CIVIL ENGINEERING (CIVE)

CIVE 112 Introduction to Civil Engineering
Description: Introduction to civil engineering as a career by use of case studies; alternate approaches to engineering designs illustrated by use of engineering principles.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LEC

CIVE 125 Ecology, the Environment, and the Engineer
Description: Investigation into the nature of ecology, man's relation with the environment and man's chance of survival in that environment, and the potential influence, for good or bad, of modern man's activities.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 130 Computer-Aided Design
Crosslisted with: BSEN 130
Description: Use of computer-aided design software to communicate engineering ideas. Specifications, dimensioning, tolerancing, 2- and 3-D model development, topographic mapping, and process layout with environmental, bioprocess, and biomedical emphases.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LEC
Prerequisite for: AGEN 470, BSEN 470

CIVE 221 Geometric Control Systems
Crosslisted with: CONE 221
Prerequisites: MATH 106, 106B or 108H
Description: Introduction to the theory and application of mensuration and geometric information processing in civil engineering. Measurement of distance, direction, elevation, and location using mechanical, electronic, and satellite systems. Collection of field data and error propagation. Elementary geometric data bases for design, construction, operation, and control of civil works.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LAB
Prerequisite for: CIVE 361

CIVE 252 Construction Materials Laboratory
Prerequisites: MATH 106/106B/108H; CNST 251 or parallel.
Description: Introduction to ASTM and AASHTO standard procedures used to measure soil and concrete properties; common modifications to soil and concrete mixes are discussed and analyzed.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LAB

CIVE 310 Fluid Mechanics
Prerequisites: MECH 373 and MATH 221
Description: Fluid statics, equations of continuity, momentum, and energy dimensional analysis and dynamic similarity. Applications to: flow meters; fluid pumps and turbines; viscous flow and lubrication; flow in closed conduits and open channels. Two-dimensional potential flow.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Offered: FALL/SPR
Prerequisite for: AGEN 325, BSEN 325; AGEN 344, BSEN 344; BSEN 425, CIVE 425; CIVE 352; MECH 446

CIVE 310H Honors: Fluid Mechanics
Prerequisites: Good standing in the University Honors Program or by invitation; MECH 373, MATH 221
Description: Honor students required to study beyond levels expected of students in normal sections and prepare a special report.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: AGEN 325, BSEN 325; AGEN 344, BSEN 344; CIVE 352; MECH 446

CIVE 319 Hydraulics Laboratory
Prerequisites: CIVE 310 or CIVE 310 or parallel
Description: Introduction to principles of environmental engineering
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LAB

CIVE 326 Introduction to Environmental Engineering
Crosslisted with: BSEN 326
Prerequisites: CHEM 110 or 111 or 113 and MATH 221
Description: Introduction to 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: BSEN 425, CIVE 425

CIVE 326H Honors: Introduction to Environmental Engineering
Crosslisted with: BSEN 326H
Prerequisites: Good standing in the University Honors Program or by invitation; CHEM 110 or 111 or 113 and Math 221.
Description: Introduction to 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
CIVE 327 Environmental Engineering Laboratory
Crosslisted with: BSEN 327
Prerequisites: CHEM 110 or 111 or 113, and MATH 221.
Description: 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.
Credit Hours: 1
Max credits per semester: 1
Max credits per degree: 1
Format: LAB

CIVE 328 Concrete Materials
Prerequisites: CHEM 111 and MECH 223.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LEC

CIVE 334 Introduction to Geotechnical Engineering
Prerequisites: MECH 325.
Notes: Parallel: CIVE 310.
Description: 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.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

CIVE 341 Introduction to Structural Engineering
Prerequisites: MECH 325.
Description: Introduction to the analysis and design of structural systems. Analyses of determinate and indeterminate trusses, beams, and frames, and design philosophies for structural engineering. Laboratory experiments deal with the analysis of determinate and indeterminate structures.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC

CIVE 352 Introduction to Water Resources Engineering
Prerequisites: CIVE/MECH 310.
Description: Introduction to water resources engineering design and planning, surface hydrology, ground water hydraulics, reservoirs, and other control structures. Introduction to field measurement and computational methods in water resources.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 361 Highway Engineering
Prerequisites: CIVE/CONE 221 (CONE 2210 (UNO)) MECH 223.
Description: Introduction to the principles of highway engineering and traffic operations and control.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 378 Materials of Construction
Prerequisites: MECH 325.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LEC
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Description</th>
<th>Credit Hours</th>
<th>Max credits per semester</th>
<th>Max credits per degree</th>
<th>Format</th>
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</thead>
<tbody>
<tr>
<td>CIVE 421</td>
<td>Hazardous Waste Management and Treatment</td>
<td>CIVE 326/BSEN 326</td>
<td>Survey of the hazardous waste management system in the USA. State and federal hazardous waste regulations. Chemical characteristics of hazardous waste and unit operations and processes used for treatment of soil, water, and air.</td>
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<td>CIVE 422</td>
<td>Pollution Prevention: Principles and Practices</td>
<td>CIVE 422, BSEN 822, CIVE 822</td>
<td>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.</td>
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<td>CIVE 424</td>
<td>Solid Waste Management Engineering</td>
<td>CIVE 326, CIVE 334</td>
<td>Planning, design and operation of solid and waste collection processing, treatment, and disposal systems including materials, resources and energy recovery systems.</td>
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<td>CIVE 425</td>
<td>Process Design in Water Supply and Wastewater Treatment</td>
<td>BSEN 425</td>
<td>Design of unit operations and processes associated with drinking water and wastewater treatment facilities.</td>
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<td>CIVE 426</td>
<td>Design of Water Treatment Facilities</td>
<td>CIVE 826</td>
<td>Analysis of water supplies and design of treatment and distribution systems.</td>
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<td>CIVE 427</td>
<td>Design of Wastewater Treatment and Disposal Facilities</td>
<td>CIVE 827</td>
<td>Analysis of systems for wastewater treatment and disposal.</td>
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<td>CIVE 430</td>
<td>Fundamentals of Water Quality Modeling</td>
<td>CIVE 326</td>
<td>Comprehensive study of water quality and the effects of various water pollutants on the aquatic environment; modeling of water quality variables.</td>
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<td>CIVE 431</td>
<td>Small Treatment Systems</td>
<td>Parallel CIVE/BSEN 425</td>
<td>Design of small and decentralized waste water management systems.</td>
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<td>CIVE 432</td>
<td>Bioremediation of Hazardous Wastes</td>
<td>CIVE 326, CIVE/MECH 310</td>
<td>Principles, applications, and limitations of bioremediation of hazardous wastes and design of some bioremediation systems.</td>
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<td>CIVE 434</td>
<td>Soil Mechanics II</td>
<td>CIVE 334</td>
<td>Application of the effective stress principle to shear strength of cohesive soil; analysis of stability of slopes. Development of continuum relationships for soil; solutions for stresses and displacements for an elastic continuum. Solution of the consolidation equation for various initial and boundary conditions.</td>
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<td>CIVE 436</td>
<td>Foundation Engineering</td>
<td>CIVE 334</td>
<td>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.</td>
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CIVE 439 Introduction to Bridge Engineering
Crosslisted with: CIVE 839
Prerequisites: CIVE 440/840 or 441.
Description: Structural types, bridge loads, design of bridge slabs, steel girder bridges, and prestressed concrete girder bridges. Evaluation of existing bridges. Problems related to fatigue and corrosion. Field testing of bridges.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 440 Reinforced Concrete Design I
Crosslisted with: CIVE 840
Prerequisites: CIVE 341.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 441 Steel Design I
Prerequisites: CIVE 341.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 443 Advanced Structural Analysis
Crosslisted with: CIVE 843
Prerequisites: CIVE 341.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 444 Structural Design and Planning
Crosslisted with: CIVE 844
Prerequisites: CIVE 440 and CIVE 441.
Notes: CIVE 844 is not available for graduate credit for civil engineering students.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product

CIVE 446 Steel Design II
Crosslisted with: CIVE 846
Prerequisites: CIVE 441.
Description: 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, introduction to seismic design of steel buildings. Plate buckling, beam, column and beam-column design, and frame stability. Introduction to connection design.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 447 Reinforced Concrete Design II
Crosslisted with: CIVE 847
Prerequisites: CIVE 440/840.
Notes: CIVE 447/847 is a continuation of topics covered in CIVE 440/840.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 452 Water Resources Development
Crosslisted with: CIVE 852
Prerequisites: CIVE 352.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 454 Hydraulic Engineering
Crosslisted with: CIVE 854
Prerequisites: CIVE 352.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 455 Nonpoint Source Pollution Control Engineering
Crosslisted with: BSEN 455, BSEN 855, CIVE 855
Prerequisites: BSEN 326 or CIVE 326; BSEN 350 or AGEN 350 or CIVE 352.
Description: Identification, characterization, and assessment of nonpoint source pollutants; transport mechanisms and remediation technologies; design methodologies and case studies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
CIVE 456 Surface Water Hydrology
Crosslisted with: CIVE 856
Prerequisites: CIVE 352 or CIVE 353/CIVE 853 or permission.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 458 Groundwater Engineering
Crosslisted with: BSEN 458, BSEN 858, CIVE 858
Prerequisites: CIVE 352 or AGEN 350 or BSEN 350 or equivalent.
Description: Application of engineering principles to the movement of groundwater. Analysis and design of wells, well fields, and artificial recharge. Analysis of pollutant movement.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 459 Reliability of Structures
Crosslisted with: CIVE 859
Prerequisites: CIVE 341.
Description: Fundamental concepts related to structural reliability, safety measures, load models, resistance models, system reliability, optimum safety levels, and optimization of design codes.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 461 Urban Transportation Planning
Crosslisted with: CIVE 861
Prerequisites: CIVE 361.
Description: Development of urban transportation planning objectives and goals. Data collection procedures, land use and travel forecasting techniques, trip generation, trip distribution, modal choice analyses, and traffic assignment. Site development and traffic impact analysis.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 462 Highway Design
Crosslisted with: CIVE 862
Prerequisites: CIVE 361
Notes: CIVE 462/862 has an emphasis on design projects.
Description: Design of roadways, intersections, interchanges, parking facilities, and land development site access and circulation. Emphasis on design projects.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 463 Traffic Engineering
Crosslisted with: CIVE 863
Prerequisites: CIVE 361.
Notes: CIVE 463/863 emphasizes design projects.
Description: Design of signalized intersections, arterial street and network signal systems, and freeway control systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 468 Airport Planning and Design
Crosslisted with: CIVE 868
Prerequisites: CIVE 361.
Description: 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 systems, runway system, and air traffic control facilities and airspace. Emphasis on design projects.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 469 Computer-Aided Interchange Design
Crosslisted with: CIVE 869
Prerequisites: CIVE 462/862 or equivalent.
Description: Principles of high-speed traffic operations, safety, and decision making related to critical design parameters used for optimal interchange geometric designs.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 471 Bituminous Materials and Mixtures
Crosslisted with: CIVE 871
Prerequisites: CIVE 378 or equivalent
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 472 Pavement Design and Evaluation
Crosslisted with: CIVE 872
Prerequisites: CIVE 334.
Description: Thickness design of flexible and rigid pavement systems for highways and airports; design of paving materials; evaluation and strengthening of existing pavements.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
CIVE 475 Water Quality Strategy
Crosslisted with: NRES 475, NRES 875, SOCI 475, SOCI 875, SOIL 475, WATS 475, AGRO 475, AGRO 875, CIVE 875, CRPL 475, CRPL 875, GEOL 475, GEOL 875, MSYM 475, MSYM 875, POLS 475, POLS 875
Prerequisites: Senior standing or permission
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product
Groups: American Government&Public Pol

CIVE 476 Construction Cost Controls
Prerequisites: ACCT 306 or 201 and 202
Description: Development of cost accounting principles and financial controls appropriate for construction contractors. Includes purchasing policies and procedures, labor and equipment cost reporting techniques, accounting procedures for control of materials and supplies, billing methods, principles of financial reporting and analysis.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 481 Computational Problem Solving In Civil Engineering
Crosslisted with: CIVE 881
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

CIVE 489 Senior Design Project
Prerequisites: Senior standing and CIVE 385.
Notes: CIVE 489 requires the formulation and completion of a civil engineering design project.
Description: 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.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product

CIVE 489H Honors: Senior Design Project
Prerequisites: Senior standing; parallel CIVE 385; good standing in the University Honors Program or by invitation.
Notes: CIVE 489H requires study beyond the level expected of non-honors section and requires the preparation of a special report.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product

CIVE 498 Special Topics in Civil Engineering
Crosslisted with: CIVE 898
Prerequisites: Permission.
Description: Special problems, topics, or research in civil engineering.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: LEC

CIVE 499H Honors Thesis
Prerequisites: Senior standing in civil engineering and admission in the University Honors Program.
Description: Honors thesis research project meeting the requirements of the University Honors Program. Independent research project executed under the guidance of a member of the faculty of the Department of Civil Engineering which contributes to the advancement of knowledge in the field. Culminates in the presentation of an honors thesis to the Department and College.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 3
Format: IND