CIVIL AND ENVIRONMENTAL ENGINEERING (CIV ENGR)

CIV ENGR 1 – COOPERATIVE EDUCATION PROGRAM
1 credit.

Work experience which combines classroom theory with practical knowledge of operations to provide students with a background upon which to base a professional career.
Requisites: Sophomore standing
Course Designation: Workplace - Workplace Experience Course
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 150 – INTRODUCTION TO ARCHITECTURAL THEORY
3 credits.

A survey of architectural design theory through research analysis and criticism of works and ideas of significant architects and architectural theorists.
Requisites: None
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 151 – ARCHITECTURAL MAKING I
3 credits.

Introduction to architecture and architectural making. 2D and 3D form and space tested through the theoretical, pragmatic, and contextual issues that influence architecture.
Requisites: None
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 152 – ARCHITECTURAL MAKING II
3 credits.

Survey and application of twentieth century design techniques in architecture.
Requisites: None
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 155 – ARCHITECTURAL THINKING
3 credits.

Canonical buildings since 1800 alongside their accompanying theoretical texts are evaluated within the discipline and allied fields of inquiry.
Requisites: None
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 159 – CIVIL ENGINEERING GRAPHICS
2 credits.

Graphical communication including lettering, drawing equipment and techniques; geometric constructions, orthographic projections, technical sketching, isometric views, descriptive geometry, and computer-aided design drawing, with applications specific to civil engineering.
Requisites: Not open to students with credit for M E 170.
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 250 – ARCHITECTURAL VISUALIZATION
3 credits.

Development of precise standards of drawing and the history and techniques of descriptive and analytical drawing.
Requisites: None
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/G L E 291 – PROBLEM SOLVING USING COMPUTER TOOLS
4 credits.

Introduction to engineering computations with emphasis on computer tools and computer based measurement, data collection, and processing. Tools will include computer aided design, spreadsheets, other engineering computation tools, and hardware and software for laboratory and spatial measurements.
Requisites: MATH 222, 276, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 299 – INDEPENDENT STUDY
1-3 credits.

Under faculty supervision.
Requisites: Consent of instructor
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2016

CIV ENGR 310 – FLUID MECHANICS
3 credits.

Fluid statics and dynamics, dimensional analysis, flow of an ideal fluid, flow of a real fluid--including laminar and turbulent flow, applications to engineering problems.
Requisites: (MATH 234 or 375) and (E M A 202 or M E 240), graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 311 – HYDROSCIENCE
3 credits.

Introduction to the water cycle, its relationship to the environment and human attempts to conserve, control, and utilize water judiciously. Fundamentals of hydrology, hydraulics, coastal engineering and water resources engineering.
Requisites: MATH 222, 276, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 320 – ENVIRONMENTAL ENGINEERING
3 credits.

Fundamental sanitary aspects of environmental engineering. Role of the engineer in the control of the environment; water supply and wastewater problems; solid waste disposal; air pollution; and administration in environmental engineering.
Requisites: CHEM 104, 109, 116, graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 322 – ENVIRONMENTAL ENGINEERING PROCESSES
3 credits.

Combination of theory and laboratory practice to study basic unit operations and processes in environmental engineering. Emphasis on water and wastewater treatment processes, such as coagulation/flocculation, chemical precipitation, filtration, adsorption, activated sludge, anaerobic digestion, and substrate utilization kinetics.
Requisites: CIV ENGR 320, CBE 250, BSE 249, graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 324 – ENVIRONMENTAL ENGINEERING THERMODYNAMICS
3 credits.

A systematic introduction to the application of the first and second laws of thermodynamics to systems relevant to environmental engineering. Energy balances used to solve environmental engineering problems in flowing and non-flowing systems. Examines the relationship between energy, heat and work using theoretical and practical models. Chemical reactions as well as gas and fluid mixing from a thermodynamics perspective. Performance limits imposed by the second law of thermodynamics on devices used in power generation, fluid flow, refrigeration, and air conditioning.
Requisites: (CHEM 104 or 109), MATH 234, and (E M A 201, PHYSICS 201 or 207), or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 325 – ENVIRONMENTAL ENGINEERING MATERIALS
3 credits.

Properties and tests of materials used in the treatment and conveyance of water and air. Introduction to laboratory and field measurement techniques to assess material performance capabilities. Technical report preparation.
Requisites: CIV ENGR 320 and E M A 201, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E 330 – SOIL MECHANICS
3 credits.

Basic principles of soil mechanics and fundamentals of application in engineering practice; soil composition and texture; classification; permeability and seepage; consolidation; settlement; shear strength; lateral earth pressures and retaining structures, shallow and deep foundations, slope stability; subsurface exploration; laboratory characterization of physical and engineering properties of soils.
Requisites: E M A 303 or M E 306, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 340 – STRUCTURAL ANALYSIS I
3 credits.

Analysis of statically determinate and indeterminate beams, trusses, and rigid frames; deflections by virtual-work, moment-area; influence lines; force methods; structural design loads, introduction to structural design, approximate methods.
Requisites: (E M A 303 or M E 306) and M E/E M A 307, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 352 – FRANK LLOYD WRIGHT - DESIGN SEMINAR
3 credits.

Introduction to the design language of Frank Lloyd Wright. Beginning understanding of his architectural design process, his methods, tools and processes in building design and construction.
Requisites: None
Repeatable for Credit: No
Last Taught: Spring 2023

CIV ENGR 360 – CONSTRUCTION SYSTEMS
3 credits.

Introduction to the parts and pieces of a building at the construction level. How a building is built from start to finish, and how the individual building systems affect one another. Systems, how they interact, design and construction, cost implications, schedule implications.
Requisites: E M A 201, PHYSICS 201, 207, 247, graduate/professional standing, or member of Engineering Guest Students. Not open to students with credit in CIV ENGR 290.
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

CIV ENGR 370 – TRANSPORTATION ENGINEERING
3 credits.

Characteristics of transportation supply and demand; measuring and estimating demand; social and environmental impacts; planning of transportation systems; characteristics of transportation modes; interaction between modes; mode interfaces; transportation technology; economics; public policy, implementation and management.
Requisites: STAT 311, 324 or concurrent enrollment, graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/BSE/SOIL SCI 372 – ON-SITE WASTE WATER TREATMENT AND DISPERSAL
2 credits.

On-site treatment and dispersal of waste water from homes, commercial sources and small communities. Sources, pretreatment units, nutrient removal units, constructed wetlands, surface and soil dispersal systems, recycle and reuse systems, regulations, alternative collection systems.
Requisites: CHEM 103, 109, or 115
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/ENVIR ST/GEOG 377 – AN INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEMS
4 credits.

Design, implementation and use of automated procedures for storage, analysis and display of spatial information. Covers data bases, information manipulation and display techniques, software systems and management issues. Case studies.
Requisites: Sophomore standing, member of Engineering Guest Students, or declared in Capstone Certificate in GIS Fundamentals
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 392 – BUILDING INFORMATION MODELING (BIM)
3 credits.

An introduction to the use of Building Information Modeling (BIM) technology in the construction industry. Gain experience in using 3D 4D modeling software to model and coordinate building designs.
Requisites: CIV ENGR 159, M E 160, 231, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/E M A 395 – MATERIALS FOR CONSTRUCTED FACILITIES
3 credits.

Properties and tests of materials used in the initial construction or repair of facilities (including buildings, transportation systems, utility systems, and reinforced earth). Introduction to laboratory and field measurement techniques to assess material performance capabilities. Technical report preparation.
Requisites: (E M A 303 or M E 306), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 410 – HYDRAULIC ENGINEERING
3 credits.

Engineering approaches to measurement, control and conveyance of water and wastewater flows, emphasizing analysis, design, characteristics and selection of: measurement devices, distribution and collection pipe systems, and pumps and turbines with consideration of plant, quality, economic, reliability, and security aspects.
Requisites: CIV ENGR 310, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

CIV ENGR 411 – OPEN CHANNEL HYDRAULICS
3 credits.

Analysis and characteristics of flow in open channels (natural and artificial); channel design considerations including uniform flow (rivers, sewers), flow measuring devices (weirs, flumes), gradually varied flow (backwater and other flow profiles, flood routing), rapidly varied flow (hydraulic jump, spillways), and channel design problems (geometric considerations, scour, channel stabilization, sediment transport).
Requisites: CIV ENGR 310, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 412 – GROUNDWATER HYDRAULICS
3 credits.

Engineering fundamentals of groundwater flow. Mass and momentum conservation, diffusion, and dispersion. Applications to wells, recharge, plumes, and convective transport. Physical models and elementary numerical methods, including flow nets. Some laboratory work.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2021

CIV ENGR 414 – HYDROLOGIC DESIGN
3 credits.

An introduction to the design of engineering structures which control and/or utilize runoff, emphasizing the sizing of structures to meet hydrologic uncertainty. Applies principles and techniques from several disciplines, including hydrology, hydraulics, probability and statistics. Specific techniques include flood frequency analysis; risk analysis; design storm and historic storm techniques; rainfall-runoff modeling.
Requisites: G L E/CIV ENGR 291 and CIV ENGR 311, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2023

CIV ENGR 415 – HYDROLOGY
3 credits.

Water cycle as related to air mass properties and movement, precipitation, evaporation, snowmelt, infiltration, streamflow, floods, and groundwater. Statistical hydrology, and hydrologic simulations--including runoff prediction, streamflow and reservoir routing, impoundment operation studies, and urban hydrology.
Requisites: G L E/CIV ENGR 291 and CIV ENGR 311, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 416 – WATER RESOURCES SYSTEMS ANALYSIS
3 credits.

Water supply and demand are increasingly stressed by climate, population, land-use, policy, etc. Presents a variety of systems analysis techniques for water resources planning and management. Deterministic and stochastic optimization and simulation models will be developed and applied. Problems addressed include water supply, water quality, and river basin development.
Requisites: CIV ENGR 311, graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E 421 – ENVIRONMENTAL SUSTAINABILITY ENGINEERING
3 credits.

Uses the three paradigms of sustainability (environmental, social, and economic) for strategic environmental initiatives in an engineering setting. Proactive environmental management opportunities, including practices of pollution prevention, industrial ecology, and design for the environment. A systems approach to manufacturing, examining the life cycle of products, incorporating total cost accounting, extended producer responsibility, and design for end-of-life.
Requisites: (MATH 217, 221, or 275) and (CHEM 104 or 109), or graduate/professional standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 422 – ELEMENTS OF PUBLIC HEALTH ENGINEERING
3 credits.

Overview of the public health profession and the role of environmental sanitary engineers in public health. Introduction to chemical and microbial contaminants of public health concern - their routes of exposure and development of regulatory standards for drinking water, air, hazardous wastes, and industrial workplaces. Introduction to occurrence, toxicity, and virulence as components of public health risk and the engineer's role in identifying occurrence and design of engineering controls for public health protection.
Requisites: CIV ENGR 320, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2022

CIV ENGR 423 – AIR POLLUTION EFFECTS, MEASUREMENT AND CONTROL
3 credits.

The influence of man-caused pollution on the atmosphere, globally and locally. Evaluation of human health, economic, and aesthetic effects of air pollution. Techniques for measurement of atmosphere pollutant concentrations and determination of local and regional air quality. Detailed presentation of air pollution sources and methods for their control. The role of local, state and federal government in air pollution control.
Requisites: Senior standing and declared in Biomed, Biological Sys, Chemical, Civil, Computer, Electrical, Environmental, Geological, Industrial, Mechanical or Nuclear Egr, Mat Sci & Egr, Egr Physics, Egr Mechanics, grad/prof standing or member of Egr Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 425 – ENVIRONMENTAL ENGINEERING MICROBIOLOGY
3 credits.

Microbial interactions in soils, water, extreme environments and biofilms. Modern methods for studying microbial ecology. Role of microbes in nutrient cycles and biogeochemistry. Use of microbes for mitigating human-made environmental problems of industrial, agricultural, and domestic origin. Emphasis on engineered systems.
Requisites: MICROBIO 303 or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 426 – DESIGN OF WASTEWATER TREATMENT PLANTS
3 credits.

Unit operations in wastewater treatment; physical, chemical, and biological processes for treatment of wastewater; sludge treatment and disposal; design of a wastewater treatment plant; site visits to wastewater treatment plants.
Requisites: Senior standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 427 – SOLID AND HAZARDOUS WASTES ENGINEERING
3 credits.

Basic concepts in designing, evaluating, and operating solid wastes storage, collection, and disposal systems; waste reduction, resource recovery, incineration and land disposal methods; hazardous wastes engineering; legal, political, and administrative considerations.
Requisites: Senior standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 428 – WATER TREATMENT PLANT DESIGN
3 credits.

Preliminary studies and design of water treatment processes and subordinate plant facilities; project control of design project; unit operations in water treatment; groundwater treatment; preliminary cost estimates; introduction of computer-aided design concept; site visits to water treatment plants.
Requisites: Senior standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E 430 – INTRODUCTION TO SLOPE STABILITY AND EARTH RETENTION
1 credit.

Introduction to theory and approaches commonly used in geotechnical engineering practice for design and analysis of slopes and earth retaining structures.
Requisites: CIV ENGR/G L E 330, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E 432 – INTRODUCTION TO SHALLOW AND DEEP FOUNDATION SYSTEMS
1 credit.

Introduction to theory and approaches commonly used in geotechnical engineering practice for design and analysis of slopes and earth retaining structures.
Requisites: CIV ENGR/G L E 330, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E 434 – INTRODUCTION TO UNDERGROUND OPENINGS ENGINEERING
1 credit.

Subsurface stress; rock failure criteria; openings in competent rock; openings in layered rocks; plastic behavior around openings in weak rock; stereographic projections and stereonet; block theory; rock bolts; stabilization methods and design.
Requisites: CIV ENGR/G L E 330, GEOSCI/CIV ENGR/G L E/M S & E 474 or concurrent enrollment, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 440 – STRUCTURAL ANALYSIS II
3 credits.

Analysis of structures by displacement methods with computer solutions. Slope deflection and moment distribution methods. Derivation of stiffness matrices for two-dimensional frames. Introduction to commercial structural analysis software. Shear deformations.
Requisites: CIV ENGR 340, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/ENVIR ST/G L E/GEOSCI 444 – PRACTICAL APPLICATIONS OF GPS SURVEYING
2 credits.

Global positioning system surveying for field applications. Signals. Coordinate systems. Datums. Cartographic projections. Satellite orbits. Choosing hardware. Strategies for data collection and analysis. Assessing uncertainty. Geocoding satellite images. Integrating data with Geographic Information Systems. Emerging technologies.
Requisites: MATH 211, 217, 221, 275, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

CIV ENGR 445 – STEEL STRUCTURES I
3 credits.

Design loads, codes, specifications and standards; philosophies of design; load and resistance factor design (LRFD); allowable stress design (ASD); properties and types of structural steel; residual stresses; behavior and LRFD design criteria for tension members, compression; laterally braced and unbraced beams; essentials of bolted and welded connections.
Requisites: CIV ENGR 340, graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 447 – CONCRETE STRUCTURES I
3 credits.

Behavior of reinforced concrete structural elements; concepts of design and proportioning sections for strength and serviceability; background of specification requirements; strength design applied to beams, columns, and members under combined axial load and bending; continuous beams.
Requisites: CIV ENGR 340, graduate/professional standing, or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 451 – ARCHITECTURAL DESIGN
3 credits.

Introduction to building design, its methods, tools and processes and the interface with other professionals in building design and construction. Buildings as an integrated system of components, assemblies and sub-systems, including: structure, enclosure, internal finish and furnishing, circulation, conveyance and mechanical systems. Pragmatic design elements that make a project sustainable, energy efficient and comfortable, including; fenestration options, daylighting, passive heating and cooling, energy efficiency and other lower impact approaches identified in LEED standards.
Requisites: None
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 465 – DATA SENSING AND ANALYSIS IN CONSTRUCTION
3 credits.

Introduction to data sensing and analysis technologies for the onsite data capture, analysis and visualization in construction projects. Experience of using close range remote sensors and computing tools to facilitate construction engineering and management tasks. Focus on 1) project 3D as-built modeling and documentation, 2) visual detection, tracking and activity recognition of construction equipment and personnel, and 3) virtual construction inspection and site tour in mixed reality.
Requisites: G L E/CIV ENGR 291, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E/GEOSCI/M S & E 474 – ROCK MECHANICS
3 credits.

Classification of rock masses, stress and strain in rock, linear and non-linear behavior of rock, failure mechanisms, state of stress in rock masses, lab testing, geological and engineering applications.
Requisites: E M A 201, PHYSICS 201, 207, or 247, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 489 – HONORS IN RESEARCH
1-3 credits.

Undergrad honors research projects supervised by faculty members.
Requisites: Consent of instructor
Course Designation: Honors - Honors Only Courses (H)
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 491 – LEGAL ASPECTS OF ENGINEERING
3 credits.

Legal principles and institutions germane to engineering practice; formation and performance of engineer-client and owner-contractor relationships; preparation of technical specifications; surety bonds and insurance; construction liens; contract administration; construction contract remedies; intellectual property of engineers; engineers' obligations to society and their fellow engineers.
Requisites: Senior standing or member of Engineering Guest Students
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 492 – INTEGRATED PROJECT ESTIMATING AND SCHEDULING
3 credits.

Principles of estimating and scheduling for the construction industry, engineer's preliminary and final estimates' quantity take offs and cost and duration determinations for major items related to a construction project; use manual and computer techniques.
Requisites: Junior standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 494 – CIVIL AND ENVIRONMENTAL ENGINEERING DECISION MAKING
3 credits.

Planning, designing, and managing civil and environmental engineering systems. Fundamentals of the systems approach; marginal analysis; optimization techniques; decision analysis; economic analysis; cost-effectiveness analysis. Case study applications.
Requisites: MATH 217, 221, 275, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 495 – SUSTAINABLE BUILDING AND MATERIALS
3 credits.

Concepts of sustainability in Civil Engineering with an emphasis on construction materials. Introduction to life-cycle assessment approach to evaluating the impact of infrastructure development. Current sustainable practices in construction projects. Connecting values to clients, stakeholders, and societal needs. Sustainability rating programs, such as LEED, Envision, and INVEST.
Requisites: CIV ENGR 325, E M A/CIV ENGR 395, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 496 – ELECTRICAL SYSTEMS FOR CONSTRUCTION
3 credits.

Basic electricity, utility systems, standards and codes, electrical construction materials, branch circuit design, motor branch circuit design, feeder and service design, estimating and management concepts in electrical contracting, grounding, lighting, telecommunications.
Requisites: PHYSICS 202, 208, 248, graduate/professional standing, or member of engineering guest students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 497 – MECHANICAL SYSTEMS FOR CONSTRUCTION
3 credits.

Introduction to building mechanical systems. Plumbing, heating, ventilation, air conditioning, fire protection, automation/controls and process systems. Introduction to mechanical systems design and cost estimating. Mechanical system management.
Requisites: PHYSICS 202, 208, 248, graduate/professional standing, or member of engineering guest students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 498 – CONSTRUCTION PROJECT MANAGEMENT
3 credits.

Characteristics of Construction Industry; project organizations; the design and construction process; labor, material, and equipment utilization; cost estimation; construction pricing and contracting; construction planning; cost control, monitoring accounting; and management systems construction.
Requisites: Junior standing or member of Engineering Guest Students
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 500 – WATER CHEMISTRY
3 credits.

Elements of fresh and marine water chemistry; acid-base, precipitation, complexation, oxidation-reduction, adsorption, and biochemical reactions in natural waters and water treatment processes.
Requisites: CHEM 104, 109, 116, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 501 – WATER ANALYSIS-INTERMEDIATE
3 credits.

Principles and applications of chemical and instrumental methods for the chemical analysis of water.
Requisites: CHEM 104, 109, 116, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2020

CIV ENGR/E M A/M E 508 – COMPOSITE MATERIALS
3 credits.

Physical properties and mechanical behavior of polymer, metal, ceramic, cementitious, cellulosic and biological composite systems; micro- and macro-mechanics; lamination and strength analyses; static and transient loading; fabrication; recycling; design; analytical-experimental correlation; applications.
Requisites: (E M A 303 or M E 306), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E 511 – MIXING AND TRANSPORT IN THE ENVIRONMENT
3 credits.

Application of fluid mechanics to understand the mixing and transport of contaminants, pollutants, and other solutes in the environment. Introduction to chemical and biochemical transformation processes as well as boundary interactions at the air-water and sediment-water interfaces. Transport phenomena: diffusive processes, advective processes, turbulent diffusion, and shear flow dispersion. Introduction to both analytical and computational solutions with applications to mixing and transport in rivers, lakes, the atmosphere, and coastal waters.
Requisites: (CIV ENGR/G L E 291, COMP SCI 220, or E C E 203) and (CIV ENGR 310 or M E 363), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 514 – COASTAL ENGINEERING
2-3 credits.

The effect of natural forces associated with storms, hurricanes, and water-level variations on the coastal zone, and efforts made to combat these forces. Wave and storm-surge prediction, the change of waves as they approach shore, and wave forces on the shore; shore erosion and littoral drift; nearshore pollution in lakes and oceans; harbor, breakwater, and revetment design.
Requisites: CIV ENGR 311, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2021

CIV ENGR 515 – HYDROCLIMATOLOGY FOR WATER RESOURCES MANAGEMENT
3 credits.

Introduction to various strategies for integrating climate science into water resources, specifically addressing climatic influences on hydrologic variables, the prospects for prediction, and the implications on water management and development. Consider both space and time variability of hydrological processes in the context of sub-seasonal, seasonal, and climate change time-scales.
Requisites: CIV ENGR 415 and (STAT 224, 311, or 324), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/G L E 520 – REACTIVE PROCESSES FOR SUSTAINABLE ENERGY AND RESOURCE PRODUCTION
3 credits.

Key scientific concepts related to fossil and renewable energy resources. Apply the fundamentals of thermodynamics and chemical kinetics at solid interfaces to better understand the science behind using fossil and renewable energy resources. Evaluate the impacts of existing and emerging energy technologies on the environment.
Requisites: Senior standing, (MATH 211, 217, 221, or 275), (CHEM 103, 104, or 109), and CIV ENGR 320, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

CIV ENGR 522 – HAZARDOUS WASTE MANAGEMENT
3 credits.

Environmental regulations, remediation site characterization, contaminant characterization, detailed engineering and management considerations related to the design and operation of hazardous waste remediation systems involving water pollution, air pollution, solid waste, and groundwater pollution.
Requisites: Senior standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E 530 – SEEPAGE AND SLOPES
3 credits.

Practical aspects of seepage effects and ground water flow. Stability of natural and man-made slopes under various loading conditions. Design and construction of earth dams and embankments. Flow net and its use; wells; filters; total and effective stress methods of slope analysis; selection of pertinent soil parameters.
Requisites: CIV ENGR/G L E 330, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/G L E 532 – FOUNDATIONS
3 credits.

Shallow and deep foundations. Analysis and design of footings, mats, piers and piles, and related fill and excavation operations. Consolidation settlement, time rate of settlement, stress distribution, elastic (immediate) settlement, load bearing capacity; methods to reduce settlements and increase shear strength; the selection of a foundation system.
Requisites: CIV ENGR/G L E 330, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

CIV ENGR/G L E 535 – WIND ENERGY BALANCE-OF-PLANT DESIGN
3 credits.

Wind Energy Development and Balance-of-Plant Design. Up-front coverage includes the science and mechanics of wind energy including turbine basics, wind resource assessment, energy production, and economic return. Balance-of-plant design aspects include site layout and micro-siting, foundation systems, collector systems and interconnection, site civil and electrical infrastructure, and structural tower analysis. Development includes environmental due diligence and permitting, stakeholder engagement, energy policy and markets, and levelized cost of energy (LCOE).
Requisites: PHYSICS 201, 207, 247, E M A 201, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 545 – STEEL STRUCTURES II
3 credits.

Composite construction; composite vs. non-composite behavior; shored vs. unshored construction; stability of frames; elastic analysis of frames including second order effects; strength of members subject to combined flexure and axial compression; plate girders; vertical flange buckling; flexural and shear strength; flexure and shear interaction; stiffener requirements.
Requisites: CIV ENGR 445, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 547 – CONCRETE STRUCTURES II
3 credits.

Deflections under short duration and sustained loads; compression members with emphasis on stability and secondary bending moments; two-way slab systems; prestressed concrete including prestress losses; design of shear walls, special topics in strut and tie modelling, compression field theory and design for torsion may be covered; flexure analysis; design of sections; and shear strength.
Requisites: CIV ENGR 447, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/ENVIR ST/LAND ARC 556 – REMOTE SENSING DIGITAL IMAGE PROCESSING
3 credits.

Techniques of enhancement and quantification of remote sensing imagery. Emphasis on processing and analyzing data gathered by airborne and satellite sensors. Techniques to quantitatively analyze data from photography, electro-optical scanners, satellite systems, and radar and passive microwave systems. Applications to: agriculture and forestry, geology and soils, water quality, and urban and regional planning.
Requisites: LAND ARC/ENVIR ST/F&W ECOL/G L E/GEOG/GEOSCI 371, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/A A E/ENVIR ST/URB R PL 561 – ENERGY MARKETS
3 credits.

Energy resources are an essential element of the world's business, political, technical and environmental landscape. Analytic tools provided by the discipline of economics expands our understanding of this critical issue. Energy supply markets reviewed include both fossil fuels and renewable resources. Energy demand sectors include residential, commercial, industrial and transportation. Electricity represents an intermediate energy market. The interactions among these markets participants indicate how scarce resources are allocated among competing needs in the world economy.
Requisites: A A E 215, ECON 101, 111, or graduate/professional standing
Course Designation: Breadth - Social Science
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

CIV ENGR 571 – URBAN TRANSPORTATION PLANNING
3 credits.

Principles of planning, evaluation, selection, adoption, financing, and implementation of alternative urban transportation systems; formulation of community goals and objectives, inventory of existing conditions; transportation modeling--trip generation, distribution, modal choice, assignment, technological characteristics and operation of modern transit and other movement systems.
Requisites: CIV ENGR 370, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 572 – TRANSPORTATION OPERATIONS
3 credits.

Introduction to assessment tools of transportation operations and fundamental concepts in flow theory, flow control, observation and measurement techniques, and scheduled transportation. Applied to various modes of transportation. Emphasis on logic rather than recipe-oriented practice.
Requisites: CIV ENGR 370 and (E C E 331, STAT/MATH 431, or STAT 311), graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 573 – GEOMETRIC DESIGN OF TRANSPORT FACILITIES
3 credits.

Problems in ground transportation facility design; generation, capacity, location and design; rural and urban at-grade intersection design; grade separations; interchanges; parking lots and terminals.
Requisites: CIV ENGR 370, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 574 – TRAFFIC CONTROL
3 credits.

Traffic data collection studies; measures of effectiveness and evaluation of traffic system performance; design and application of traffic control devices; design of traffic signal systems; operational controls and traffic management strategies.
Requisites: CIV ENGR 370, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 575 – ADVANCED HIGHWAY MATERIALS AND CONSTRUCTION
3 credits.

Soils, soil stabilization, aggregates, bituminous materials and mixtures, general highway materials and construction of rigid and flexible pavements.
Requisites: E M A/CIV ENGR 395, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2023

CIV ENGR 576 – ADVANCED PAVEMENT DESIGN
3 credits.

Covers the principles of stress and strain analyses in typical highway pavement structures due to loading from traffic and climate. Also covers the most commonly used analysis and design procedures/software to determine thickness of pavement layers and prediction of performance.
Requisites: E M A/CIV ENGR 395, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 577 – TRAFFIC FLOW THEORY
3 credits.

Comprehensive overview of vehicular traffic flow theory and its use in evaluating congestion and determining control strategies. Starting from the basic concepts defining traffic streams, existing theories are presented at different scales, including car-following (microsimulation) models, lane-changing models, cellular automata models, the kinematic wave model, and macroscopic/network fundamental diagram. Techniques for empirical analysis. Connected and automated vehicles.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 578 – SENIOR CAPSTONE DESIGN
4 credits.

The application of theoretically and academically acquired knowledge to a civil and environmental engineering problem in as near "real-world" as possible.
Requisites: CIV ENGR 414, 426, 427, 428, 442, 445, 447, 522, 573, 574, 576, G L E/CIV ENGR 530, or 532
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 579 – SEMINAR-TRANSPORTATION ENGINEERING
1 credit.

Current problems and research developments in transportation, highways, traffic engineering, and transportation planning and systems analysis.
Requisites: Senior standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 609 – SPECIAL TOPICS IN WATER CHEMISTRY
1-3 credits.

Topics vary.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2023

CIV ENGR/G L E 612 – ECOHYDROLOGY
3 credits.

Mutual interactions between the hydrologic cycle and ecosystems, including hydrologic mechanisms that underlie ecological patterns and processes, movement of water and energy through the soil-plant-atmosphere continuum, application and development of models for simulating ecohydrologic processes, and case studies on ecohydrologic function and ecosystem services of varied environments.
Requisites: CIV ENGR 311, GEOSCI/G L E 627, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 618 – SPECIAL TOPICS IN HYDRAULICS AND FLUID MECHANICS
1-3 credits.

Topics vary.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2023

CIV ENGR 619 – SPECIAL TOPICS IN HYDROLOGY
1-3 credits.

Topics vary.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2023

CIV ENGR 621 – BIOLOGICAL TREATMENT PROCESS MODELING
1 credit.

Modeling for wastewater treatment plant evaluation and design using a commercial modeling program. Focus on biological treatment processes and the kinetics of biological growth and substrate degradation. Set up and calibrate model, configure and size plant processes, and explore the impact of configuration and kinetic parameters on treatment efficiency. Evaluate impacts and tradeoffs for advanced treatment scenarios with regards to chemical use, energy needs, sludge production, and plant footprint.
Requisites: CIV ENGR 426, 721, or 821
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2023

CIV ENGR/SOIL SCI 623 – MICROBIOLOGY OF WATERBORNE PATHOGENS AND INDICATOR ORGANISMS
3 credits.

Source, environmental fate and transport of major groups of waterborne pathogens, including epidemiology and testing of associated indicator organism. Management and treatment technologies for prevention of pathogen transmission.
Requisites: CIV ENGR 322 or SOIL SCI/MICROBIO 523 or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

CIV ENGR 629 – SPECIAL TOPICS IN ENVIRONMENTAL ENGINEERING
1-3 credits.

Topics vary.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2023

CIV ENGR/M&ENVTOX/SOIL SCI 631 – TOXICANTS IN THE ENVIRONMENT: SOURCES, DISTRIBUTION, FATE, & EFFECTS
3 credits.

Nature, sources, distribution, and fate of contaminants in air, water, soil, and food and potential for harmful exposure.
Requisites: (CHEM 104, 109, or 116) and (MATH 211, 217, 221, or 275) and (PHYSICS 104, 202, 208, or 248)
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/G L E 635 – REMEDIATION GEOTECHNICS
3 credits.

Geotechnical practice for remediation of sites containing contaminated soil and groundwater is discussed. Topics include non-invasive and invasive subsurface exploration techniques, methods to monitor for the presence of contaminants in the saturated and unsaturated zones, and geotechnically-oriented remedial action technologies.
Requisites: CIV ENGR/G L E 330, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

CIV ENGR 639 – SPECIAL TOPICS IN GEOTECHNICAL ENGINEERING
1-4 credits.

Topics vary.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2023

CIV ENGR 643 – PRESTRESSED CONCRETE
3 credits.

Analysis and design of prestressed concrete members, including working stress and ultimate strength analysis and design for flexure; shear design; prestress losses, deflections, and composite beams. Knowledge of Concrete Structures [such as CIV ENGR 447] required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

CIV ENGR 649 – SPECIAL TOPICS IN STRUCTURAL ENGINEERING
1-3 credits.

Topics vary.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 669 – SPECIAL TOPICS IN CONSTRUCTION ENGINEERING AND MANAGEMENT
1-4 credits.

Topics vary.
Requisites: Senior standing or member of Engineering Guest Students
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 678 – ADVANCED TRAFFIC MODELING AND COMPUTER SIMULATION
3 credits.

Theoretical and practical perspectives of traffic flow modeling with a focus on micro-simulation. Simulation software, such as CORSIM, VISSIM, and PARAMICS. Develop and calibrate a set of base models of existing conditions, extend the models to include design alternatives (generally using traffic demands projected for future years), and then generate conclusions on the basis of the modeling results.
Requisites: CIV ENGR 370, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 679 – SPECIAL TOPICS IN TRANSPORTATION AND CITY PLANNING
3 credits.

Topics vary.
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR/PUB AFFR 694 – MANAGEMENT OF CIVIL INFRASTRUCTURE SYSTEMS
3 credits.

Comprehensive systems approach to civil infrastructure and asset management with emphasis on transportation facilities. Social, political, economic factors that influence transportation planning, design, construction, maintenance and operation. Needs assessment, information management, performance measurement, life cycle cost and benefits analysis, prioritization and optimization, budgeting and finance.
Requisites: CIV ENGR 494, or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2019

CIV ENGR 699 – INDEPENDENT STUDY
1-9 credits.

Under faculty supervision.
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 700 – CHEMISTRY OF NATURAL WATERS
3 credits.

Application of chemical principles to cycling of important elements in natural waters; mineral weathering, cycles of carbon, nitrogen, phosphorus, silicon, sulfur, and minor elements in natural waters; relationships of atmospheric chemistry to natural waters.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

CIV ENGR/ATM OCN 701 – THE CHEMISTRY OF AIR POLLUTION
2 credits.

Covers background and modern research methods for the application of chemical analysis tools to understanding of the origin, composition, and the chemical transformations of pollutants that occur in the atmosphere. Emphasis will be directed at the pollutants impacting human health, climate change, and ecosystem degradation. Approximately half of the course materials will be taken from the scientific literature and will provide the opportunity to advance skills in the critical reading of journal articles. The course is directed at graduate students conducting research and interested in air pollution and environmental chemistry. Gain experiences in presenting scientific research methods and results related to course materials.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

CIV ENGR 702 – GRADUATE COOPERATIVE EDUCATION PROGRAM
1-2 credits.

Work experience that combines classroom theory with practical knowledge of operations to provide a background on which to develop and enhance a professional career. The work experience is tailored for MS students from within the U.S. as well as eligible international students.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2023

CIV ENGR 703 – ENVIRONMENTAL GEOCHEMISTRY
3 credits.

A quantitative treatment of chemical and biological processes controlling the speciation and partitioning of inorganic compounds in natural waters. Particular attention will be paid to heterogeneous reaction mechanisms, and kinetics controlling inorganic compounds in aqueous environments. Discuss in-situ techniques for measurement of environmental reactions. For those interested in environmental chemistry, chemistry, limnology, geology, environmental microbiology, soil science, and environmental modeling.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

CIV ENGR 704 – ENVIRONMENTAL CHEMICAL KINETICS
3 credits.

Fundamental molecular processes that govern the fate and transformation of organic contaminants in natural environmental systems and engineered treatment processes. Emphasizes the kinetics describing these processes and focuses on transformation mechanisms of organic contaminants in aquatic systems. Specific topics include partitioning between air, water, and solids; chemical kinetics; substitution, hydrolysis, and redox reactions; oxidation reactions encountered in ozone and chlorine-based disinfection systems; and photochemical and biological transformations. Knowledge of water chemistry [such as CIV ENGR 500] required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2022

CIV ENGR 716 – STATISTICAL MODELLING OF HYDROLOGIC SYSTEMS
3 credits.

Real world applications of probability and statistics to the analysis and modeling of problems in surface and groundwater hydrology. Basic knowledge of probability and statistics [such as STAT 311] required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2018

CIV ENGR/ENVIR ST/URB R PL 717 – WATER RESOURCES MANAGEMENT PRACTICUM PLANNING SEMINAR I
1 credit.

The first of two seminars for planning the activities of the practicum.
Requisites: Declared in Water Resources Management MS or Doctoral Minor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/ENVIR ST/URB R PL 718 – WATER RESOURCES MANAGEMENT PRACTICUM PLANNING SEMINAR II
2 credits.

The second of two seminars for planning the field work, analysis, and reporting of the practicum.
Requisites: Declared in Water Resources Management MS or Doctoral Minor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR/ENVIR ST/URB R PL 719 – WATER RESOURCES MANAGEMENT SUMMER PRACTICUM
4 credits.

Interdisciplinary team of students and staff working with agency personnel, citizen groups, and/or private sector representatives on the analysis of a contemporary, problem-oriented water resource issue. Physical, biological, economic and social aspects of the issue analyzed. Comprehensive written report results, practicum's findings and management recommendations.
Requisites: URB R PL/CIV ENGR/ENVIR ST 718
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2023

CIV ENGR 721 – BIOLOGICAL PRINCIPLES OF ENVIRONMENTAL ENGINEERING
3 credits.

Biological principles important to diagnosing and controlling pollution through environmental engineering applications such as fate and transport of contaminants in the environment, eutrophication, water treatment for human consumption, biological waste treatment for pollution control and bioenergy generation.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 722 – CHEMICAL PRINCIPLES OF ENVIRONMENTAL ENGINEERING
3 credits.

Principles of general, physical, equilibrium, colloid and biochemistry applied to environmental engineering processes such as evaluating environmental quality and treating water, air and soil to meet environmental standards.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 723 – ENERGY PRINCIPLES OF ENVIRONMENTAL ENGINEERING
3 credits.

Principles of energy applied to environmental engineering such as energy resources, sustainability concerns, work and power, thermodynamics, system and process efficiencies, energy production from waste, heat transfer, and heating and cooling of systems.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

CIV ENGR 729 – ENVIRONMENTAL SUSTAINABILITY TOOLS
3 credits.

Environmental impact must be quantified systematically and rigorously in order to inform decision making, process improvement, and policy. Life cycle assessment will be utilized in a project-based framework to evaluate the environmental impacts of products and process across multiple environmental impact categories.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2023

CIV ENGR/G L E 730 – ENGINEERING PROPERTIES OF SOILS
3 credits.

Determination and interpretation of soil properties for engineering purposes; physio-chemical properties of soil-water systems, permeability and capillarity, compression characteristics of soils, measurement of soil properties in the triaxial test, properties of frozen soils and permafrost.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2022

CIV ENGR/G L E 732 – UNSATURATED SOIL GEOENGINEERING
3 credits.

Engineering principles of unsaturated soils as they apply to geotechnical and geoenvironmental systems. Effect of soil water suction and stress on hydraulic conductivity, shear strength, and compressibility of soils in the context of geoengineering problems of flow and stability. Knowledge of Soil Mechanics [such as CIV ENGR/G L E 330] is required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

CIV ENGR/G L E 733 – PHYSICOCHEMICAL BASIS OF SOIL BEHAVIOR
3 credits.

Applications of physiochemical, mineralogical and environmental considerations to the engineering behavior of soils. Soil composition, formation, fabric, pore fluid chemistry and interaction of phases. The particulate nature of soils and the fabric-engineering property (volume change, strength, deformation and conduction) relationships. Knowledge of Soil Mechanics [such as CIV ENGR/G L E 330] is required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR/G L E 735 – SOIL DYNAMICS
3 credits.

Geotechnical considerations of earthquake engineering and foundation vibrations. Seismic surveying; ground motion during earthquakes; determination of soil properties for ground response analysis; dynamic properties of soils; soil structure interaction effects; soil liquefaction; dynamic analysis of earth dams; settlements resulting from earthquakes, lateral earth pressures during earthquakes; foundation vibrations. Knowledge of Soil Mechanics [such as CIV ENGR/G L E 330] and Foundations [such as G L E 452 or CIV ENGR/G L E 532] is required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

CIV ENGR 744 – STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING
4 credits.

Dynamic analysis and behavior of structures; basic principles and application of engineering seismology; determination of earthquake-induced loads for earthquake-resistant design; and analysis and design of reinforced concrete and steel buildings subjected to ground motion. Knowledge of analysis and design of reinforced concrete and structural steel buildings [such as CIV ENGR 440, 445, and 447] required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 749 – SPECIAL TOPICS IN STRUCTURAL ENGINEERING
1-4 credits.

Advanced topics of special interest to graduate students in structural engineering.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 760 – RESEARCH METHODS IN CONSTRUCTION ENGINEERING MANAGEMENT
1 credit.

Present research in Construction Engineering Management, discuss ideas and results. Receive feedback on research and presentation style.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

CIV ENGR/ENVIR ST 772 – PRACTICUM IN TRANSPORTATION MANAGEMENT AND POLICY
3 credits.

Integrative capstone course in transportation management and policy. Interdisciplinary team experience in the application of theoretical knowledge and analytical tools for developing policy and making management decisions on "real-world" problems.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2016

CIV ENGR/E M A/M E 775 – TURBULENT HEAT AND MOMENTUM TRANSFER
3 credits.

Stochastic methods in turbulent heat and momentum transfer; fully developed turbulence; numerical methods including model applications to boundary layers, reacting flows, mass transfer, and unsteady flows; linear and non-linear stability and transition; emphasis on applications of interest to Mechanical, Aerospace, and Environmental Engineers. Knowledge of fluid mechanics [such as M E 363 or CBE 320] strongly encouraged.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2022

CIV ENGR 790 – MASTER'S RESEARCH OR THESIS
1-9 credits.

Under faculty supervision.
Requisites: Declared in a Civil and Environmental Engineering or Environmental Chemistry and Technology graduate program
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 820 – HYDRAULICS AND APPLIED FLUID MECHANICS FOR ENVIRONMENTAL ENGINEERS
3 credits.

Principles of hydraulics and fluid mechanics applied to environmental engineering systems that convey, control, and measure the flow of liquids, solid-liquid slurries, and gases.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2023

CIV ENGR 821 – ENVIRONMENTAL ENGINEERING: BIOLOGICAL TREATMENT PROCESSES
3-4 credits.

Advanced theory and applications of biological systems for the treatment of wastes; lab techniques to assess treatability and to provide design parameters. Introductory knowledge of Environmental Engineering [such as CIV ENGR 320] is required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2023

CIV ENGR 822 – ENVIRONMENTAL ENGINEERING: PHYSICAL/ CHEMICAL TREATMENT PROCESS
3-4 credits.

Advanced theory and applications of chemical and physical-chemical processes for the treatment of water and wastewater; lab techniques to assess design requirements and treatability. Introductory knowledge of Environmental Engineering [such as CIV ENGR 320] is required.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2023

CIV ENGR 823 – ENVIRONMENTAL ENGINEERING DESIGN PROJECT
3 credits.

Engineering design project applied to environmental engineering solutions involving environmental chemistry, environmental quality, physical-chemical treatment processes, biological treatment processes, solid and hazardous waste engineering, energy, resource recovery, economic analysis, hydrology, and/or hydraulics and applied fluid mechanics.
Requisites: Declared in Civil and Environmental Engineering MS, Environmental Chemistry and Technology MS, or Civil and Environmental Engineering: Environmental Engineering ME
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2024

CIV ENGR 890 – PRE-DISSERTATOR'S RESEARCH
1-9 credits.

Under faculty supervision.
Requisites: Declared in Civil and Environmental Engineering PHD or Environmental Chemistry and Technology PHD
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 909 – GRADUATE SEMINAR - ENVIRONMENTAL CHEMISTRY & TECHNOLOGY
1 credit.

Current research in environmental chemistry and technology.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR/ATM OCN/BOTANY/ENVIR ST/GEOSCI/ZOOLOGY 911 – LIMNOLOGY AND MARINE SCIENCE SEMINAR
1 credit.

Sections in various fields of zoological research.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 919 – SEMINAR-HYDRAULIC ENGINEERING AND FLUID MECHANICS
1 credit.

Current research and review of literature in theoretical and applied fluid mechanics and hydraulic engineering.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 929 – SEMINAR-ENVIRONMENTAL ENGINEERING
1 credit.

Current research and literature on water, wastewater, water pollution control, solid wastes engineering and management.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 939 – GEOTECHNICAL ENGINEERING SEMINAR
1 credit.

Geotechnical analysis, design, and construction.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 949 – SEMINAR-STRUCTURAL ENGINEERING
1 credit.

Structural analysis, design, and construction.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR/ENVIR ST 970 – COLLOQUIUM IN TRANSPORTATION MANAGEMENT AND POLICY
1 credit.

Current issues, case studies, research, and literature dealing with transportation management and policy development.
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2016

CIV ENGR 990 – THESIS
1-12 credits.

Under faculty supervision.
Requisites: Declared in Civil and Environmental Engineering PHD or Environmental Chemistry and Technology PHD
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024

CIV ENGR 999 – ADVANCED INDEPENDENT STUDY
1-9 credits.

Under faculty supervision.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2024