

CIVIL ENGINEERING (CIVE)

CIVE 101 Introduction to Civil Engineering

Description: 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.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Prerequisite for: CIVE 102

CIVE 102 Geomatics for Civil Engineering

Prerequisites: CIVE 101

Description: 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.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

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

Grading Option: Graded with Option

CIVE 131 Civil Engineering Graphics

Notes: This course can be used to remove failing grades from CIVE130.

Description: Use of computer-aided design software to communicate engineering ideas. Dimensioning, 2- and 3-D model development, topographic mapping, and process layout with emphasis on Civil Engineering applications.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

CIVE 201 Civil Engineering Analysis I

Prerequisites: CSCE 101

Description: 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.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

CIVE 202 Civil Engineering Analysis II

Prerequisites: Prerequisite CSCE 101 and Corequisite CIVE 378

Description: 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.

Credit Hours: 2

Max credits per semester: 2

Max credits per degree: 2

Grading Option: Graded

CIVE 221 Geometric Control Systems

Prerequisites: MATH 106

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

Grading Option: Graded with Option

Prerequisite for: CIVE 361

Course and Laboratory Fee: \$15

CIVE 301 Civil Engineering Synthesis I

Prerequisites: Corequisite: CIVE 310 or CIVE 361 or CIVE 341

Description: 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.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded

CIVE 302 Civil Engineering Synthesis II

Prerequisites: Corequisite: CIVE 334 or CIVE 352 or CIVE 321

Description: 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.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded

CIVE 310 Fluid Mechanics

Prerequisites: MECH 223, MATH 208 and MATH 221

Description: 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.

Credit Hours: 3

Max credits per semester: 3

Max credits per degree: 3

Grading Option: Graded

Offered: FALL/SPR

Prerequisite for: AGEN 325, BSEN 325; AGEN 344, BSEN 344; AREN 412; CIVE 319; CIVE 352; CIVE 420; ENVE 410; MECH 446

CIVE 310H Honors: Fluid Mechanics

Prerequisites: Good standing in the University Honors Program or by invitation; MECH 223, MATH 208, 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

Grading Option: Graded

Prerequisite for: AGEN 325, BSEN 325; AGEN 344, BSEN 344; AREN 412; CIVE 319; CIVE 352; ENVE 410; MECH 311; MECH 446

CIVE 319 Hydraulics Laboratory

Prerequisites: MECH 310 or CIVE 310 or parallel

Description: Hydraulics experiments and demonstrations. Velocity, pressure and flow measurements; pipe flow, open channel flow; hydraulic structures and machinery, hydrologic and sediment measurements and student projects.

Credit Hours: 1

Max credits per semester: 1

Max credits per degree: 1

Grading Option: Graded with Option

Course and Laboratory Fee: \$15

CIVE 321 Principles of Environmental Engineering

Crosslisted with: BSEN 321

Prerequisites: CHEM 109A & CHEM 109L or CHEM 110A & CHEM 110L or CHEM 113A & CHEM 113L, and MATH 107

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

Grading Option: Graded

Prerequisite for: BSEN 321L, CIVE 321L; CIVE 401; CIVE 420; ENVE 322; ENVE 410; ENVE 430

CIVE 321H Honors: Principles of Environmental Engineering

Crosslisted with: BSEN 321H

Prerequisites: Good standing in the University Honors Program or by invitation: CHEM 109A & CHEM 109L or CHEM 110A & CHEM 110L or CHEM 113A & CHEM 113L, MATH 107

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

Grading Option: Graded

Prerequisite for: BSEN 321L, CIVE 321L; CIVE 401; CIVE 420; ENVE 322; ENVE 410; ENVE 430

CIVE 321L Environmental Engineering Laboratory

Crosslisted with: BSEN 321L

Prerequisites: CIVE 321 or parallel

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

Grading Option: Graded

Course and Laboratory Fee: \$50

CIVE 334 Introduction to Geotechnical Engineering

Prerequisites: MECH 325; 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

Grading Option: Graded with Option

Prerequisite for: CIVE 401

Course and Laboratory Fee: \$15

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

Grading Option: Graded with Option

Prerequisite for: CIVE 401; CIVE 440

Course and Laboratory Fee: \$10

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

Grading Option: Graded with Option

Prerequisite for: CIVE 401

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

Grading Option: Graded with Option

Prerequisite for: CIVE 401

CIVE 378 Materials of Construction**Prerequisites:** MECH 325.**Description:** 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.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$20**CIVE 385 Professional Practice and Management in Civil Engineering****Prerequisites:** Junior standing and CIVE major.**Description:** 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.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CIVE 489; CIVE 489H**CIVE 401 Civil Engineering Design I****Prerequisites:** CIVE 321, CIVE 334, CIVE 341, CIVE 352, and CIVE 361**Description:** 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.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**Prerequisite for:** CIVE 402**CIVE 402 Civil Engineering Design II****Prerequisites:** CIVE 401**Description:** 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.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** FALL/SPR**ACE:** ACE 10 Integrated Product**CIVE 419 Flow Systems Design****Crosslisted with:** CIVE 819**Prerequisites:** CIVE 326 or CIVE 327; parallel CIVE 352.**Description:** Application of hydraulic principles to the design of water distribution systems, wastewater and stormwater collection systems, channelized flow systems, and treatment facilities.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CIVE 420 Environmental Engineering Process Design****Prerequisites:** CIVE/BSEN 321; and CIVE 310 or CHME 332**Description:** Design of unit operations and processes associated with drinking water and wastewater treatment facilities, and other environmental treatment systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**CIVE 422 Pollution Prevention: Principles and Practices****Crosslisted with:** BSEN 422, BSEN 822, CIVE 822**Prerequisites:** Permission**Description:** 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.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CIVE 424 Solid Waste Management Engineering****Crosslisted with:** CIVE 824**Prerequisites:** CIVE 326, CIVE 334.**Description:** Planning, design and operation of solid and waste collection processing, treatment, and disposal systems including materials, resources and energy recovery systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CIVE 426 Design of Water Treatment Facilities****Crosslisted with:** CIVE 826**Prerequisites:** CIVE 420**Description:** Analysis of water supplies and design of treatment and distribution systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CIVE 427 Design of Wastewater Treatment and Disposal Facilities****Crosslisted with:** CIVE 827**Prerequisites:** CIVE 420**Description:** Analysis of systems for wastewater treatment and disposal.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CIVE 430 Fundamentals of Water Quality Modeling****Crosslisted with:** CIVE 830**Prerequisites:** CIVE 326.**Description:** Comprehensive study of water quality and the effects of various water pollutants on the aquatic environment; modeling of water quality variables.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option

CIVE 434 Soil Mechanics II**Crosslisted with:** CIVE 834**Prerequisites:** CIVE 334.

Description: 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.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CIVE 436 Foundation Engineering****Crosslisted with:** CIVE 836**Prerequisites:** CIVE 334.**Notes:** Optional lab CIVE 436L/CIVE 836L.

Description: 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.

Credit Hours: 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CIVE 440 Reinforced Concrete Design I****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**Grading Option:** Graded**Prerequisite for:** CIVE 447, CIVE 847; CIVE 839**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**Grading Option:** Graded with Option**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**Grading Option:** Graded with Option**Prerequisite for:** CIVE 839; CIVE 849**CIVE 444 Structural Design and Planning****Crosslisted with:** CIVE 844**Prerequisites:** CIVE 440 and CIVE 441.

Notes: CIVE 444/844 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**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**CIVE 446 Steel Design II****Crosslisted with:** CIVE 846**Prerequisites:** CIVE 441**Notes:** A continuation of the topics covered in 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**Grading Option:** Graded with Option**CIVE 447 Reinforced Concrete Design II****Crosslisted with:** CIVE 847**Prerequisites:** CIVE 440/840**Notes:** 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**Grading Option:** Graded with Option**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**Grading Option:** Graded with Option

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**Grading Option:** Graded with Option**Prerequisite for:** CIVE 954**CIVE 455 Nonpoint Source Pollution Control Engineering****Crosslisted with:** BSEN 455, BSEN 855, CIVE 855**Prerequisites:** BSEN 326/CIVE 326 or BSEN 355; AGEN/BSEN 350 or CIVE 352 as prerequisite or parallel.**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**Grading Option:** Graded with Option**Offered:** FALL**CIVE 456 Surface Water Hydrology****Crosslisted with:** CIVE 856**Prerequisites:** CIVE 352**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**Grading Option:** Graded with Option**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**Grading Option:** Graded with Option**Prerequisite for:** AGEN 955, AGRO 955, CIVE 955, GEOL 985**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**Grading Option:** Graded with Option**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**Grading Option:** Graded with Option**Prerequisite for:** CIVE 864**CIVE 462 Highway Design****Crosslisted with:** CIVE 862**Prerequisites:** CIVE 361**Notes:** 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**Grading Option:** Graded with Option**Prerequisite for:** CIVE 865**CIVE 463 Traffic Engineering****Crosslisted with:** CIVE 863**Prerequisites:** CIVE 361**Notes:** 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**Grading Option:** Graded with Option**Prerequisite for:** CIVE 866**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**Grading Option:** Graded with Option

CIVE 471 Bituminous Materials and Mixtures**Crosslisted with:** CIVE 871**Prerequisites:** CIVE 378

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**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$15**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**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$30**CIVE 475 Water Quality Strategy**

Crosslisted with: NRES 475, NRES 875, SOCI 475, SOCI 875, SOIL 475, WATS 475, PLAS 475, AGRO 875, CIVE 875, CRPL 475, CRPL 875, GEOL 475, GEOL 875, MSYM 475, MSYM 875, POLS 475, POLS 875

Prerequisites: Senior standing.**Notes:** Capstone course.

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**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**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**Grading Option:** Graded**CIVE 481 Computational Problem Solving In Civil Engineering****Crosslisted with:** CIVE 881**Prerequisites:** MATH 221 and CSCE 155A or 155E or 155H or 155N.

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**Grading Option:** Graded with Option**Offered:** FALL/SPR**CIVE 489 Senior Design Project****Prerequisites:** Senior standing and CIVE 385.

Notes: 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**Grading Option:** Graded with Option**ACE:** ACE 10 Integrated Product**Course and Laboratory Fee:** \$15**CIVE 489H Honors: Senior Design Project**

Prerequisites: Senior standing; parallel CIVE 385; good standing in the University Honors Program or by invitation.

Notes: 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**Grading Option:** Graded**ACE:** ACE 10 Integrated Product**Course and Laboratory Fee:** \$15**CIVE 491 Special Topics in Civil Engineering****Prerequisites:** Permission

Description: Special topics in emerging areas of civil engineering which may not be covered in other courses in the civil engineering curriculum.

Credit Hours: 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 12**Grading Option:** Graded

CIVE 494 Independent Study in Civil Engineering

Prerequisites: Permission

Description: 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.

Credit Hours: 1-3

Min credits per semester: 1

Max credits per semester: 3

Max credits per degree: 9

Grading Option: Graded with Option

CIVE 498 Independent Research in Civil Engineering

Prerequisites: Permission.

Description: 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.

Credit Hours: 1-6

Min credits per semester: 1

Max credits per semester: 6

Max credits per degree: 6

Grading Option: Graded with Option

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

Grading Option: Graded