

# CIVIL ENGINEERING (CIVE)

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## CIVE 819 Flow Systems Design

**Crosslisted with:** CIVE 419

**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:** Grade Pass/No Pass Option

## CIVE 822 Pollution Prevention: Principles and Practices

**Crosslisted with:** BSEN 422, BSEN 822, CIVE 422

**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:** Grade Pass/No Pass Option

## CIVE 823 Physical and Chemical Treatment Processes in Environmental Engineering

**Prerequisites:** CIVE 420

**Description:** Evaluation and analysis of physical and chemical unit operations and processes applied to the treatment of water, wastewater, and hazardous wastes.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

## CIVE 824 Solid Waste Management Engineering

**Crosslisted with:** CIVE 424

**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:** Grade Pass/No Pass Option

## CIVE 826 Design of Water Treatment Facilities

**Crosslisted with:** CIVE 426

**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:** Grade Pass/No Pass Option

## CIVE 827 Design of Wastewater Treatment and Disposal Facilities

**Crosslisted with:** CIVE 427

**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:** Grade Pass/No Pass Option

## CIVE 828 Environmental Engineering Chemistry

**Prerequisites:** CIVE 326

**Description:** Basic concepts from general chemistry. Thermodynamic and kinetic basis for the composition of aquatic systems. Equilibrium chemistry, including acid-base reactions, reduction-oxidation reactions, metal speciation and precipitation, and gas/liquid partitioning.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**Offered:** FALL

## CIVE 829 Biological Waste Treatment

**Prerequisites:** CIVE 326

**Description:** Principles of biological processes and their application in the design of waste treatment systems.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

## CIVE 830 Fundamentals of Water Quality Modeling

**Crosslisted with:** CIVE 430

**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:** Grade Pass/No Pass Option

## CIVE 834 Soil Mechanics II

**Crosslisted with:** CIVE 434

**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:** Grade Pass/No Pass Option

**CIVE 836 Foundation Engineering**

**Crosslisted with:** CIVE 436

**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:** Grade Pass/No Pass Option

**CIVE 839 Introduction to Bridge Engineering**

**Prerequisites:** CIVE 440/840, CIVE 441, CIVE 443/843; CIVE 850 or parallel

**Notes:** CIVE 850 co-requisite.

**Description:** Types of Bridges, Site Design Overview, Highway Bridge Loading, Bridge Analysis, Bridge Deck Slabs, Prestressed Concrete Bridge Design, Steel Bridge Design, Substructure Design, Fatigue and Bridge Rating.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**Offered:** FALL/SPR

**CIVE 842 Structural Dynamics**

**Prerequisites:** CIVE 443

**Description:** Concepts of Newtonian and Lagrangian mechanics for dynamical systems. Free and forced vibration of linear single-degree-of-freedom systems and multiple degree-of-freedom systems. Harmonic, periodic, pulse, arbitrary, and earthquake response. Numerical evaluation of dynamic response and linear response spectrum concepts. Introduction to non-linear system response. Dynamic response of continuous beams.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**Prerequisite for:** CIVE 945; CIVE 948

**CIVE 843 Advanced Structural Analysis**

**Crosslisted with:** CIVE 443

**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:** Grade Pass/No Pass Option

**Prerequisite for:** CIVE 839; CIVE 849

**CIVE 844 Structural Design and Planning**

**Crosslisted with:** CIVE 444

**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:** Grade Pass/No Pass Option

**CIVE 846 Steel Design II**

**Crosslisted with:** CIVE 446

**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:** Grade Pass/No Pass Option

**CIVE 847 Reinforced Concrete Design II**

**Crosslisted with:** CIVE 447

**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:** Grade Pass/No Pass Option

**CIVE 849 Introductory Finite Element Analysis in Solid Mechanics**

**Prerequisites:** CIVE 443/843

**Description:** Matrix methods of analysis. The finite element stiffness method with a focus on solid mechanics. Isoparametric elements formulation based on energy principles. Perform finite element analyses using commercial software.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**Offered:** FALL/SPR

**Course and Laboratory Fee:** \$25

**CIVE 850 Prestressed Concrete****Prerequisites:** CIVE 341 and CIVE 440**Description:** Analysis and design of prestressed concrete members. Axial force, bending, shear, torsion, prestress losses, initial and long-term deflection, partial prestressing, statically indeterminate structures.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Prerequisite for:** CIVE 839**CIVE 852 Water Resources Development****Crosslisted with:** CIVE 452**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:** Grade Pass/No Pass Option**CIVE 853 GIS in Water Resources****Prerequisites:** Graduate standing in Engineering or a related discipline in Natural Resources or Earth Science**Description:** Familiarization with a wide range of spatial information and used in hydrologic and water resources analysis. Development of expertise in GIS systems, especially ArcGIS. Digital mapping and analysis of water resources information. Hydrologic terrain analysis using digital elevation models. Integration of time series and geospatial data. Hydrologic Information Systems. River and watershed networks. Evapotranspiration, Precipitation (PRISM), Soil, and Landuse maps, and databases. Use of Remote Sensing tools.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 854 Hydraulic Engineering****Crosslisted with:** CIVE 454**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:** Grade Pass/No Pass Option**Prerequisite for:** CIVE 954**CIVE 855 Nonpoint Source Pollution Control Engineering****Crosslisted with:** BSEN 455, BSEN 855, CIVE 455**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:** Grade Pass/No Pass Option**Offered:** FALL**CIVE 856 Surface Water Hydrology****Crosslisted with:** CIVE 456**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:** Grade Pass/No Pass Option**CIVE 857 Applied Structural Analysis****Prerequisites:** CIVE 851**Description:** Review of basic concepts. Mesh generation using a preprocessor. 2D and 3D Model generation. Boundary conditions. Implicit and explicit solution algorithms. Interpretation of analysis results using a post-processor. Solution of problems using existing FE software.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 858 Groundwater Engineering****Crosslisted with:** BSEN 458, BSEN 858, CIVE 458**Prerequisites:** CIVE 352 or AGEN 350 or BSEN 350**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:** Grade Pass/No Pass Option**Prerequisite for:** AGEN 955, AGRO 955, CIVE 955, GEOL 985**CIVE 859 Reliability of Structures****Crosslisted with:** CIVE 459**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:** Grade Pass/No Pass Option

**CIVE 861 Urban Transportation Planning****Crosslisted with:** CIVE 461**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:** Grade Pass/No Pass Option**Prerequisite for:** CIVE 864**CIVE 862 Highway Design****Crosslisted with:** CIVE 462**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:** Grade Pass/No Pass Option**Prerequisite for:** CIVE 865**CIVE 863 Traffic Engineering****Crosslisted with:** CIVE 463**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:** Grade Pass/No Pass Option**Prerequisite for:** CIVE 866**CIVE 864 Analysis and Estimation of Transportation Demand****Prerequisites:** CIVE 461/861**Description:** Introduction to conceptual, methodological, and mathematical foundations of analysis and design of transportation services. Review of probabilistic modeling. Application of discrete choice models to demand analysis.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 865 Highway Geometrics****Prerequisites:** CIVE 462/862**Description:** Principles of highway geometrics. Sight distance, design vehicles, vehicle characteristics, horizontal and vertical alignment, cross section elements, and at-grade intersections and interchanges.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 866 Transportation Characteristics****Prerequisites:** CIVE 463/863 and MATH/STAT 380**Description:** Use of the concepts of volume, speed, density, and capacity to describe the characteristics and performance of surface, air, and water transportation systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Prerequisite for:** CIVE 964**CIVE 867 Transportation Safety Engineering****Prerequisites:** Permission**Description:** Safety criteria in the planning, design, and operation phases of highway, rail, airport, mass transit, pipeline, and waterway transportation systems. Background of safety legislation and funding requirements. Identification of high accident locations and methods to determine cost/effectiveness of improvements.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 868 Airport Planning and Design****Crosslisted with:** CIVE 468**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:** Grade Pass/No Pass Option**CIVE 871 Bituminous Materials and Mixtures****Crosslisted with:** CIVE 471**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:** Grade Pass/No Pass Option**Course and Laboratory Fee:** \$15**CIVE 872 Pavement Design and Evaluation****Crosslisted with:** CIVE 472**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:** Grade Pass/No Pass Option**Course and Laboratory Fee:** \$30

**CIVE 875 Water Quality Strategy**

**Crosslisted with:** NRES 475, NRES 875, SOCI 475, SOCI 875, SOIL 475, WATS 475, PLAS 475, AGRO 875, CIVE 475, 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:** Grade Pass/No Pass Option

**CIVE 880 Engineering Economy**

**Prerequisites:** Permission

**Description:** Economic comparison of engineering alternatives. Equipment selection and replacement, depreciation, break-even points, and minimum-cost points.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Grade Pass/No Pass Option

**CIVE 881 Computational Problem Solving In Civil Engineering**

**Crosslisted with:** CIVE 481

**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:** Grade Pass/No Pass Option

**CIVE 891 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 894 Independent Study in Civil Engineering**

**Prerequisites:** Permission

**Description:** Individual study at the masters 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:** Grade Pass/No Pass Option

**CIVE 898 Independent Research in Civil Engineering**

**Prerequisites:** Permission

**Description:** Independent research work and written findings, other than thesis or dissertation work, in a selected area of civil and environmental 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

**CIVE 899 Masters Thesis**

**Prerequisites:** Admission to masters degree program and permission of major adviser

**Credit Hours:** 1-10

**Min credits per semester:** 1

**Max credits per semester:** 10

**Max credits per degree:** 99

**Grading Option:** Grade Pass/No Pass Option

**CIVE 916 Environmental Law and Water Resource Management Seminar**

**Crosslisted with:** NRES 916

**Prerequisites:** Permission

**Description:** An interdisciplinary seminar with the Department of Civil Engineering. Contemporary environmental issues and water resource management.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**CIVE 945 Structural Analysis and Design for Dynamic Loads**

**Prerequisites:** CIVE 443/843 and CIVE 842

**Description:** Behavior of structural materials and systems under dynamic loads. Analysis and design for dynamic loads. Computational and analytical techniques. Selected laboratory demonstrations of the dynamic behavior of structural systems.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**CIVE 948 Blast-resistant Structural Design**

**Prerequisites:** CIVE 842

**Description:** Introduction to explosion effects. Air-blast. Fragmentation. Single-Degree-of-Freedom (SDOF) analysis. Equivalent SDOF systems. Pressure-impulse diagrams. Energy solutions. Steel design. Reinforced concrete design. Masonry design. Progressive collapse. Windows and doors.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**CIVE 954 Advanced Hydraulics**

**Prerequisites:** CIVE 854 and permission

**Description:** Advanced studies involving pipe and culvert hydraulics, rapidly-varied flow in open channels, sediment transport, river mechanics, control, and design.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option



**CIVE 955 Solute Movement in Soils****Crosslisted with:** AGEN 955, AGRO 955, GEOL 985**Prerequisites:** MATH 208; AGRO 861 or GEOL 888 or MSYM 852 or CIVE 858**Description:** Examination of the theory and experimental evidence available to characterize the movement of chemicals in soil. Both saturated and unsaturated flow conditions examined. Initial presentation of basic theoretical concepts. Remainder of class a discussion of the literature.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 957 Modeling Vadose Zone Hydrology****Crosslisted with:** AGEN 957, BSEN 957, GEOL 957**Prerequisites:** MATH 221/821 or equivalent. AGEN/BSEN 350 or NRES 453/853 or equivalent.**Notes:** Typically offered spring semester in even years.**Description:** Principles and modeling of fluid flow and solute transport in the vadose zone. Topics include hydraulic properties of variably saturated media, application of Darcy's Law in variably saturated media, hydrologic and transport processes in the vadose zone, and solution of steady and unsteady flow problems using numerical techniques including finite element methods. Contemporary vadose zone models will be applied to engineering flow and transport problems. Review and synthesis of classic and contemporary research literature on vadose zone hydrology will be embedded in the course.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**Offered:** SPRING**CIVE 958 Contaminant Transport in Porous Media****Prerequisites:** Permission.**Description:** Theory of flow and contaminant transport in porous media including groundwater flow, multiphase flow, equilibrium contaminant distribution, reactive transport of contaminants, and colloid transport in porous media.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 961 Mass Transit Systems****Prerequisites:** Permission**Description:** The place of mass transit in solving urban transportation problems: transit system and terminal characteristics and planning criteria. Speed, capacity, accessibility, and operation of mass transit systems. Future prospects in transit technology and case studies of existing systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 962 Application of Geographic Information Systems GIS to Transportation****Prerequisites:** Permission.**Description:** Geographic Information Systems (GIS) structure, functions, and concepts such as spatial data models, relational databases, and spatial analyses. GIS project planning, management, and applications to transportation-related issues.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 963 Highway Safety Data Analysis****Prerequisites:** STAT 801A and permission**Description:** Highway safety issues and appropriate accident data analyses. Quantify changes in safety when modifications are made to highways in an effort to enhance safety. Judge reported safety improvements and carry out appropriate analyses for assessing the effectiveness of safety improvements.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 964 Theory of Traffic Flow****Prerequisites:** STAT 801A and CIVE 866**Description:** Analysis of traffic characteristics as applied to traffic engineering facility design and flow optimization. Capacity of expressways, ramps, weaving sections, and intersections. Analytical approaches to flow analysis, queueing theory, flow density relationships, and traffic simulation.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 965 Traffic Control Systems****Prerequisites:** Permission**Description:** Principles of traffic control. Design an analysis of intersection, arterial street, network, and freeway control systems. Traffic surveillance and driver information systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 966 Transportation Planning and Economics****Prerequisites:** Permission.**Description:** Community growth and development based on planning decisions regarding land use whereby transportation facilities are fitted to land use. Economic studies that consider the consequences to transportation agencies, users, and nonusers. Agency expenditures, capital outlay and annual expenses for maintenance and operations. User consequences such as vehicle operating costs; commercial time costs; accident costs; discomfort and inconvenience costs; and assignment of money valuations to pleasure, recreation, and culture. Nonusers consequences such as cost reductions or increases in public services; increases in value of crops and natural resources where areas become more readily accessible; changes in business and industrial activities; and increase or decrease of residential property values.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option

**CIVE 967 Analysis and Design of Transportation Supply Systems****Prerequisites:** Permission**Description:** Operations research techniques for modeling system performance and design of transportation services. Routing and scheduling problems. Network equilibration and partially distributed queuing systems.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 990 Civil Engineering Seminar****Description:** Frontiers of an area of civil engineering.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 6**Grading Option:** Grade Pass/No Pass Option**CIVE 990E Civil Engineering Seminar in Environmental Engineering****Description:** Frontiers of an area of environmental engineering.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 6**Grading Option:** Graded**CIVE 990M Civil Engineering Seminar in Geotechnical and Materials Engineering****Description:** Frontiers of an area of geotechnical and materials engineering.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 6**Grading Option:** Grade Pass/No Pass Option**CIVE 990R Civil Engineering Seminar in Structural Engineering****Description:** Frontiers of an area of structural engineering.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 6**Grading Option:** Grade Pass/No Pass Option**CIVE 990T Civil Engineering Seminar in Transportation Engineering****Description:** Frontiers of an area of transportation engineering.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 6**Grading Option:** Grade Pass/No Pass Option**CIVE 990W Civil Engineering Seminar in Water Resources Engineering****Description:** Frontiers of an area of water resources engineering.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 6**Grading Option:** Grade Pass/No Pass Option**CIVE 991 Advanced Special Topics in Civil Engineering****Prerequisites:** Permission**Description:** Advanced special topics in emerging areas of civil and environmental 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 994 Advanced Independent Study in Civil Engineering****Prerequisites:** Permission**Description:** Advanced individual study at the doctoral 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:** 3**Grading Option:** Grade Pass/No Pass Option**CIVE 998 Advanced Independent Research in Civil Engineering****Prerequisites:** Permission**Description:** Advanced independent research work and written findings, other than thesis or dissertation work, 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:** Grade Pass/No Pass Option**CIVE 999 Doctoral Dissertation****Prerequisites:** Admission to doctoral degree program and permission of supervisory committee chair**Credit Hours:** 1-24**Min credits per semester:** 1**Max credits per semester:** 24**Max credits per degree:** 99**Grading Option:** Grade Pass/No Pass Option