Project based.
Prerequisite(s): CIST 1600 (grade of C or better)

CIVE 202 CIVIL ENGINEERING ANALYSIS II (2 credits)
Expanding programming logic to data analysis & visualization, solution of linear systems of equations, and ordinary differential equations. Control of sensors and visualization of scientific data. Use of authentic civil engineering projects linking engineering mechanics and materials of construction. Emphasis on integrating professional skills, data analysis, and technical skills. Project based.
Prerequisite(s): Prerequisite: CIST 1600 or equivalent; Corequisite: CIVE 378

CIVE 301 CIVIL ENGINEERING SYNTHESIS I (1 credit)
Explores the co-disciplinary connections in civil engineering through authentic engineering projects; focus on synergies among fluid dynamics, transportation, and structures; emphasis on integrating professional skills, data analysis, and technical skills. Project based.
Prerequisite(s): Corequisite: CIVE 310 or CIVE 361 or CIVE 341

CIVE 302 CIVIL ENGINEERING SYNTHESIS II (1 credit)
Explores the co-disciplinary connections in civil engineering through authentic engineering projects; focus on synergies among geotechnical engineering, water resources, and environmental engineering; emphasis on integrating professional skills, data analysis, and technical skills. Project based.
Prerequisite(s): Corequisite: CIVE 331 or CIVE 351 or CIVE 321

CIVE 310 FLUID MECHANICS (3 credits)
Fluid statics, equations of continuity, momentum, and energy; dimensional analysis and dynamic similitude. Applications to: flow meters; fluid pumps and turbines; viscous flow and lubrication; flow in closed conduits and open channels. Two-dimensional potential flow.
Prerequisite(s): MATH 2350 (grade of C or better) and MECH 223 (grade of C or better)

CIVE 310L HYDRAULICS LAB (1 credit)
Hydraulic experiments and demonstrations. Velocity, pressure and flow measurements; pipe flow, open channel flow; hydraulic structures and machinery, hydrologic and sediment measurement and student projects.
Prerequisite(s): CIVE 310 pre-requisite/co-requisite

CIVE 321 PRINCIPLES OF ENVIRONMENTAL ENGINEERING (3 credits)
Introduction to the principles of environmental engineering, including water quality, atmospheric quality, pollution prevention, and solid and hazardous wastes engineering. Design of water, air, and waste management systems.
Prerequisite(s): MATH 1960 (grade of C or better), and CHEM 1180 (grade of C or better) and CHEM 1184, or CHEM 1190 (grade of C or better) and CHEM 1194

CIVE 321L ENVIRONMENTAL ENGINEERING LABORATORY (1 credit)
Environmental engineering experiments, demonstrations, field trips, and projects. Experiments include the measurement and determination of environmental quality parameters such as solids, dissolved oxygen, biochemical and chemical oxygen demand, and alkalinity.
Prerequisite(s): Pre or Coreq: CIVE 321.

CIVE 331 INTRODUCTION TO GEOTECHNICAL ENGINEERING (4 credits)
Soil composition, structure and phase relationships; soil classification. Principles of effective stress; loading induced subsurface stresses; load history; deformation and failure of soils. Elastic and limit analysis with applications to design for bearing capacity, settlement, retaining walls and slope stability. Steady state seepage.
Prerequisite(s): MECH 325 (grade of C or better); Pre or Coreq: CIVE 310.

CIVE 341 STRUCTURAL ANALYSIS FUNDAMENTALS (3 credits)
Introduction to the analysis of structural systems. Analyses of determinate and indeterminate trusses, beams, and frames.
Prerequisite(s): MECH 325 (C or better)

CIVE 342 STRUCTURAL DESIGN FUNDAMENTALS (1 credit)
Introduction to structural engineering design philosophy, steel and concrete design criteria, and procedures for trusses, simple beams, continuous beams, and frames. Introduction to structural experiments and software used in structural analysis and design.
Prerequisite(s): MECH 325 (C or better)

CIVE 351 INTRODUCTION TO WATER RESOURCES ENGINEERING (3 credits)
Introduction to water resources engineering design and planning, surface hydrology, groundwater hydraulics, reservoirs and other control structures. Introduction to field measurement and computational methods in water resources.
Prerequisite(s): CIVE 310

CIVE 361 PRINCIPLES OF TRANSPORTATION ENGINEERING (3 credits)
Introduction to the principles of transportation engineering including operator, user and vehicle characteristics, transportation facility design, traffic operations and control, and transportation planning.
Prerequisite(s): MECH 223 (C or better)

CIVE 371 MATERIALS OF CONSTRUCTION (3 credits)
Introduction to the behavior, testing and design of soil, portland cement concrete, steel, wood and composites. Experiments covering the concepts of stress and strain under axial, torsional, shear and flexural loading conditions. Common ASTM laboratory test procedures and specifications, field quality control tests and statistical applications.
Prerequisite(s): Prerequisite: MECH 223 (grade of C or better); Corequisite: MECH 325

CIVE 385 PROFESSIONAL PRACTICE AND MANAGEMENT IN CIVIL ENGINEERING (3 credits)
Basic elements of civil engineering practice. Roles of all participants in the process-owners, designers, architects, contractors, and suppliers. Basic concepts in business management, public policy, leadership, and professional licensure. Professional relations, civic responsibilities, and ethical obligations for engineering practice. Project management, contracts, allocation of resources, project estimating, planning, and controls.
Prerequisite(s): Junior standing and CIVE major. Not open to non-degree graduate students.

CIVE 395 CIVIL & ENVIRONMENTAL ENGINEERING INTERNSHIP EDUCATIONAL EXPERIENCE (1 credit)
Practical on-the-job experience to apply classroom theory in the civil & environmental engineering field.
Prerequisite(s): CIVE or ENVE major and permission of the Civil & Environmental Engineering curriculum chair

CIVE 401 CIVIL ENGINEERING DESIGN I (3 credits)
The first of two courses in the capstone sequence. Practical application of the engineering design process in a team project focused on an authentic and comprehensive civil engineering design project.
Prerequisite(s): CIVE 321, CIVE 331, CIVE 341, CIVE 351, and CIVE 361

CIVE 402 CIVIL ENGINEERING DESIGN II (3 credits)
The second of two courses in the capstone sequence. Practical application of the engineering design process in a team project focused on an authentic and comprehensive civil engineering design project.
Prerequisite(s): CIVE 401

CIVE 419 FLOW SYSTEMS DESIGN (3 credits)
Application of hydraulic principles to the design of water distribution systems, wastewater and stormwater collection systems, channelized flow systems and treatment facilities. (Cross-listed with CIVE 819)
Prerequisite(s): CIVE 321; Corequisite: CIVE 351

CIVE 420 ENVIRONMENTAL ENGINEERING PROCESS DESIGN (3 credits)
Design of unit operations and processes associated with drinking water and wastewater treatment facilities, and other environmental treatment systems.
Prerequisite(s): CIVE 321 and CIVE 310

CIVE 422 POLLUTION PREVENTION: PRINCIPLES AND PRACTICES (3 credits)
Introduction to pollution prevention (P2) and waste minimization methods. Practical applications to small businesses and industries. Legislative and historical development of P2 systems analysis, waste estimation, P2 methods, P2 economics, and sources of P2 information. (Cross-listed with CIVE 822).
Prerequisite(s): Permission

CIVE 424 SOLID WASTE MANAGEMENT ENGINEERING (3 credits)
Planning design and operation of solid and waste collection processing, treatment, and disposal systems including materials, resources and energy recovery systems. (Cross-listed with CIVE 824).
Prerequisite(s): CIVE 321

CIVE 425 DESIGN OF WATER TREATMENT FACILITIES (3 credits)
Analyses of water supplies and design of water treatment and distribution systems. (Cross-listed with CIVE 825).
Prerequisite(s): CIVE 420

CIVE 427 DESIGN OF WASTEWATER TREATMENT AND DISPOSAL FACILITIES (3 credits)
Analysis of systems for wastewater treatment and disposal. (Cross-listed with CIVE 827).
Prerequisite(s): CIVE 420

CIVE 430 FUNDAMENTALS OF WATER QUALITY MODELING (3 credits)
Comprehensive study of water quality and the effects of various water pollutants on the aquatic environment; modeling of water quality variables. (Cross-listed with CIVE 830).
Prerequisite(s): CIVE 321

CIVE 434 SOIL MECHANICS II (3 credits)
Application of the effective stress principle to shear strength of cohesive soils; analysis of stability of slopes. Development of continuum relationships for soils; solutions for stresses and displacements for an elastic continuum. Solution of the consolidation equation for various initial and boundary conditions.
Prerequisite(s): CIVE 334

CIVE 436 FOUNDATION ENGINEERING (3 credits)
Subsoil exploration and interpretation; selection of foundation systems; determination of allowable bearing capacity and settlement; design of deep foundations; pile driving analysis; control of groundwater.
Prerequisite(s): CIVE 331

CIVE 440 REINFORCED CONCRETE DESIGN I (3 credits)
Introduction to the design concepts of reinforced concrete building components. The design of flexural and compression members, simple walls, foundations, and floor systems using the latest American Concrete Institute (ACI) design requirements.
Prerequisite(s): CIVE 341

CIVE 441 STEEL DESIGN I (3 credits)
Introduction to the design concepts for structural steel building components. Design of tension members, bolted and welded connections, column members, and beam members. Limit states design concepts used throughout, and emphasis on behavior of members and code design procedures.
Prerequisite(s): CIVE 341

CIVE 443 ADVANCED STRUCTURAL ANALYSIS (3 credits)
Matrix analysis methods and computer solutions for indeterminate structures. Additional topics: static condensation, shear deformations, and non-prismatic members in matrix-based analyses, moment distribution method, load cases and load combinations for buildings and bridges, and influence lines and analysis for moving loads. (Cross-listed with CIVE 843)
Prerequisite(s): CIVE 341. Not open to non-degree graduate students.

CIVE 444 STRUCTURAL DESIGN AND PLANNING (3 credits)
Principles of design of steel and reinforced concrete structural building systems, planning of building vertical and horizontal load resisting systems, and bridge systems. Several design projects involve indeterminate analysis and design concepts for both steel and reinforced concrete. (Cross-listed with CIVE 844).
Prerequisite(s): CIVE 440 and CIVE 441

CIVE 446 STEEL DESIGN II (3 credits)
A continuation of the topics covered in CIVE 441. The principles and procedures used in design of steel buildings, design of plate girders, design and analysis of building systems, design and analysis of composite steel-concrete building systems, innovative building systems, and introduction to seismic design of steel buildings. Plate buckling, beam, column, and beam-column design, and frame stability. Introduction to connection design.
Prerequisite(s): CIVE 441

CIVE 447 REINFORCED CONCRETE II (3 credits)
Shear friction theory, strut-and-tie modeling, anchorage, deflection, slender and bi-axially loaded members, torsion, two-way action and punching shear, and footing design. Excel spreadsheets are developed and used for various design tasks. (Continuation of topics covered in CIVE 440/CIVE 840.) (Cross-listed with CIVE 847).
Prerequisite(s): CIVE 440 or CIVE 840

CIVE 448 RELIABILITY OF STRUCTURES (3 credits)
Fundamental concepts related to structural reliability, safety measures, load models, resistance models, system reliability, optimum safety levels, and optimization of design codes.
Prerequisite(s): CIVE 341.

CIVE 451 INTRODUCTION TO FINITE ELEMENT ANALYSIS (3 credits)
Matrix methods of analysis. The finite element stiffness method. Computer programs. Applications to structures and soils. Introduction to finite element analysis of fluid flow. (Cross-listed with CIVE 851)

CIVE 452 WATER RESOURCES DEVELOPMENT (3 credits)
Theory and application of systems engineering with emphasis on optimization and simulation techniques for evaluating alternatives in water resources developments related to water supply, flood control, hydroelectric power, drainage, water quality, water distribution, irrigation and water measurement. (Cross-listed with CIVE 852).
Prerequisite(s): CIVE 351

CIVE 454 HYDRAULIC ENGINEERING (3 credits)
Fundamentals of hydraulics with applications of mechanics of solids, mechanics of fluids, and engineering economics to the design of hydraulic structures. Continuity, momentum, and energy principles are applied to special problems from various branches of hydraulic engineering. (Cross-listed with CIVE 854).
Prerequisite(s): CIVE 351

CIVE 455 NONPOINT SOURCE POLLUTION CONTROL ENGINEERING (3 credits)
Identification, characterization, and assessment of nonpoint source pollutants; transport mechanisms and remediation technologies; design methodologies and case studies. (Cross-listed with CIVE 855).
Prerequisite(s): CIVE 326 and CIVE 352

CIVE 456 SURFACE WATER HYDROLOGY (3 credits)
Stochastic analysis of hydrological data and processes including rainfall, runoff, infiltration, temperature, solar radiation, wind, and non-point pollution. Space-time hydrologic modeling with emphasis on the application of techniques in the design of engineering projects. (Cross-listed with CIVE 856).
Prerequisite(s): CIVE 351

CIVE 458 GROUNDWATER ENGINEERING (3 credits)
Application of engineering principles to the movement of groundwater. Analysis and design of wells, well fields, and artificial recharge. Analysis of pollutant movement. (Cross-listed with CIVE 858).
Prerequisite(s): CIVE 351

CIVE 461 URBAN TRANSPORTATION PLANNING (3 credits)
Development of urban transportation planning objectives and goals. Data collection procedures, land use and travel forecasting techniques, trip generation, trip distribution, modal choice analysis, and traffic assignment. Site development and traffic impact analysis. (Cross-listed with CIVE 861).
Prerequisite(s): CIVE 361

CIVE 462 HIGHWAY DESIGN (3 credits)
Design of roadways, intersections, interchanges, parking facilities, and land development site access and circulation. Emphasis on design projects. (Cross-listed with CIVE862)
Prerequisite(s): CIVE361

CIVE 463 TRAFFIC ENGINEERING (3 credits)
Design of signalized intersections, arterial street and network signal systems, and freeway control systems. Emphasis on design projects. (Cross-listed with CIVE863)
Prerequisite(s): CIVE361

CIVE 468 AIRPORT PLANNING AND DESIGN (3 credits)
Planning and design of general aviation and air-carrier airports. Land-side components include vehicle ground access systems, vehicle circulation parking and terminal buildings. Air-side components include aircraft apron-gate area, taxi-way system, runway system and air traffic control facilities and airspace. Emphasis on design projects. (Cross-listed with CIVE868)
Prerequisite(s): CIVE 361

CIVE 471 BITUMINOUS MATERIALS AND MIXTURES (3 credits)
Understanding of the physical, chemical, geometrical, and mechanical characteristics and practical applications of bituminous materials and mixtures. Fundamental mechanics for elastic and inelastic materials and basic theories associated with mechanical data analyses and designs. Recent advances and significant research outcomes for further discussions. Applications of theories to laboratory and field testing. (Cross-listed with CIVE 871)
Prerequisite(s): CIVE 371. Not open to non-degree graduate students.

CIVE 472 PAVEMENT DESIGN AND EVALUATION (3 credits)
Thickness design of flexible and rigid pavement systems for highways and airports; design of paving materials; evaluation and strengthening of existing pavements. (Cross-listed with CIVE 872).
Prerequisite(s): CIVE 334

CIVE 475 WATER QUALITY STRATEGY (3 credits)
Holistic approach to the selection and analysis of planning strategies for protecting water quality from nonpoint sources of contamination. Introduction to the use of methods of analyzing the impact of strategies on whole systems and subsystems for selecting strategies; and for evaluating present strategies.
Prerequisite(s): Senior standing

CIVE 476 CONSTRUCTION COST CONTROLS (3 credits)
Development of cost accounting principles and financial controls appropriate for construction contractors. Includes purchasing policies and procedure, labor and equipment cost reporting techniques, accounting procedures for control of materials and supplies, billing methods, principles of financial reporting and analysis.
Prerequisite(s): ACCT 2010 and ACCT 2020.

CIVE 481 COMPUTATIONAL PROBLEM SOLVING IN CIVIL ENGINEERING (3 credits)
Introduction of numerical methods to solve problems in civil engineering, including finding roots of equations, solving linear algebra equations, optimization, curve fitting, numerical differentiation and integration, and finite difference method. Computational methods in numerical integration, matrix operations and ordinary differential equations as they apply to civil engineering problems. (Cross-listed with CIVE 881)
Prerequisite(s): MATH 2350; CIST 1600. Not open to non-degree graduate students.

CIVE 489 SENIOR DESIGN PROJECT (3 credits)
Requires the formulation and completion of a civil engineering design project. Course provides senior civil engineering students with the opportunity to apply engineering concepts and principles to a comprehensive design project of multiple sub-disciplinary nature. The principal objectives are for students to develop an understanding of the entire life-cycle of civil engineering projects with emphasis on the development of a unified and sustainable design that addresses the client's needs; project team work; strong engineer-client relationships; and effective project communications.
Prerequisite(s): Senior standing and CIVE 385

CIVE 491 SPECIAL TOPICS IN CIVIL ENGINEERING (1-6 credits)
Special topics in emerging areas of civil engineering which may not be covered in other courses in the civil engineering curriculum.

CIVE 494 INDEPENDENT STUDY IN CIVIL ENGINEERING (1-3 credits)
Individual study at the undergraduate level in a selected area of civil engineering under the supervision and guidance of a Civil & Environmental Engineering faculty member.

CIVE 498 INDEPENDENT RESEARCH IN CIVIL ENGINEERING (1-6 credits)
Independent research work and written findings in a selected area of civil engineering under the supervision and guidance of a Civil & Environmental Engineering faculty member.
Prerequisite(s): Permission