CIVIL ENGINEERING (C E)

C E 508 - Advanced Soil Mechanics (3.0 hours)
Consolidation theory and settlements, stress-path method, strength and deformation behavior of soils, failure theories, confined flow, flow nets, numerical analysis of flow, unconfined flow, seepage through earth dams. Laboratory experiments on consolidation and shear strength.
Prerequisite: C E 350; or graduate standing.

C E 515 - Advanced Foundation Engineering (3.0 hours)
Advanced pile capacity formulations, buckling, and lateral loading. Mat foundations, finite difference solutions. Foundations on difficult soils. Slope stability; stability of earth dams. Excavations; geotechnical instrumentation.
Prerequisite: C E 422; or graduate standing.

C E 520 - Advanced Numerical Methods (3.0 hours)
Selected numerical methods and applications chosen to meet current needs for solving problems in civil engineering.
Prerequisite: C E 210; or graduate standing.

C E 541 - Pollution Modeling (3.0 hours)
Phenomena that affect mass balance of contaminants in environmental systems. Advection, diffusion, dispersion, and interfacial mass transfer. Physical, chemical, and biological descriptions of these processes with mathematical models. Solutions to these models with illustrations from reactor engineering and surface water quality modeling. Application to actual process reactor.
Prerequisite: C E 360; or graduate standing.

C E 542 - Advanced Water Treatment (3.0 hours)
Design of physical and chemical unit processes and unit operations with an emphasis on water treatment. Design of aeration systems, coagulation and flocculation processes, sedimentation tanks, filtration systems, chemical precipitation processes, ion exchange processes, and disinfection processes. Advanced purification methods including adsorption, reverse osmosis, electro-dialysis, and membrane processes. Treatment and disposal of physiochemical process sludges.
Prerequisite: C E 360; or graduate standing.

C E 543 - Advanced Wastewater Treatment (3.0 hours)
Application of concepts from microbiology and biology to environmental engineering systems. Detailed integrated design of waste water treatment. Microbiology of waste water treatment processes and soil bioremediation processes. Interaction between biogeochemical phenomena and microbial processes in an environmental engineering context.
Prerequisite: C E 360; or graduate standing.

C E 546 - Groundwater Hydrology (3.0 hours)
Groundwater in the hydrological cycle, fundamentals of groundwater flow; flow net analysis; steady-state and transient well testing techniques for parameter estimation; multiple well systems; leaky aquifers; sea water intrusion; groundwater investigation; artificial recharge of aquifers, design of wells; subsidence and lateral movement of land surface due to groundwater pumping. Design and computer applications.
Prerequisite: C E 260, or graduate standing.

C E 555 - Sustainability and Environmental Regulations (3.0 hours)
Sustainability as it is expressed in environmental regulations and policies for conventional and hazardous wastes in air, water, and groundwater. Toxicological, risk assessment, risk-based engineering, and regulatory aspects for the sustainable management of all types of waste.
Prerequisite: C E 360 or CON 352; or graduate standing.

C E 558 - Solid Waste Management (3.0 hours)
Sources, composition, and properties of solid waste. Transport of solid wastes and design of transfer stations. Separation, transformation, and recycling of waste materials. Landfill siting. Leachate generation, collection, and removal systems. Liner system design. Landfill settlement and stability analysis. Accelerated treatment of solid waste. Methane recovery from landfills. Closure, restoration, and rehabilitation of landfills. Case studies.
Prerequisite: C E 350 or CON 320; or graduate standing.

C E 560 - Advanced Structural Analysis (3.0 hours)
Direct stiffness method for the analysis of two-dimensional trusses and frames, equivalent nodal forces, thermal and settlement effects, principle of virtual work, space trusses, grid structures, static condensation, Lagrange multipliers, tapered elements.
Prerequisite: C E 210 and C E 359; or graduate standing.

C E 562 - Advanced Steel Design (3.0 hours)
Structural framing systems; rigid frame design; design of bracing; design of simple rigid and moment resisting connections; torsion of steel open sections; design of beams subjected to torsion; design of steel plate girders; design of composite beams.
Prerequisite: C E 442; or graduate standing.

C E 565 - Advanced Concrete Design (3.0 hours)
Advanced topics in flexural design; torsion in beams; behavior and design of slender columns; biaxial bending of columns; design of two-way slabs; behavior and design of frame-wall structural systems; inelastic analysis of flexural members; use of strut and tie analysis; yield line analysis; design of mat foundations.
Prerequisite: C E 365; or graduate standing.

C E 567 - Prestressed Concrete Design (3.0 hours)
Theory and analysis of prestressed concrete members by various methods of prestressing; design of simple and continuous beams and slabs; prestress losses; composite beams. Extensive study of materials used in prestressed concrete. Precast concrete systems.
Prerequisite: C E 365; or graduate standing.

C E 570 - Advanced Mechanics of Materials (3.0 hours)
Two- and three-dimensional stress and strain at a point; two-dimensional elasticity; beams on elastic foundations; torsion of noncircular sections; curved beams; unsymmetrical bending; plastic collapse and limit analysis.
Prerequisite: C E 270; or graduate standing.

C E 575 - Structural Dynamics (3.0 hours)
Single degree of freedom systems; multi-degree of freedom systems; lumped mass and consistent mass-MDOF beams; free and forced vibrations; earthquake loading; impact and impulsive loads; numerical procedures.
Prerequisite: C E 210 and C E 359; or graduate standing.

C E 577 - Seismic Design (3.0 hours)
Theory, analysis, and design of building structures under earthquake loading. Application of current codes and standards related to steel, concrete, masonry, and wood structures.
Prerequisite: C E 365 and C E 442; or graduate standing.

C E 580 - Highway Safety (3.0 hours)
Safety aspects of streets and highways; planning, implementation, and evaluation of highway safety improvement projects and programs. Highway risk analysis and risk management systems.
Prerequisite: C E 310 and C E 480; or graduate standing.

C E 582 - Traffic Flow Theory (3.0 hours)
Traffic flow theories and applications in the design, development and operation of transportation systems, macroscopic and microscopic models of traffic flow, mathematical distributions of traffic events, car following theory, shock wave analysis, queuing analysis.
Prerequisite: C E 480 and C E 310; or graduate standing.

C E 583 - Geometric Highway Design (3.0 hours)
Application of standards, theory, and practice in design of streets and highways. Design of streets and highways including cross section elements, shoulder, and roadside features.
Prerequisite: C E 480; or graduate standing.

C E 584 - Urban Transportation Planning (3.0 hours)
Planning and analysis of urban transportation; travel demand models including trip generation, trip distribution, mode choice and traffic assignment; land use planning, site impact analysis and traffic impact studies for proposed developments, and context sensitive solutions.
Prerequisite: C E 480; or graduate standing.

C E 585 - Pavement Management Systems (3.0 hours)
Distresses in pavements, assessment of asphalt (flexible) and concrete (rigid) pavements, performance tests of pavement materials, material characterization to maintain and rehabilitate pavements, pavement maintenance and rehabilitation methods, life cycle cost analysis of pavement maintenance and rehabilitation.
Prerequisite: C E 356; or graduate standing.

C E 586 - Advanced Pavement Design (3.0 hours)
Materials characterization for pavement, base, and subgrade; traffic load analysis to design pavement; structural design of flexible (asphalt), rigid (concrete) and composite pavements; pavement distress evaluation and rehabilitation.
Prerequisite: C E 356; or graduate standing.

C E 587 - Traffic Signal Design (3.0 hours)
Analysis and design of traffic signals for isolated intersections and coordinated systems. Hardware, communication, and detection systems associated with signal systems. Fundamental concepts of simulation of traffic operations. Application of optimization/simulation computer software programs.
Prerequisite: C E 480; or graduate standing.

C E 588 - Transportation Economics (3.0 hours)
Application of engineering economy for transportation systems; analysis of congestion costs, highway transportation costs, and road user consequences. Identification and measurement of highway benefits, concepts of value and time, and willingness to pay; discount rate and vest charge; concepts of depreciation and service life; life cycle cost analysis; evaluation of transportation alternatives and evaluation of completed projects/programs.
Prerequisite: C E 394; or graduate standing.

C E 591 - Advanced Topics I (1.0-3.0 hours)
Topics of special interest, which may vary each time course is offered. Topic stated in current Schedule of Classes.
Prerequisite: Consent of department chair.

C E 592 - Advanced Topics II (1.0-3.0 hours)
Topics of special interest, which may vary each time course is offered. Topic stated in current Schedule of Classes.
Prerequisite: Consent of department chair.

C E 593 - Advanced Project I (1.0-3.0 hours)
Supervised individual study of civil engineering and construction projects.
Prerequisite: Consent of department chair.

C E 594 - Advanced Project II (1.0-3.0 hours)
Supervised individual study of civil engineering and construction projects.
Prerequisite: Consent of department chair.

C E 650 - Site Remediation (3.0 hours)
Preliminary studies and engineering design of various treatment technologies used for remediation of contaminated soil and groundwater. Brownfield remediation. Soil composition and behavior, development and movement of groundwater. Soil sampling and monitoring of contaminants in groundwater. Drilling techniques based on soil type. Processes affecting the distribution of inorganic and organic pollutants in the environment, exchange among soil, water, sediment, and biota.
Prerequisite: C E 350 and C E 360; or graduate standing.

C E 655 - Environmental Management Modeling (3.0 hours)
Development, solution, and interpretation of management models used in environmental planning and water resource systems. Risk analysis and management. Risk and how its various aspects influence environmental regulations and policy. Decision making with risk including risk-based design. Environmental impact assessment. Water resource allocation decisions.
Prerequisite: C E 360; or graduate standing.

C E 691 - Advanced Graduate Topics I (3.0 hours)
Advanced topics of special interest in civil engineering and construction which may vary each time course is offered. Topic stated in current Schedule of Classes
Prerequisite: Consent of department chair

C E 692 - Advanced Graduate Topics II (3.0 hours)
Advanced topics of special interest in civil engineering and construction which may vary each time course is offered. Topic stated in current Schedule of Classes
Prerequisite: Consent of department chair

C E 699 - Thesis (0.0-6.0 hours)
Research on a topic selected by the student and approved by the chair. Repeatable to a maximum of six hours total.
Prerequisite: Consent of department chair