

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Courses

Subjects in this department include: Civil Engineering (CIVE)

Civil Engineering (CIVE)

CIVE 102 Introduction to Civil and Environmental Engr Credits: 3 (2-2-0)

Course Description: Civil and environmental engineering professions, computer applications related to civil and environmental engineering; engineering design concepts.

Prerequisite: None.

Restriction: Must be a: Undergraduate.

Registration Information: Walter Scott College of Engineering majors only. Must register for lecture and laboratory. Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 103 Engineering Graphics and Computing Credits: 3 (2-3-0)

Course Description: Introduction to the profession and academia; principles of civil engineering design; graphical, and written communication.

Prerequisite: CIVE 102 or ENGR 101.

Registration Information: Must register for lecture and laboratory.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: Yes.

CIVE 182A Study Abroad--London: Intro to Civil and Environmental Engineering Credits: 3 (0-0-3)

Course Description: Introduction to civil and environmental engineering, including infrastructure, design processes, engineering ethics, sustainability, and relevant software. Exploration of global engineering in London, England, exploring concepts through guest lectures, field trips to London infrastructure, and visits to English engineering companies.

Prerequisite: None.

Registration Information: Written consent of advisor. This is a partial semester course. Credit not allowed for both CIVE 102 and CIVE 182A.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 202 Numerical Modeling and Optimization Credits: 3 (2-2-0)

Course Description: Fundamentals of programming and application to numerical modeling and optimization of civil and environmental engineering systems.

Prerequisite: (CIVE 103) and (MATH 159, may be taken concurrently or MATH 160, may be taken concurrently).

Registration Information: Must register for lecture and laboratory. Civil engineering, environmental engineering or engineering science majors only. Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 203 Engineering Systems and Decision Analysis Credits: 3 (2-2-0)

Course Description: Civil engineering infrastructure systems, numerical and decision analysis techniques, applications of risk analysis.

Prerequisite: CIVE 202.

Registration Information: Civil engineering, environmental engineering, and engineering science majors only. Must register for lecture and laboratory. Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 260 Engineering Mechanics-Statics Credits: 3 (3-0-0)

Course Description: Forces using vector notation; static equilibrium of rigid bodies; friction, virtual work, centroids, and moments of inertia.

Prerequisite: (MATH 159 or MATH 160) and (PH 141).

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 261 Engineering Mechanics-Dynamics Credits: 3 (3-0-0)

Course Description: Kinematics and kinetics of particles and rigid bodies; concepts of work-energy and impulse-momentum; computer applications; vector notation.

Prerequisite: CIVE 260.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 300 Fluid Mechanics Credits: 3 (3-0-0)

Course Description: Fluid properties; statics, kinematics, and dynamics of fluid motion including viscous and gravitational effects.

Prerequisite: (CIVE 261 and MATH 340, may be taken concurrently) and (MECH 237, may be taken concurrently or MECH 337, may be taken concurrently).

Registration Information: Sections may be offered: Online. Credit allowed for only one of the following courses: CBE 331, CIVE 300, ENGR 342, or MECH 342.

Terms Offered: Fall, Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 301 Fluid Mechanics Laboratory Credit: 1 (0-3-0)

Course Description: Fluid properties; statics, kinematics, and dynamics of fluid motion including viscous and gravitational effects.

Prerequisite: CIVE 300, may be taken concurrently.

Terms Offered: Fall, Spring.

Grade Mode: Traditional.

Special Course Fee: Yes.

CIVE 302 Evaluation of Civil Engineering Materials Credits: 3 (2-3-0)

Course Description: Behavior and properties of construction materials, instrumentation, use of statistical tools, material standards, material selection, quality control.

Prerequisite: CHEM 111 and CIVE 360.

Registration Information: Must register for lecture and laboratory.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: Yes.

CIVE 303 Infrastructure and Transportation Systems Credits: 3 (3-0-0)

Course Description: Principles of infrastructure systems, transportation systems, applications of spatial data and GIS, project management and engineering economy.

Prerequisite: CIVE 260.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 305 Intermediate AutoCAD Credits: 3 (2-2-0)

Course Description: Creating layouts and templates, objects, graphic patterns and symbols, inserting and managing external references, and creating isometric drawings.

Prerequisite: CIVE 103.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 322 Basic Hydrology Credits: 3 (3-0-0)

Course Description: Hydrologic cycle, soil moisture, groundwater, runoff processes, applications in water resources and environmental engineering.

Prerequisite: (CIVE 203 or CONE 201 or STAT 301 or STAT 315) and (CIVE 300 or CBE 331 or WR 416).

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 330 Ecological Engineering Credits: 3 (3-0-0)

Course Description: Principles of ecological engineering and design of sustainable ecosystems.

Prerequisite: (BZ 110 and BZ 111 or BZ 120 or LIFE 102 or SOCR 240) and (CHEM 113) and (CIVE 300 or LIFE 320).

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 339 Environmental Engineering Concepts Credits: 3 (3-0-0)

Course Description: Fundamental topics of environmental engineering, including water chemistry, chemical and biological reactions for water and wastewater treatment, reactor design for water and wastewater treatment processes, sanitary and storm sewer design, hazardous waste management, noise pollution, and sanitary landfill design.

Prerequisite: (CHEM 113) and (CBE 331 or CIVE 300 or MECH 342).

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 355 Geotechnical Engineering Credits: 3 (3-0-0)

Course Description: Soil behavior, stress-strain and strength properties, application to earth pressure, slope and foundation problems.

Prerequisite: CIVE 360.

Terms Offered: Fall, Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 356 Geotechnical Engineering Laboratory Credit: 1 (0-3-0)

Course Description: Laboratory to demonstrate standard methods of soils testing, methods of data collection, analysis of results.

Prerequisite: CIVE 355, may be taken concurrently.

Terms Offered: Fall, Spring.

Grade Mode: Traditional.

Special Course Fee: Yes.

CIVE 360 Mechanics of Solids Credits: 3 (3-0-0)

Course Description: Stresses and deformations in structural members and machine elements, combined stresses, stress transformation.

Prerequisite: CIVE 260.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 367 Structural Analysis Credits: 3 (3-0-0)

Course Description: Determination of actions in and deformations of determinate and indeterminate structures.

Prerequisite: CIVE 360.

Terms Offered: Fall, Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 371 Study Abroad--Peru: Grand Challenges in Engineering in Peru Credits: 3 (0-0-3)

Course Description: Faculty-led study abroad program that includes cultural, language, and engineering instruction.

Prerequisite: None.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 401 Hydraulic Engineering Credits: 3 (3-0-0)

Course Description: Basic principles of fluid mechanics applied to practical problems in hydraulic engineering.

Prerequisite: CIVE 300.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 402 Senior Design Principles Credits: 3 (2-2-0)

Course Description: Design of civil engineering systems, nontechnical and economic design considerations, project organization, design project development and presentation.

Prerequisite: (CIVE 300) and (CIVE 303 or CHEM 245).

Registration Information: Must register for lecture and laboratory.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 403 Senior Project Design Credits: 3 (2-2-0)

Course Description: Design of civil engineering systems, nontechnical and economic design considerations, project organization, design project development and presentation.

Prerequisite: CIVE 402.

Registration Information: Must register for lecture and laboratory.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 405 Sustainable Civil/Environmental Engineering Credits: 3 (3-0-0)

Course Description: Concepts of sustainable engineering principles in civil and environmental engineering. Life cycle analysis. Life cycle cost analysis. LEED and Envision rating systems. Resiliency concepts.

Prerequisite: CIVE 203 or STAT 315.

Registration Information: Junior standing. Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 413 Environmental River Mechanics Credits: 3 (3-0-0)

Course Description: Fluvial geomorphology, river hydraulics, sediment transport, and river response with special emphasis on environmental aspects.

Prerequisite: CIVE 300 or WR 416.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 421 Global Water Challenges Credits: 3 (3-0-0)

Course Description: Cross-cultural competence in the engineering and environmental sciences fields, focusing on global, social, economic, regulatory, and technological differences in water resource management, water quality management, and water/wastewater treatment. Interactions between domestic students and those at partner institutions in Central Asia.

Prerequisite: None.

Restriction: Must not be a: Freshman, Sophomore.

Registration Information: Completion of AUCC categories 3A or 3C.

Sections may be offered: Online. Credit not allowed for both CIVE 421 and CIVE 480A4.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 423 Groundwater Engineering Credits: 3 (3-0-0)

Course Description: Development of groundwater resources; origin, movement, distribution of water below ground surface.

Prerequisite: CIVE 300 or CBE 331 or WR 416.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 425 Soil and Water Engineering Credits: 3 (2-3-0)

Course Description: Control of the soil-water-plant medium for optimum plant growth and environmental protection.

Prerequisite: CBE 331 or CIVE 300 or SOCR 240.

Registration Information: Must register for lecture and laboratory.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 437 Wastewater Treatment Facility Design Credits: 3 (3-0-0)

Course Description: Design concepts and principles for wastewater treatment systems and unit processes, principles of treatment plant operation.

Prerequisite: (CIVE 300) and (CIVE 438, may be taken concurrently).

Registration Information: Credit not allowed for both CIVE 437 and ENVE 437.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 438 Fundamentals of Environmental Engr Credits: 3 (3-0-0)

Course Description: Core topics of environmental engineering including water quality and chemistry, wastewater removal and treatment, air pollution, noise pollution, and sanitary landfill design. Sustainability, green engineering and ethics are also discussed.

Prerequisite: (CBE 331 or CIVE 300 or MECH 342) and (CHEM 113).

Registration Information: Walter Scott Jr. College of Engineering majors only. Sections may be offered: Online.

Terms Offered: Fall, Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 439 Applications of Environmental Engr Concepts Credits: 3 (2-3-0)

Course Description: Design concepts related to environmental engineering problems with a focus on design projects.

Prerequisite: CIVE 339.

Registration Information: Must register for lecture and laboratory.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 440 Nonpoint Source Pollution Credits: 3 (3-0-0)

Course Description: Principles, processes, impacts and control of nonpoint source pollution of surface and groundwater.

Prerequisite: CIVE 300 or CIVE 322 or SOCR 240 or WR 416.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 441 Water Quality Analysis and Treatment Credits: 3 (2-3-0)

Course Description: Physical, chemical and biological methods for the characterization of waters and wastewaters.

Prerequisite: CIVE 339, may be taken concurrently or CIVE 438, may be taken concurrently.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: Yes.

CIVE 442 Air Quality Engineering Credits: 3 (3-0-0)

Course Description: Air pollution problems and solutions, at scales ranging from local to global. Quantitative analysis of chemical and physical processes governing air pollutants in natural and built environments.

Prerequisite: (CBE 331 or CIVE 300 or MECH 342) and (CHEM 113).

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 455 Applications in Geotechnical Engineering Credits: 3 (3-0-0)

Course Description: Geotechnical engineering applications of earth retaining structures, foundations, dams and embankments, geosynthetics, waste containment systems.

Prerequisite: CIVE 355.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 458 Environmental Geotechnics Credits: 3 (3-0-0)

Course Description: Application of principles from soil physics, soil chemistry, soil mechanics, hydrogeology, and geotechnical engineering to solve problems in Environmental Geotechnics related to engineered containment of contaminants and remediation of contaminated sites for the protection of human health and the environment.

Prerequisite: CIVE 355.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 466 Design and Behavior of Steel Structures Credits: 3 (3-0-0)

Course Description: Loads acting on a structure; behavior and design of steel members, connections, and systems.

Prerequisite: CIVE 367.

Terms Offered: Fall, Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 467 Design of Reinforced Concrete Structures Credits: 3 (3-0-0)

Course Description: Design and behavior of reinforced concrete structural members.

Prerequisite: CIVE 367.

Terms Offered: Fall, Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 495 Independent Study Credits: Var[1-3] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 496 Group Study Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 502 Fluid Mechanics Credits: 3 (3-0-0)

Course Description: Fundamental physical concepts of fluid mechanics, including ideal and viscous fluid flows and boundary-layers.

Prerequisite: CIVE 300.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 505 Structural Inspection, Management and Repair Credits: 3 (3-0-0)

Course Description: Modes of deterioration for existing structures; techniques for structural inspection, modeling deterioration and evaluating structures; asset management strategies; failure case studies; repair techniques.

Prerequisite: CIVE 466 or CIVE 467.

Registration Information: Credit not allowed for both CIVE 505 and CIVE 580B1.

Term Offered: Fall (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 506 Wind Effects on Structures Credits: 3 (3-0-0)

Course Description: Analysis of wind effects on buildings and structures; deterministic and probabilistic methods; aerodynamic loading and response; codes and standards.

Prerequisite: CIVE 300.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 507 Transportation Engineering Credits: 3 (3-0-0)

Course Description: Principles of highway engineering, transportation engineering and bridge engineering with a focus on design.

Prerequisite: CIVE 261 and CIVE 303 and CIVE 367.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 508 Bridge Engineering Credits: 3 (3-0-0)

Course Description: Introduces the fundamentals of bridge engineering, including bridge basics, bridge loads, bridge analysis and bridge design.

Prerequisite: CIVE 367.

Term Offered: Spring (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 510 Applied Hydraulic System Design Credits: 3 (3-0-0)

Course Description: Operational management systems, data collection, real-time control, management modeling, rehabilitation and retrofit, maintenance.

Prerequisite: CIVE 401.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 511 Coastal Engineering Credits: 3 (3-0-0)

Course Description: Coastal processes (waves, tides, storm surge, currents, coastal morphology, deltas) and their effects on infrastructure design and eco-protection.

Prerequisite: CIVE 401.

Registration Information: Credit not allowed for both CIVE 511 and CIVE 580A6.

Term Offered: Fall (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 512 Irrigation Systems Design Credits: 3 (3-0-0)

Course Description: Irrigation systems principles and design procedures for operation of sprinkler, trickle, and surface irrigation systems.

Prerequisite: CIVE 322 or CIVE 425.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 513 Morphodynamic Modeling Credits: 3 (3-0-0)

Course Description: Principles and techniques for simultaneous modeling of flow, sediment transport, and channel evolution to address problems in river morphodynamics.

Prerequisite: CIVE 300.

Registration Information: Sections may be offered: Online. Credit not allowed for both CIVE 513 and CIVE 581A9.

Term Offered: Fall (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 514 Hydraulic Structures/Systems Credits: 3 (3-0-0)

Course Description: Analysis and design of hydraulic structures which make up components of water resource systems.

Prerequisite: CIVE 401.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 515 River Mechanics Credits: 3 (3-0-0)

Course Description: The complex fluvial processes that occur in rivers and the implications for engineering applications. Topics include the controls of river complexity, fundamentals of river hydraulics, sediment transport mechanisms, ecological links to river morphology, river restoration applications, and mathematical modeling of river hydraulics.

Prerequisite: CIVE 300 and CIVE 401.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 518 Sprinkler and Trickle Irrigation Systems Credits: 3 (3-0-0)

Course Description: Basic principles, design, and evaluation of pressurized irrigation systems.

Prerequisite: CIVE 300 and CIVE 425.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 519 Irrigation Water Management Credits: 3 (3-0-0)

Course Description: Soil, plant, water, and atmospheric engineering principles for the determination of crop water needs to sustain agricultural production and the environment.

Prerequisite: CIVE 322 or SOCR 370.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 520 Physical Hydrology Credits: 3 (3-0-0)

Course Description: Hydrologic, atmospheric processes in the water cycle; linear systems, hydrologic response; geomorphologic description of hydrologic processes, response.

Prerequisite: CIVE 322 or CIVE 322.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 521 Hydrometry Credits: 3 (2-3-0)

Course Description: Principles, methods, instruments, and equipment for measuring water quantity and water quality variables in nature.

Prerequisite: CIVE 322.

Registration Information: Must register for lecture and laboratory.

Term Offered: Fall (even years).

Grade Mode: Traditional.

Special Course Fee: Yes.

CIVE 524 Modeling Watershed Hydrology Credits: 3 (2-2-0)

Also Offered As: WR 524.

Course Description: Development and application of watershed models: structure, calibration, evaluation, sensitivity analysis, simulation.

Prerequisite: (CIVE 203 or STAT 301 or STAT 315) and (CIVE 322 or WR 416).

Registration Information: Must register for lecture and laboratory. Credit not allowed for both CIVE 524 and WR 524.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 525 Water Engineering International Development Credits: 3 (3-0-0)

Course Description: Planning and design of small-scale and low-cost water supply and wastewater systems for rural communities in developing countries.

Prerequisite: CIVE 339 or CIVE 401 or CIVE 438.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: Yes.

CIVE 526 Pollution, Exposure, and the Environment Credits: 3 (3-0-0)

Course Description: Basic principles and applications of quantitative exposure science with an emphasis on exposure measurement; exposure pathway and data analysis; exposure modeling; and the development and application of novel methodological, technological, and statistical tools for exposure science.

Prerequisite: CHEM 113 and MATH 160.

Registration Information: Sections may be offered: Online. Credit not allowed for both CIVE 526 and CIVE 580B4.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 527 Tools for Food-Energy-Water Systems Analysis Credits: 3 (2-2-0)

Course Description: Analysis of complex food-energy-water (FEW) issues to explore prevailing relationships under varying conditions. Introduction to tools and approaches for systems thinking and FEW analysis, including frameworks for system analysis, data mining, life cycle assessment, triple bottom line analysis, and multi-criteria decision analysis.

Prerequisite: CHEM 103 or CHEM 107 or CHEM 111.

Restriction: Must be a: Graduate.

Registration Information: Graduate standing. Must register for lecture and laboratory. Credit not allowed for both CIVE 527 and CIVE 580B6.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 528 Assessing the Food, Energy, Water Nexus Credits: 3 (3-0-0)

Also Offered As: GES 528.

Course Description: A broad overview of Food/Energy/Water (FEW) nexus issues, including the science underpinning FEW and the trade-offs, socio-economic constraints, and policy limitations inherent in FEW challenges. Introduction to tools that enhance systems-level thinking and problem solving.

Prerequisite: CHEM 103 or CHEM 107 or CHEM 111.

Restriction: Must be a: Graduate.

Registration Information: Graduate standing. Written consent of instructor. Credit allowed for only one of the following courses: CIVE 528, CIVE 580B5, or GES 528.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 529 Environmental Organic Chemistry Credits: 3 (3-0-0)

Course Description: Fate and transport of organic compounds in natural and engineered environments.

Prerequisite: MATH 160 and CHEM 111.

Registration Information: Credit not allowed for both CIVE 529 and CIVE 580A5.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 530 Environ Engr at the Water-Energy-Health Nexus Credits: 3 (3-0-0)

Course Description: Key principles and applications of state-of-the-art technologies at the water-energy-health nexus. Emerging technologies that produce clean water and energy from unconventional water resources such as wastewater and saline water, as well as new approaches (e.g., using environmental nanotechnology) that prevent water-borne diseases beyond conventional disinfection.

Prerequisite: CHEM 113 and MATH 161.

Registration Information: Credit not allowed for both CIVE 530 and CIVE 580B3.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 531 Groundwater Hydrology Credits: 3 (3-0-0)

Course Description: Groundwater occurrence, distribution, movement, exploration and recharge, well hydraulics and design, interaction of ground and surface water.

Prerequisite: CIVE 300 or CBE 331 or MECH 342.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 532 Wells and Pumps Credits: 3 (3-0-0)

Course Description: Well field hydraulics, well drilling methods, well design, aquifer test methods, pumping systems, well maintenance, storage/distribution systems.

Prerequisite: (CIVE 423 and CHEM 111) and (CIVE 531 or GEOL 452).

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 533 Biomolecular Tools for Engineers Credits: 3 (2-3-0)

Also Offered As: BIOM 533.

Course Description: Theoretical and practical aspects of biomolecular laboratory tools—PCR, cloning, sequencing, single-molecule optical techniques and live-cell imaging.

Prerequisite: BMS 300 or MIP 300.

Registration Information: Must register for lecture and laboratory. Credit not allowed for BIOM 533, CIVE 533 and ECE 533.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: Yes.

CIVE 534 Applied and Environmental Molecular Biology Credits: 3 (2-2-0)

Course Description: Environmental microbiology and molecular biology tools used to investigate both natural systems and engineered processes.

Prerequisite: CIVE 540.

Registration Information: Must register for lecture and laboratory.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 537 Residuals Management Credits: 3 (3-0-0)

Course Description: Planning and design for processing and disposal of residuals including solid wastes, sludges, and hazardous wastes.

Prerequisite: CIVE 300.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 538 Aqueous Chemistry Credits: 3 (3-0-0)

Course Description: Principles of solution chemistry applied to aquatic systems.

Prerequisite: CHEM 113 and MATH 340.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 539 Water and Wastewater Analysis Credits: 3 (2-3-0)

Course Description: Chemical and biological methods of assessing water quality; significance of chemicals in aquatic systems.

Prerequisite: CHEM 113 and MATH 340.

Registration Information: Must register for lecture and laboratory.

Term Offered: Fall (odd years).

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 540 Advanced Biological Wastewater Processing Credits: 3 (3-0-0)

Also Offered As: CBE 540.

Course Description: Fundamentals of environmental biotechnology: environmental microbiology, microbial kinetics, basic reactor design, wastewater treatment.

Prerequisite: CBE 320 or CIVE 339 or CIVE 438.

Registration Information: Sections may be offered: Online. Credit not allowed for both CBE 540 and CIVE 540.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 541 Physical Chemical Water Treatment Processes Credits: 3 (3-0-0)

Course Description: Theory and practice of separations and conversions in water treatment process. Reactor theory, filtration, adsorption, mass transfer, oxidation, membrane technologies, biological reactors, disinfection.

Prerequisite: CIVE 439.

Registration Information: Section may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 542 Water Quality Modeling Credits: 3 (3-0-0)

Course Description: Chemical, physical, and biological processes defining surface water quality, construction and application of computer models for lakes and streams.

Prerequisite: None.

Registration Information: Must have taken two semesters of chemistry; one course in hydrology or water quality.

Term Offered: Spring (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 543 Instrumental Environmental Analysis Credits: 3 (2-3-0)

Course Description: Environmental sampling and preservation techniques followed by the instrumental analysis of the samples.

Prerequisite: CHEM 113.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 544 Water Resources Planning and Management Credits: 3 (3-0-0)
Course Description: Management and planning of natural and constructed water systems. Integrated management and case studies of water use and environmental resources.

Prerequisite: CIVE 322.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 546 Water Resource Systems Analysis Credits: 3 (2-2-0)

Course Description: Applications of systems analysis and optimization techniques in water resources planning and management.

Prerequisite: (CIVE 322, may be taken concurrently) and (ENGR 510, may be taken concurrently or MATH 510, may be taken concurrently).

Registration Information: Must register for lecture and laboratory. Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 547 Statistics for Environmental Monitoring Credits: 3 (3-0-0)

Also Offered As: STAT 547.

Course Description: Applications of statistics in environmental pollution studies involving air, water, or soil monitoring; sampling designs; trend analysis; censored data.

Prerequisite: STAT 301.

Registration Information: Credit not allowed for both CIVE 547 and STAT 547. Sections may be offered: Online.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 549 Drainage and Wetland Engineering Credits: 3 (3-0-0)

Course Description: Drainage and wetlands design for agricultural and natural resource applications. Water table modification for nonpoint sources pollution control.

Prerequisite: CIVE 322 or SOCR 370 or SOCR 470.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 550 Foundation and Retaining Wall Engineering Credits: 3 (3-0-0)

Course Description: Mechanics and methodology of foundation engineering, selection and design of foundation systems, retaining wall design, and application of principles to related special problems.

Prerequisite: CIVE 355.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 551 The Material Point Method Credits: 3 (3-0-0)

Course Description: Basic elements of the material point method, covering theory, and developing computational code to solve problems in solids, fluids, and soil mechanics.

Prerequisite: CIVE 261 and MATH 340.

Registration Information: Sections may be offered: Online. Credit not allowed for both CIVE 551 and CIVE 580B7.

Term Offered: Fall (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 555 Mining Geotechnics Credits: 3 (3-0-0)

Course Description: Challenges associated with mine tailings and mine waste management, including relevant geotechnical and geoenvironmental engineering factors. Case studies are used to illustrate important concepts.

Prerequisite: CIVE 355.

Term Offered: Spring (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 556 Slope Stability, Seepage, and Earth Dams Credits: 3 (3-0-0)

Course Description: Slope stability, seepage analysis and control, and earth dam and embankment design in Geotechnical Engineering practice. Students will gain an understanding of the theory, design, and analysis necessary to evaluate slope stability, seepage, and earth dam problems.

Prerequisite: CIVE 355.

Term Offered: Spring (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 558 Containment Systems for Waste Disposal Credits: 3 (3-0-0)

Course Description: Basic principles governing the design of containment systems used in waste disposal applications.

Prerequisite: CIVE 355.

Registration Information: Sections may be offered: Online.

Term Offered: Fall (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 559 Special Topics in Geotechnical Engineering Credits: 3 (3-0-0)

Course Description: Advanced topics in geotechnical engineering including expansive soils, unsaturated soil mechanics, soil-structure interaction and mining geotechnics.

Prerequisite: CIVE 355.

Registration Information: Sections may be offered: Online.

Term Offered: Spring (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 560 Advanced Mechanics of Materials Credits: 3 (3-0-0)

Course Description: Analysis of stress and strain failure theory; selected topics in solid mechanics, plate analysis; introduction to elastic stability.

Prerequisite: CIVE 360.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 561 Advanced Steel Behavior and Design Credits: 3 (3-0-0)

Course Description: Behavior of steel components and systems. Design of composite members, plate girders, and bolted and welded connections.

Prerequisite: CIVE 466.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 562 Fundamentals of Vibrations Credits: 3 (3-0-0)

Course Description: Free and forced vibrations of single, two, and multiple degree of freedom systems. Closed-form and numerical solutions.

Prerequisite: CIVE 261 and CIVE 360.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 564 Principles of Structural Load Modeling Credits: 3 (3-0-0)

Course Description: Modern structural load modeling and analysis techniques for buildings and other structures exposed to natural and man-made hazards.

Prerequisite: (CIVE 203) and (CIVE 466 or CIVE 467).

Restriction: Must be a: Graduate.

Registration Information: Graduate standing. Credit not allowed for both CIVE 564 and CIVE 581A7.

Term Offered: Fall (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 565 Finite Element Method Credits: 3 (3-0-0)

Course Description: Theory and application in elasticity, porous flow, heat conduction, and other engineering problems.

Prerequisite: MATH 340.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 566 Intermediate Structural Analysis Credits: 3 (3-0-0)

Course Description: Work and energy concepts, curved members and arches, matrix analysis of linear systems, numerical techniques.

Prerequisite: CIVE 367.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 567 Advanced Concrete Design Credits: 3 (3-0-0)

Course Description: Behavior of reinforced and prestressed concrete members; development of design methods; behavior and design of slabs, shearwalls, and buildings.

Prerequisite: CIVE 467.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 568 Design of Masonry and Wood Structures Credits: 3 (3-0-0)

Course Description: Behavior and design of structures and structural components constructed of masonry or engineered wood.

Prerequisite: CIVE 466 or CIVE 467.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 571 Pipeline Engineering and Hydraulics Credits: 3 (3-0-0)

Course Description: Water supply, wastewater, stormwater, oil and gas, and industrial applications. Emphasis on pressurized water pipelines.

Prerequisite: CIVE 300.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 572 Analysis of Urban Water Systems Credits: 3 (2-2-0)

Course Description: Behavior and interaction of urban water distribution and collection systems; how system state and driving variables affect system performance.

Prerequisite: CIVE 300 and CIVE 401.

Registration Information: Must register for lecture and laboratory.

Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 573 Urban Stormwater Management Credits: 3 (3-0-0)

Course Description: Effects of urbanization on watershed hydrology and receiving waters; control practices to mitigate effects using mathematical models.

Prerequisite: (CIVE 322) and (CIVE 401).

Registration Information: Sections may be offered: Online.

Term Offered: Spring (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 574 Civil Engineering Project Management Credits: 3 (3-0-0)

Course Description: Principles of civil engineering project management including proposals, contracts, scheduling, quality assurance, budgeting, and risk management.

Prerequisite: None.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 575 Sustainable Water and Waste Management Credits: 3 (3-0-0)

Course Description: The science, engineering, and policy behind sustainable water and waste practices. Sustainable urban water and wastewater management.

Prerequisite: CIVE 322.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 576 Engineering Applications of GIS and GPS Credits: 3 (2-2-0)

Course Description: Integration of GPS and GIS in the planning and decision making process, application to case study.

Prerequisite: None.

Registration Information: Must register for lecture and laboratory.

Sections may be offered: Online.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 577 GIS in Civil and Environmental Engineering Credits: 3 (2-2-0)

Course Description: GIS technology for spatial design/analysis; applications in facilities management, urban infrastructure, water resources, environmental engineering.

Prerequisite: (CIVE 300) and (CIVE 322).

Registration Information: Must register for lecture and laboratory.

Sections may be offered: Online.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 578 Infrastructure and Utility Management Credits: 3 (3-0-0)

Course Description: Infrastructure and utility planning, management, and security. Systems approach to life cycle management. Problems, analysis, decision support systems.

Prerequisite: CIVE 303.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 584 Supervised College Teaching Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 592A Seminar: Fluid Mechanics and Wind Engineering Credit: 1 (0-0-1)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 592E Seminar: Geotechnical Engineering Credit: 1 (0-0-1)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 592G Seminar: Environmental Engineering Credit: 1 (0-0-1)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 592L Seminar: Space Engineering Credit: 1 (0-0-1)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596A Group Study: Fluid Mechanics/Wind Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596B Group Study: Hydraulics Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596C Group Study: Hydrology and Water Resources Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596D Group Study: Mechanics Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596E Group Study: Geotechnical Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596F Group Study: Structures Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596G Group Study: Environmental Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596H Group Study: Water Resource Planning and Management Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596I Group Study: Groundwater Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 596J Group Study: Bioresource and Agricultural Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 604 Fluid Turbulence and Modeling Credits: 3 (3-0-0)

Course Description: Engineering concepts for transport of pollutants, toxic and flammable species, sand, and snow. Fluid modeling, numerical and analytical approaches.

Prerequisite: CIVE 300.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 607 Computational Fluid Dynamics Credits: 3 (3-0-0)

Course Description: Numerical methods used in computational solutions of hydraulics, environmental and wind engineering problems.

Prerequisite: CIVE 300.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 610 Special Topics in Hydraulics Credits: 3 (3-0-0)

Course Description: Advanced topics in hydraulics, hydromechanics, environmental hydraulics, and computational hydraulics.

Prerequisite: CIVE 502.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 612 Open Channel Flow Credits: 4 (4-0-0)

Course Description: Steady, uniform, and non-uniform flow; backwater curves; flow through bridge piers, transitions, and culverts; spatially varied and unsteady flow.

Prerequisite: CIVE 202.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 613 River Restoration Design Credits: 3 (3-0-0)

Course Description: Analysis and design for assisting the recovery of hydrologic, geomorphic, and ecological processes and ecosystem services in degraded river systems.

Prerequisite: CIVE 401.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 622 Risk Analysis of Water/Environmental Systems Credits: 3 (3-0-0)

Course Description: Risk and uncertainty analysis applied to hydrology, hydraulics, groundwater, water resources, and environmental engineering systems.

Prerequisite: (CIVE 322) and (STAT 315).

Restriction: Must be a: Graduate, Professional.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 625 Quantitative Eco-Hydrology Credits: 3 (3-0-0)

Course Description: Quantitative examination of the hydrologic and ecologic mechanisms underlying climate-soil-vegetation and soil moisture dynamics.

Prerequisite: CIVE 322 or WR 416.

Restriction: Must be a: Graduate, Professional.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 626 Integrated Analysis of Coupled Water Issues Credits: 3 (3-0-0)

Course Description: Integrative systems and policy analysis applied to coupled human-water systems from interdisciplinary technical and institutional perspectives.

Prerequisite: GR 304 or WR 304.

Restriction: Must be a: Graduate, Professional.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 631 Computational Methods in Subsurface Systems Credits: 3 (3-0-0)

Course Description: Numerical flow models; finite difference and finite element methods; parameter identification, stochastic modeling and advanced analytical solutions.

Prerequisite: (MATH 340) and (CIVE 531).

Restriction: Must be a: Graduate, Professional.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 638 Groundwater Quality and Contaminant Transport Credits: 3 (3-0-0)

Course Description: Analysis of hydrochemical data. Advection with and without mixing. Retardation of reactive solutes. Design of groundwater quality investigations.

Prerequisite: CIVE 531.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 645 Computer-Aided Water Management and Control Credits: 3 (2-2-0)

Course Description: Real-time management and control of water resource systems; applications of computer control concepts to improve system performance.

Prerequisite: CIVE 546 or CIVE 577.

Restriction: Must be a: Graduate, Professional.

Registration Information: Must register for lecture and laboratory. Sections may be offered: Online.

Term Offered: Fall (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 655 Advanced Soil Mechanics Credits: 3 (3-0-0)

Course Description: Advanced topics in shear strength and consolidation of soils; stress paths; anisotropy; submergence; partial and radial drainage; numerical methods.

Prerequisite: CIVE 355.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 657 Oral Communication in Geo-Engineering Credit: 1 (1-0-0)

Course Description: Principles of technical oral communication in geotechnical engineering, creating presentations, delivering presentations, listening and responding to questions.

Prerequisite: CIVE 550 or CIVE 556 or CIVE 558 or CIVE 655.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 658 Remediation Systems - Subsurface Contamination Credits: 3 (3-0-0)

Course Description: Applications in geoenvironmental engineering practice involving design of in situ containment and remediation systems.

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Term Offered: Fall (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 659 Advanced Topics in Geo-Engineering Credits: 3 (3-0-0)

Course Description: Advanced topics in geotechnical and geoenvironmental engineering including: (1) chemical diffusion, (2) theoretical saturated and unsaturated soil mechanics, (3) numerical modeling, (4) coupled physico-chemico-mechanical processes.

Prerequisite: CIVE 355.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 661 Stochastic Methods in Structural Dynamics Credits: 3 (3-0-0)

Course Description: Time-dependent excitations are modeled using stochastic processes, enabling prediction of random dynamic response under time-dependent excitations.

Prerequisite: CIVE 562.

Restriction: Must be a: Graduate, Professional.

Registration Information: Credit not allowed for both CIVE 661 and CIVE 681A3.

Term Offered: Spring (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 662 Foundations of Solid Mechanics Credits: 3 (3-0-0)

Course Description: Analysis of stress and strain in solids emphasizing linear elasticity and plasticity; introduction to creep, viscoelasticity, and finite deformations.

Prerequisite: CIVE 560.

Restriction: Must be a: Graduate, Professional.

Term Offered: Fall.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 663 Structural Stability Credits: 3 (3-0-0)

Course Description: Structural stability analysis of buildings and other structures; mathematical and mechanics tools for investigating stability of equilibrium.

Prerequisite: CIVE 560 and CIVE 566.

Restriction: Must be a: Graduate, Professional.

Registration Information: Credit not allowed for both CIVE 663 and CIVE 680A6.

Term Offered: Spring (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 664 Mechanics of Fatigue and Fracture Credits: 3 (3-0-0)

Course Description: Fracture mechanics including linear elastic, elastic-plastic, and dynamic fracture; on ductile and cleavage fracture in metals.

Prerequisite: CIVE 560.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Term Offered: Spring.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 665 Wind Engineering Credits: 3 (3-0-0)

Course Description: Fundamental elements of wind engineering, including wind climatology, structural dynamics, random vibrations, bluff body aerodynamics, wind effects on structures, wind resistant design, modeling, analysis, and simulation tools.

Prerequisite: CIVE 300.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online. Credit not allowed for both CIVE 504 and CIVE 665.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 667 Advanced Structural Analysis Credits: 3 (3-0-0)

Course Description: Analysis program development, application of finite element analysis, computer-assisted analysis, introduction to nonlinear analysis.

Prerequisite: CIVE 566.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring.

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 668 Structural Reliability--Theory, Application Credits: 3 (3-0-0)

Course Description: Theory of structural reliability as it relates to analysis, design, construction, and maintenance of structural and mechanical systems.

Prerequisite: CIVE 203 or STAT 315.

Restriction: Must be a: Graduate, Professional.

Registration Information: Credit not allowed for both CIVE 563 and CIVE 668.

Term Offered: Fall.

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 684 Supervised College Teaching Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695A Independent Study: Fluid Mechanics and Wind Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695B Independent Study: Hydraulics Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695C Independent Study: Hydrologic Science and Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695D Independent Study: Mechanics Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695E Independent Study: Geotechnical Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695F Independent Study: Structures Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695G Independent Study: Environmental Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695H Independent Study: Water Resource Planning and Management Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695J Independent Study: Bioresource and Agricultural Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695K Independent Study: Water and International Development Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Sections may be offered: Online.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 695L Independent Study: Construction Engineering and Management Credits: Var[1-18] (0-0-0)

Course Description: A) Fluid mechanics and wind engineering. B) Hydraulics. C) Hydrology and water resources. D) Mechanics. E) Geotechnical engineering, F) Structures, G) Environmental Engineering. H) Water resource planning and management, I) Groundwater. J) Bioresource and agricultural engineering. K) Water and International Development, L) Construction Engineering & Management.

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 696A Group Study: Fluid Mechanics and Wind Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 696B Group Study: Hydraulics Credits: Var[1-18] (0-0-0)**Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 696C Group Study: Hydrology and Water Resources Credits:****Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 696D Group Study: Mechanics Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 696E Group Study: Geotechnical Engineering Credits:****Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 696F Group Study: Structures Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 696G Group Study: Environmental Engineering Credits:****Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 696H Group Study: Water Resource Planning and Management Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 696I Group Study: Groundwater Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 696J Group Study: Bioresource and Agricultural Engineering Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 699A Thesis: Fluid Mechanics and Wind Engineering Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 699B Thesis: Hydraulics Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 699C Thesis: Hydrologic Science and Engineering Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Registration Information:** Sections may be offered: Online.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 699D Thesis: Mechanics Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 699E Thesis: Geotechnical Engineering Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.

CIVE 699F Thesis: Structures Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 699G Thesis: Environmental Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 699H Thesis: Water Resource Planning and Management Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 699J Thesis: Bioresource and Agricultural Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 699K Thesis: Water and International Development Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 703 Special Topics in Fluid Mechanics Credits: 3 (3-0-0)

Course Description: Advanced topics in fluid mechanics; associated experimental and numerical techniques.

Prerequisite: CIVE 502.

Restriction: Must be a: Graduate, Professional.

Term Offered: Fall (odd years).

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 721 Stochastic Water and Environmental Systems Credits: 3 (3-0-0)

Course Description: Stochastic analysis of water and environmental systems. Simulation, forecasting, spatial analysis, modeling changes, stochastic differential equations.

Prerequisite: CIVE 622.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring (odd years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 724 River Basin Morphology Credits: 3 (3-0-0)

Course Description: Analysis of river basin properties including their connections to statistical theories and erosion processes and their hydrologic implications.

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Registration Information: Written consent of instructor.

Term Offered: Spring (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 742 Advanced Topics in Environmental Engineering Credits: 3 (2-3-0)

Course Description: Selected topics from current environmental engineering research including molecular methods, water/wastewater treatment, hazardous water remediation.

Prerequisite: CIVE 540.

Restriction: Must be a: Graduate, Professional.

Registration Information: Must register for lecture and laboratory.

Term Offered: Spring (even years).

Grade Mode: Traditional.

Special Course Fee: No.

CIVE 751 Soil Dynamics Credits: 3 (3-0-0)

Course Description: Soil behavior under dynamic loading; stress wave propagation; foundation response to vibratory and transient loading; elements of earthquake effects.

Prerequisite: CIVE 355.

Restriction: Must be a: Graduate, Professional.

Term Offered: Spring (even years).

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 766 Theory of Plates and Shells Credits: 3 (3-0-0)

Course Description: Classical plate, shell and membrane theory for isotropic and layered anisotropic media. Analytic and computational solution techniques.

Prerequisite: CIVE 560.

Restriction: Must be a: Graduate, Professional.

Term Offered: Fall (even years).

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 767 Structural Dynamics and Earthquake Engineering Credits: 3 (3-0-0)

Course Description: Analysis, behavior, and design of structural systems subjected to dynamic loads, including earthquakes, wind, and ocean waves.

Prerequisite: CIVE 562 and CIVE 667.

Restriction: Must be a: Graduate, Professional.

Term Offered: Fall (odd years).

Grade Modes: S/U within Student Option, Trad within Student Option.

Special Course Fee: No.

CIVE 799A Dissertation: Fluid Mechanics and Wind Engineering Credits: Var[1-18] (0-0-0)

Course Description:

Prerequisite: None.

Restriction: Must be a: Graduate, Professional.

Terms Offered: Fall, Spring, Summer.

Grade Mode: Instructor Option.

Special Course Fee: No.

CIVE 799B Dissertation: Hydraulics Credits: Var[1-18] (0-0-0)**Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799C Dissertation: Hydrologic Science and Engineering Credits:****Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Registration Information:** Sections may be offered: Online.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799D Dissertation: Mechanics Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799E Dissertation: Geotechnical Engineering Credits:****Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799F Dissertation: Structures Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799G Dissertation: Environmental Engineering Credits:****Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799H Dissertation: Water Resource Planning and Management Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799J Dissertation: Bioresource and Agricultural Engineering Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799K Dissertation: Water and International Development Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.**CIVE 799L Dissertation: Construction Engineering and Management Credits: Var[1-18] (0-0-0)****Course Description:****Prerequisite:** None.**Restriction:** Must be a: Graduate, Professional.**Terms Offered:** Fall, Spring, Summer.**Grade Mode:** Instructor Option.**Special Course Fee:** No.