Civil and Environmental Engineering

Civil engineering is about the planning, design, construction and operation of facilities essential to modern life, ranging from bridges to transit systems. Civil engineers are problem solvers, meeting the challenges of community planning, water supply, structures, traffic congestion, energy needs, pollution, and infrastructure improvements. Societal needs, economic conditions and public safety are paramount in the work accomplished by civil engineers. High-tech tools such as computer aided design (CAD), geographical information systems (GIS) and 3-D computer modeling are a necessity in all areas of civil engineering. Civil engineers are sought by both private companies and public agencies for a variety of professional positions. Many work for engineering consulting firms or construction companies as design engineers, field engineers and project managers. They also join government agencies to oversee transportation, water supply, environmental protection, and resource management. Graduates are equally prepared to pursue MS and Ph.D. degrees in allied fields, as well as business, management and law degrees.

The Mission of Civil Engineering

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Program Educational Objectives

Our program educational objectives are reflected in the achievements of our recent alumni.

1. **Engineering Practice:** Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward practical, sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.
2. **Professional Growth:**Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.
3. **Service:** Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Student Outcomes

Our student outcomes are what students are expected to know and be able to do by the time of their graduation.

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

This program is accredited by the Engineering Accreditation Commission of ABET, http://abet.org.

NJIT Faculty

A

Adams, Matthew, Assistant Professor

Axe, Lisa B., Professor, Chemical Engineering (Joint Faculty)

B

Bagheri, Sima, Professor Emeritus

Bandelt, Matthew, Assistant Professor

Borgaonkar, Ashish, Assistant Professor, Engineering Technology (Joint Faculty)

Boufadel, Michel, Professor

C

Castro, Eduardo-Senior University Lecturer

Chien, I Jy, Steven, Professor

Cianci, Andrew, Senior University Lecturer

D

Daniel, Janice R., Professor

Dauenheimer, Edward G., Professor Emeritus

Dimitrijevic, Branislav, Assistant Professor

Ding, Yuan, Associate Professor

Dresnack, Robert, Professor Emeritus

G

Greenfeld, Joshua S., Professor Emeritus

H

Hsieh, Hsin-Neng, Professor Emeritus

K

Karaa, Fadi A., Associate Professor

Khera, Raj P., Professor Emeritus

Kolawole, Oladoyin , Assistant Professor

Konon, Walter, Professor

L

Lee, Joyoung, Associate Professor

M

Mahgoub, Mohamed, Associate Professor, Engineering Technology (Joint Faculty)

Marhaba, Taha F., Professor

Meegoda, Jay N, Professor

Milano, Geraldine, Senior University Lecturer

O

Olenik, Thomas J., Associate Professor

P

Pennock, William, Assistant Professor

Potts, Laramie, Associate Professor, Engineering Technology (Joint Faculty)

R

Raghu, Dorairaja, Professor Emeritus

S

Saadeghvaziri, Mohamad A., Professor

Saigal, Sunil, Distinguished Professor

Salek, Franklin, Professor Emeritus

Santos, Stephanie R, Senior University Lecturer

Schuring, John, R., Professor Emeritus

Spasovic, Lazar, Professor

W

Washington, David, Associate Professor, Engineering Technology (Joint Faculty)

Wecharatana, Methi, Professor

Z

Zhang, Wen, Associate Professor

- Civil Engineering - B.S. (http://catalog.njit.edu/undergraduate/newark-college-engineering/civil-environmental/civil-engineering-bs/)
- Climate Change Adaptation and Resilience in Engineering (http://catalog.njit.edu/undergraduate/newark-college-engineering/civil-environmental/climate-change-adaptation-and-resilience-in-engineering-minor/)
- Environmental Engineering Minor (http://catalog.njit.edu/undergraduate/newark-college-engineering/civil-environmental/environmental-engineering-minor/)
- Geosystems Minor (http://catalog.njit.edu/undergraduate/newark-college-engineering/civil-environmental/geosystems-minor/)

Civil and Environmental Engineering Courses

CE 100. Introduction to Civil Engineering. 1 credit, 2 contact hours (1;0;1).
Prerequisites: ENGL 101, and MATH 111 or ENGR 101 and MATH 110. Students are introduced to the academic and professional domains of civil engineering. Topics covered include introduction to industry framework and stakeholders, engineering design methodology, civil engineering elements, with exposure to field exercises and computer applications. Students also learn to use engineering tools for computer-aided design and simulation. Technical writing and oral presentation skills are emphasized through select assignments.

CE 101. CE Computer Aided Design. 1 credit, 2 contact hours (0;2;0).
Co-requisite or CE CAD teaches students the use of basic tools, such as Autocad software, used in the preparation of Civil Engineering contract documents. Autocad is a widely used computer program for generating engineering drawings.

CE 200. Surveying. 2 credits, 3 contact hours (2;1;0).
Prerequisite: MATH 111 or ENGR 101. Angle and distance measurement; leveling; topographic mapping; traverse and area computations; horizontal and vertical curves; cross sections; triangulation; state plane coordinates; global positioning system. Emphasis on the use of the computer for solving typical field and office problems. Lab should be taken concurrently.

CE 200A. Surveying Laboratory. 1 credit, 3 contact hours (0;3;0).
Corequisite: CE 200. Field exercises in conjunction with the classroom exercises in CE 200 utilizing classical and electronic instruments and COGO/CAD software.

CE 210. Construction Materials and Procedures. 3 credits, 3 contact hours (3;0;0).
Prerequisite: ENGL 101. Introduction to construction management organization, contracts, construction safety, engineering economics, and engineering ethics. Studies current practices of heavy construction including soil and rock excavation productivity, and building construction materials and procedures. Field trips to construction sites provide opportunities to directly view many of the practices.

CE 260. Civil Engineering Methods. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ENGL 101, CE 101, CE 200, CE 200A. Provides students with in-depth experience in computer applications in civil engineering and with written and oral communication.

CE 307. Geometric Design for Highways. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 200, CE 200A. Highway design based on a study of traffic distribution, volume, and speed with consideration for the predictable future. Analysis of elements of at-grade intersections and interchanges and the geometrics of highway design and intersection layout with advanced curve work including compound and transition curves.

CE 311. Co-op Work Experience I. 0 credits, 0 contact hours (0;0;0).
Restriction: completion of the sophomore year, approval of the department, and permission of the Office of Cooperative Education and Internships. Students gain major-related work experience and reinforcement of their academic program. Work assignments facilitated and approved by the co-op office. Mandatory participation in seminars and completion of a -report.

CE 320. Fluid Mechanics. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MECH 235 with a grade of C or better, MATH 112 and PHYS 111/PHYS 111A. Corequisite: MECH 236. This course is designed to present the fundamental laws relating to the static and dynamic behavior of fluids. The emphasis is placed on applications dealing with the flow of water and other incompressible fluids. These include flow in pipe systems and natural channels.

CE 320A. Hydraulics Laboratory. 1 credit, 3 contact hours (0;3;0).
Prerequisite or corequisite: CE 320. Explores the principles of fluid mechanics through laboratory experiments. Investigates various hydraulic phenomena with both physical and computer models. Demonstrates basic civil engineering design principles for pipe networks, open channel systems, and ground water regimes.

CE 321. Water Resources Engineering. 2 credits, 3 contact hours (2;0;1).
Prerequisites: CE 200, CE 200A, MATH 279 or MATH 305. Training in methods of developing water supplies and the means to treat supplies for consumptive use. Covers hydrologic techniques such as surface and ground water yield, hydrograph and routing analyses, and probabilistic methods related to hydrologic studies.

CE 322. Hydraulic Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 320, CE 321. The objective is to provide the tools required to design water distribution systems, storm drains, and sanitary sewers. Examines related hydrologic and hydraulic techniques.

CE 332. Structural Analysis. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MECH 237 with a grade of C or better. A working knowledge of free body diagrams, equilibrium conditions for force systems and moments. The primary objective is an understanding of the various methods of analyzing determinate and indeterminate beams, frames, and trusses encountered in practice.

CE 333. Reinforced Concrete Design. 2 credits, 3 contact hours (2;1;0).
Prerequisite: CE 332. The student must have a working knowledge of structural analysis including determinate and indeterminate beams and frames. Primary objectives include the following: to acquaint the student with the properties of concrete and steel and with the behavior of reinforced concrete as a structural material; also, to develop methods for the design of reinforced concrete structural members such as beams, slabs, footings, and columns. Both ultimate strength design and working stress method will be studied.

CE 341. Geotechnical Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisite: MECH 237 with a grade of C or better or equivalent. Corequisite: CE 341A. A study of soil types and properties is made with the objective of developing a basic understanding of soil behavior. The methods of subsurface investigation and compaction are presented. Fundamentals pertaining to permeability, seepage, consolidation, and shear strength are introduced. Settlement analysis is also presented. Lab must be taken concurrently.

CE 341A. Geotechnical Engineering Laboratory. 1 credit, 3 contact hours (0;3;0).
Corequisite: CE 341. Students perform basic experiments in soil mechanics.

CE 342. Geology. 3 credits, 3 contact hours (3;0;0).
Restriction: Sophomore status. Studies science of geology with emphasis on physical geological processes. Stresses the principle of uniformity of process in the context of rock and soil formation, transformation, deformation, and mass movement. Includes aspects of historical geology and geomorphology.

CE 350. Transportation Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200, CE 200A. A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

CE 351. Intro To Transportation System. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 200, CE 200A, CE 350 A study of the principal modes of transportation, with emphasis on the planning, design and construction of facilities for modern transportation systems.

CE 360. Civil Engineering Materials. 2 credits, 3 contact hours (2;0;1).
Prerequisites: CHEM 121 or 125 and MECH 237 (with a grade of C or better). This course will provide instruction on engineering materials used in the construction of civil engineering projects. Additionally, the fundamentals of sustainability and sustainable design within the context of civil engineering will be discussed. The engineering properties of aggregates, wood, metal, portland cement concrete and asphaltic concrete and design of these materials will be covered. These materials will be used to discuss sustainability concepts and design within civil engineering.

CE 381. Geomorphology. 3 credits, 3 contact hours (3;0;0).
This is a course in geomorphology, the study of landforms and the contemporary processes that create and modify them. The course will emphasize earth surface processes and quantitative analysis of landform change. Lectures will stress geomorphic principles and two field-based problems will enable students to apply these principles to contemporary geomorphic problems in engineering and management with a focus on the natural environment.

CE 406. Remote Sensing. 3 credits, 3 contact hours (3;0;0).
Prerequisite: PHYS 234. Principles of remote sensing are covered including general concepts, data acquisition procedures, data analysis and role of remote sensing in terrain investigations for civil engineering practices.

CE 410. Construction Scheduling and Estimating. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 210. Quantity take off, cost estimate and CPM computer analysis of typical building or highway projects. A study is made of construction project organization, contract requirements and management control techniques with an introduction to computer applications.

CE 412. Construction Codes and Specifications. 3 credits, 3 contact hours (3;0;0).
Prerequisite: CE 210. Code and specification aspects of engineered construction. Topics include professional ethics, contracts, specifications, bidding procedures, building codes such as B.O.C.A. and New Jersey Uniform Construction Code, Energy Code Provisions, construction safety, and the impact of the EPA on construction.

CE 413. Co-op Work Experience II. 3 credits, 3 contact hours (0;0;3).
Prerequisites: CE 311 or equivalent, approval of the department, and permission of the Office of Cooperative Education and Internships. Provides major-related work experience. Mandatory participation in seminars and completion of requirements including a report and/or project.Note: Normal grading applies to this COOP Experience.

CE 414. Engineered Construction. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210, CE 332, CE 341. Design, erection, and maintenance of temporary structures and procedures used to construct an engineering project. Business practices, codes, design philosophies, construction methods, hardware, inspection, safety, and cost as they pertain to engineered construction projects.

CE 431. Construction Materials Lab. 1 credit, 3 contact hours (0;3;0).
Prerequisites: CE 210, MECH 237 with a grade of C or better, CE 210. This course provides an understanding of the basic properties of construction materials, and presents current field and laboratory standards and testing requirements for these materials. Students select a material or component assembly for testing, design a testing procedure, and present their results.

CE 432. Steel Design. 2 credits, 3 contact hours (2;1;0).
Prerequisite: CE 332. A working knowledge of structural analysis including determinate and indeterminate beams and frames is essential. The development of current design procedures for structural steel elements and their use in multistory buildings, bridges, and industrial buildings.

CE 443. Foundation Engineering Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 341, CE 341A. Site investigation, selection of foundation types and basis for design, allowable loads, and permissible settlements of shallow and deep foundations. Computations of earth pressure and design of retaining walls.

CE 450. Urban Planning. 3 credits, 3 contact hours (3;0;0).
Prerequisite: junior engineering standing. Introduction to urban planning, its principles, techniques, and use. Topics include development of cities, planning of new towns, redevelopment of central cities, and land use and transportation planning.

CE 455. Civil Engineering Data Management, Analysis, and Visualization. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CS 101, MATH 211, MATH 279 or MATH 333, or approval of instructor. This course offers hands-on and fundamental knowledge of various state-of-the-art processes, tools, and techniques of data analysis and management, including the collection, organization, storage, and visualization of the built environment- and civil infrastructure-related data. This course particularly focuses on how to make use of data to find trends, get insights, and solve real-world problems encountered in the various specialty areas in the civil engineering field. Programming will be used to demonstrate some practical examples.

CE 461. Professional Practice in CEE. 3 credits, 3 contact hours (3;0;0).
Develop an understanding of the process to become a licensed professional engineer and familiarize the students with the professional practice of engineering including codes of ethics and professional business practices and to provide an adequate background for the Fundamentals of Engineering.

CE 463. Energy Geotechnics and Sustainability. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 341, CE 342, or CE 360. This course will provide basic knowledge on the application of geotechnical and energy engineering principles in the design and analyses of thermo-hydro-chemo-mechanical processes encountered in extracting, exchanging, storing, and protecting underground energy resources, to reduce greenhouse gas emissions and mitigate global climate change.

CE 465. Green and Sustainable Civil Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210 and Junior standing. Designed to teach students currently available approaches that incorporate renewable energy and sustainable development concepts in civil engineering projects. This will include various methods of planning, design, and evaluation which promote increased energy efficiency and sustainable use of materials. Cost estimating and life cycle planning will also be included. The course will encourage students to look beyond the information in the course, to come up with additional methodologies which may not currently be in use.

CE 485. Special Topics in Civil Engineering. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of civil engineering not regularly covered in any other CE course. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

CE 490. Civil Engineering Projects. 3 credits, 3 contact hours (0;0;3).
Restriction: senior standing in civil engineering and approval of the department. Work on an individually selected project, guided by the department faculty advisor. The project may include planning, research (library or laboratory), engineering reports, statistical or analytical investigations, and designs. Any of these may follow class-inspired direction or the student may select his or her own topic. The project must be completed and professionally presented by assigned due dates for appropriate review and recording of accomplishment.

CE 491. Research Exper-Civil Engr. 3 credits, 3 contact hours (0;0;3).
Prerequisites: Junior standing, agreement of a department faculty advisor, and approval of the associate chairperson for undergraduate studies. This course provides the student with an opportunity to work on a research project under the individual guidance of a member of the department. A written report is required for course completion. Open to students with a GPA of 3.0 or higher.

CE 494. Civil Engineering Design I. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 210, CE 260, CE 320, CE 321, CE 350, CE 341 , CE 341A and senior standing in civil engineering. Simulates the submission and acceptance process normally associated with the initial design phases for a civil engineering project. Familiarizes students with the preparation of sketch plats, preliminary engineering design, and a related environmental assessment. Requirements include written submittals and oral presentations in defense of the project.

CE 495. Civil Engineering Design II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 333, CE 432, CE 443. Pre or Corequisite: CE 494. Provides students with the type of design experience they would receive if engaged in civil and environmental engineering design practice including incorporating engineering standards and multiple constraints. Students can select from these design areas: structures, geotechnical engineering, transportation and planning, and sanitary and environmental engineering.

CE NEXT. Civil Engineering Next Generation Professional Practice Seminar. 0 credits, 1 contact hour (0;0;1).
Restrictions: Civil and Environmental Engineering Junior and Senior students only. CE Next Gen is a non-credit elective course that introduces students to several soft skills that will enhance their ability to succeed in the field of civil and environmental engineering. Students will develop skills in communication, relationship building, public speaking, business etiquette, time management, negotiating, interviewing and presentation. The course will also help students improve their self-confidence, emotional intelligence, and interpersonal skills. Students will engage in a variety of in- class activities, homework, group projects, and presentations throughout the semester. The group projects will provide a platform to focus on the skills learned and connect skillsets.

ENE 101. Computer-Aided Design (CAD) for Environmental Engineering. 1 credit, 2 contact hours (0;2;0).
This introductory course is designed to teach Environmental Engineering students the fundamentals of Computer-Aided Design (CAD) using AutoCAD software, a widely used tool for generating precise engineering drawings. Students will gain hands-on experience in creating, editing, and interpreting CAD drawings commonly used in Environmental Engineering projects such as site plans, infrastructure designs, water treatment systems, and environmental mapping. The course will focus on using AutoCAD for preparing contract documents in environmental engineering projects.

ENE 260. Microbiology for Environmental Engineers. 2 credits, 3 contact hours (2;1;0).
Prerequisites: CHEM 126. This course provides a comprehensive overview of microorganisms and microbial processes that are integral to both natural and engineered environments. Environmental engineering students will explore the role of microorganisms in processes such as nutrient cycling, bioremediation, microbial-induced corrosion, greenhouse gas emissions, antibiotic resistance, wastewater treatment, and water disinfection. The course will combine traditional lectures with laboratory exercises, environmental engineering case studies, and current research articles. Students will develop laboratory skills in culturing and molecular techniques used in environmental microbiology and will also be exposed to experimental design, data analysis, and interpretation.

ENE 262. Introduction to Environmental Engineering. 3 credits, 4 contact hours (3;1;0).
Prerequisites: CHEM 126, MATH 112, and PHYS 121. To introduce students to the integrated science, engineering, design and management concepts of engineered environmental systems. The course will cover environmental regulations and standards, environmental parameters, mass balance and natural systems, water quality management, water and wastewater treatment, air pollution control, noise pollution, and solid and hazardous waste management. Background material and laboratories in the environmental sciences and management areas will be covered. Group term papers and presentations will be required.

ENE 330. Soil, Water and Air Quality Lab. 1 credit, 3 contact hours (0;3;0).
Prerequisites: ENE 262. This hands-on laboratory course introduces students to the analytical methods used to measure properties and characteristics of dissolved, particulate, and microbiological constituents in water, air, and soil systems. Students will gain practical experience using a variety of advanced laboratory instruments, including GC/FID, GC/MS, ICP, UV-Vis, HPLC-MS, and SEM. Emphasis is placed on understanding the principles behind these instruments, proper sample preparation, and data analysis, as well as the application of these methods in environmental quality monitoring and environmental engineering projects.

ENE 331. Environmental Systems Lab. 1 credit, 3 contact hours (0;3;0).
Pre or Corequisites: CE 320 . This lab course focuses on the measurement of water flow and solute transport in various environmental systems such as water pipe networks, open channels, and groundwater systems. The course takes a systemic approach to quantifying the evolution of contamination in these systems, with an emphasis on understanding and measuring residence times, solute transport processes, and contaminant persistence. Students will apply fluid mechanics principles in practical laboratory settings and develop skills in data collection, analysis, and interpretation of water quality in both natural and engineered systems.

ENE 360. Water and Waste Water Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262 and junior standing. Training in the methods used for water pollution control. Topics include the chemical, physical, and biological processes that occur in waste treatment design and in receiving waters; modeling schemes to determine allowable loadings in various bodies of water; and waste treatment processes used for water pollution control.

ENE 361. Solid and Hazardous Waste Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262 and junior standing. Exposure to the area of air pollution control, solid waste disposal, and radioactive waste disposal. Topics include the chemistry of contaminated atmospheres; the influence on meteorological conditions of dispersion of pollutants; abatement processes used in the control of emissions; classification and nature of solid waste, and solid waste disposal techniques; sources and methods for the disposal of radioactive contaminants; and related health effects.

ENE 362. Pollution Prevention. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 126, MATH 111. Restriction: Junior Standing. This course presents pollution prevention concepts and principles, terminologies, life cycle impact approaches, and management strategies. It will also serve as a community based service learning course. The course introduces available improvement techniques for industrial pollution prevention and control and examines specific applications to industries biological, chemical, physical, and thermal techniques.

ENE 370. Environmental Policy and Ethics. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262. This course provides an overview of the role of government in regulating the environment and helps students develop the skills to assess the costs and benefits of environmental regulations and their impact on environmental engineering projects. The course also explores ethical frameworks for understanding human environment interactions, with a focus on topics such as environmental ethics, environmental justice, environmental economics, and climate change. Through case studies, policy analysis, and ethical debates, students will gain a comprehensive understanding of how policies are shaped by economic considerations, ethical values, and social factors.

ENE 371. Remedial Systems Design. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CHEM 360. This course focuses on the design of engineered remedial systems for contaminated sites, particularly those subject to Superfund and other cleanup programs. Students will explore various technologies and treatment methods used to remediate contaminated soil, groundwater, air, and vapor, with a focus on chemical, microbiological, and biological processes. Emphasis will be placed on site assessment, risk evaluation, and designing effective treatment systems to restore contaminated environments to safe use. Through case studies, design projects, and practical exercises, students will gain the technical knowledge required to design, implement, and evaluate remedial solutions.

ENE 430. Environmental Fate and Management. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 371. This course will explore the fundamental processes that control the migration and transformation of chemicals in various environmental media (surface water, groundwater, and the atmosphere). Emphasis will be placed on understanding advection, diffusion, dispersion, retardation, and chemical reactions. Through quantitative problem-solving exercises, students will develop a comprehensive understanding of how chemicals move through the environment, identify source areas, assess exposure pathways, and apply toxicology data to evaluate environmental risks. The course will provide the skills necessary to manage environmental contaminants and inform decision-making for environmental protection.

ENE 445. Ecology and Wetlands. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: ENE 260, ENE 262. This senior-level course introduces the basic concepts of ecology and the importance of wetlands in maintaining environmental health. Topics include ecosystem dynamics, the structure and function of wetlands, the role of wetlands in biodiversity, and the impact of human activities on wetland ecosystems. The course will explore key environmental issues such as population growth, resource management, pollution, and climate change. Students will examine how wetlands contribute to ecological sustainability and how their preservation and restoration can be integrated into environmental engineering solutions. Case studies, fieldwork, and design projects will be used to apply ecological principles to real-world problems.

ENE 450. Environmental Impact Analysis. 3 credits, 3 contact hours (3;0;0).
Pre or Corequisites: ENE 494. This senior-level course introduces students to the principles, methods, and regulatory frameworks used in environmental impact analysis (EIA). Emphasizing both physical and social aspects of the environment, the course covers the evaluation of environmental effects of proposed projects and activities. Students will learn the process of developing Environmental Impact Statements (EIS) and assessing the potential environmental consequences, focusing on federal and state standards. Case studies will be used to illustrate real-world examples, with attention to the scientific, economic, and social factors that influence decision-making. The course will also address how environmental impacts are assessed, mitigated, and communicated to stakeholders.

ENE 454. Parametric Design of Sustainable Water Treatment Plants. 3 credits, 3 contact hours (3;0;0).
Prerequisites: CE 101, CE 320, CS 101, ENE 262. This problem-centered design course focuses on major water quality challenges both nationally and internationally. Human and context driven design principles are applied to drinking water contaminants with global public health impact. We develop design algorithms from first principles whenever possible and explore novel solutions. Students work in teams to design water treatment systems using Onshape and open source design tools.

ENE 465. Green and Sustainable Environmental Engineering. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 262. Environmental engineering concerns itself with preserving and restoring the quality of water, air, and soil. This course will examine drinking water, stormwater, wastewater, solid waste, and soil remediation activities from the perspective of sustainability, highlighting proven approaches. Sustainability will be framed within the Envision certification and Life Cycle Analysis (LCA) approach, with consideration of environmental justice issues.

ENE 485. Special Topics in Environmental Engineering. 3 credits, 3 contact hours (3;0;0).
The study of new and/or advanced topics in an area of environmental engineering not regularly covered in any other ENEcourse. The precise topics to be covered in the course, along with prerequisites, will be announced in the semester prior to the offering of the course.

ENE 490. Senior Project. 3 credits, 3 contact hours (0;0;3).

ENE 491. Research Experience in ENE. 3 credits, 3 contact hours (3;0;0).

ENE 494. Environmental Engineering Design I. 3 credits, 3 contact hours (3;0;0).
Restrictions: Senior standing. ENE 494 is the first part of a two-semester senior capstone design sequence (EnE494 followed by EnE 495) for Environmental Engineering students. In this course, students work in teams on real-world, client-based projects that require them to integrate knowledge from previous coursework. They will apply environmental engineering principles to solve practical engineering problems, taking into account constraints related to economics, environmental impact, sustainability, social equity, safety, and ethics. The course emphasizes project management, teamwork, client communication, and professional responsibility. By the end of the EnE 494 course, students will have developed a preliminary design for a project, including problem identification, conceptual design, and an initial set of engineering calculations and analyses. Detailed course outline will be produced based on project details.

ENE 495. Environmental Engineering Design II. 3 credits, 3 contact hours (3;0;0).
Prerequisites: ENE 494. ENE 495 is the second part of the two-semester senior capstone design sequence, focusing on the implementation and finalization of the design developed in ENE 494. Students will continue to refine their design, address any remaining technical challenges, and produce a final set of design documents. This course emphasizes client interactions, project management, and real-world problem-solving, with the goal of producing a professional-quality design ready for implementation. The final presentation of the design to the client and faculty will serve as a culmination of the students' academic and practical experience in environmental engineering design.

MECH 234. Engineering Mechanics. 2 credits, 3 contact hours (2;0;1).
Prerequisites: PHYS 111, MATH 112. A course for industrial, materials and mechanical engineering students in which the equilibrium of particles and rigid bodies subject to concentrated and distributed forces is studied.

MECH 235. Statics. 3 credits, 4 contact hours (3;0;1).
Prerequisites: PHYS 111, MATH 112. Available for CE students only. Provides an understanding of equilibrium of particles and rigid bodies subject to concentrated and distributed forces.

MECH 236. Dynamics. 2 credits, 2 contact hours (2;0;0).
Prerequisites: MECH 234 or MECH 235 with a grade of C or better or MECH 320 and MATH 112, PHYS 111/PHYS 111A. Provides an understanding of the mathematics of the motion of particles and rigid bodies, and of the relation of forces and motion of particles.

MECH 237. Strength Of Materials. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MECH 234 or MECH 235 with a grade of C or better and MATH 112, PHYS111/PHYS 111A. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions. Lab should be taken concurrently.

MECH 238. Application of Dynamics. 1 credit, 2 contact hours (1;0;1).
Prerequisites: MECH 235. This course introduces civil engineering students to the principles of dynamics, with a focus on particle motion, rigid body dynamics and vibration systems. Students will apply mathematical models to analyze forces, motion, energy, and moment, while also learning and solving problems with practical applications in civil engineering.

MECH 239. Strength of Materials for Civil Engineers. 3 credits, 4 contact hours (3;1;0).
Prerequisites: MECH 235 with a grade of C or better and MATH 112, PHYS111/PHYS 111A. Restrictions: Only Civil Engineering students. A working knowledge of statics with emphasis on force equilibrium and free body diagrams. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions. Lab should be taken concurrently.

MECH 320. Statics and Strength of Materials. 3 credits, 3 contact hours (3;0;0).
Prerequisites: PHYS 111, MATH 112. For chemical engineering and electrical engineering majors. Statics provides an understanding of the equilibrium of particles and rigid bodies, including simple machines, trusses, and frictional forces. Mechanics of materials covers pressure vessels, thermal stresses, torsion of shafts, stresses and deflection in beams, and column action.