

CIVIL/ENVIRONMENTAL AND CHEMICAL ENGINEERING

In Fall 1998, the Department of Civil and Environmental Engineering was combined with the Department of Chemical Engineering to form the Department of Civil/Environmental and Chemical Engineering. The department housed two distinct programs—Civil Engineering (CE) and Chemical Engineering (ChE)—with separate faculty lines dedicated to each program. Both programs offer BE and MS degrees.

In Fall 2020, the department joined the other engineering programs in the YSU Rayen School of Engineering.

For more information on each program, visit the College of Science, Technology, Engineering and Mathematics (<http://www.yсу.edu/academics/science-technology-engineering-mathematics/>).

Professor

John DeSantis, Ph.D., Assistant Professor

Richard Albert Deschenes, Jr., Ph.D., Assistant Professor

Sahar Ehsani, Ph.D., Assistant Professor

AKM Anwarul Islam, Ph.D., Professor

Holly J. Martin, Ph.D., Associate Professor

Byung-Wook Park, Ph.D., Assistant Professor

Suresh Sharma, Ph.D., Associate Professor

Lecturer

Shirley Xie, Ph.D., Lecturer

Majors

- Chemical Engineering Program (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-civil-environmental-chemical-engineering/chemical-engineering-program/>)
- Chemical Engineering 4+1 Graduate Track (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-civil-environmental-chemical-engineering/chemical-engineering-four-plus-one-graduate-track/>)
- Civil Engineering Program (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-civil-environmental-chemical-engineering/civil-engineering-program/>)
- Civil Engineering 4+1 Graduate Track (<http://catalog.yсу.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics/department-civil-environmental-chemical-engineering/civil-engineering-four-plus-one-graduate-track/>)

Civil and Environmental Engineering

CEEN 2601 Statics 3 s.h.

Principles of engineering mechanics as applied to statics with vector applications to forces and moments; centroid and center of gravity; equilibrium; friction; moments of inertia: relationship between loads, stress and strain in tension, compression, torsion and bending.

Prereq.: MATH 1572 or MATH 1572H; PHYS 2610 or concurrent.

CEEN 2602 Strength of Materials 3 s.h.

Relationships between loads, shear and bending moments in beams; combined stresses in beams; indeterminate beam analysis; virtual load; connections; columns.

Prereq.: CEEN 2601.

CEEN 2602L Strength of Materials Lab 1 s.h.

Experimental verification of strength of materials; testing: tension, torsion, non-destructive tests of steel; concrete compression and Poisson ration, wood tests.

Coreq.: CEEN 2602.

CEEN 2610 Surveying 3 s.h.

The theory of surveying and the use of instruments. Problems in leveling, traversing, and topography. Introduction to circular and vertical curves.

Prereq.: MATH 1513 or equivalent.

CEEN 2610L Surveying Laboratory 1 s.h.

Field surveying principles and techniques. Uses of transit and level are stressed. Three laboratory hours per week.

Coreq.: CEEN 2610.

CEEN 2660 Computer Aided Design and Drafting 2 s.h.

This course is designed for students who wish to be involved with the civil engineering design fields and for those interested in computer aided design and drafting. Students will be introduced to both traditional and computer aided design and drafting skills. The aim of this course is to introduce students to basic information, skills, and concepts related to drafting and design. Special attention is given to: sketching, measurement, room planning, multi-view drawing, auxiliary views, working drawings, sectional views, orthographic drawings along with AutoCAD tools and commands. The course includes 1 s.h. lecture and 1 s.h. lab.

CEEN 3710 Civil Engineering Materials 3 s.h.

A study of the principal materials used for civil engineering and construction purposes, with special attention paid to physical and mechanical properties of the materials and their importance to the engineer.

Prereq.: CEEN 2602.

CEEN 3711 Technology and Society 3 s.h.

A critical exploration of how societal needs affect the creation of technologies and how technology affects society. The course is interdisciplinary in nature and presents various approaches to examining the complex interaction between humans and their tools. Topics include: (1) technology in human history; (2) society, science, and technology development; (3) technology and social change; (4) technology, knowledge, and power; (5) technology, population, and the environment. Listed also as SOC 3789.

Prereq.: Junior standing or consent of instructor.

CEEN 3716 Fluid Mechanics 3 s.h.

Proportions of fluids, fluid statics, kinematics; Bernoulli equation; fluid momentum; laminar and turbulent flow through simple pipes; boundary layers; dimensional analysis and similitude.

Prereq.: CEEN 2602.

CEEN 3716L Fluid Mechanics Lab 1 s.h.

Experimental verification of the principles of fluid mechanics as applied to incompressible fluid. Three hours laboratory per week.

Prereq.: CEEN 2602.

Coreq.: CEEN 3716.

CEEN 3717 Hydraulic Design 4 s.h.

Analysis of flow in complex pipe systems; pumps; open channel flow; culverts; spillways; storm water drainage. Three hours lecture and three hours of computational laboratory per week.

Prereq.: CEEN 2610 and CEEN 3716.

CEEN 3720 Transportation Engineering 3 s.h.

Introductory survey of transportation topics including transportation systems, vehicular operation and control, and transportation planning techniques; introduction to design of highways, airports, and railroads; and traffic engineering.

Prereq.: CEEN 2610.

CEEN 3736 Fundamentals of Environmental Engineering 3 s.h.

Causes and effects of water, air and land pollution; measurements of environmental quality; environmental regulations; introduction to methods of pollution control.

Prereq.: CHEM 1515.

CEEN 3749 Structural Analysis 1 3 s.h.

The determination of shears, moments, and stresses in statically determinate beams, frames, and trusses. Consideration of dead, live, moving, and wind loads. Elastic deflections of simple structures. Introduction to the analysis of statically indeterminate structures using numerical and energy methods.

Prereq.: CEEN 2602.

CEEN 3749L Structural Analysis 1 Lab 1 s.h.

Introduction to stiffness-based analysis of determinate and indeterminate structures. Computer analysis of various structural systems, including plane and space trusses, continuous beams, plane and space frames, plates. P-delta stability analysis of frames. Three hours computational lab per week.

Prereq.: CEEN 2602; concurrent with CEEN 3749.

CEEN 3751 Water Quality Analysis 3 s.h.

Introduction to physical, chemical, and biological measurements of water quality. Sample collection and laboratory analysis of natural waters, drinking water, and wastewater. Interpretation of environmental data. Two hours lecture and three hours laboratory per week. Identical to ENST 3751.

Prereq.: CEEN 3736 or ENST 2600; CHEM 1515.

CEEN 3751L Water Quality Analysis Lab 0 s.h.

Laboratory experience in the analysis of natural waters, drinking water and wastewater. Emphasizes procedures for the collection and interpretation of data on current environmental problems. Three hours laboratory per week. Must be taken concurrently with CEEN 3751.

CEEN 4800 Special Topics 3 s.h.

Special topics and new developments in Civil Engineering. Subject matter, credit hours, and special prerequisites to be announced in advance of each offering. May be repeated to a maximum of 6 s.h.

Prereq.: Senior standing or consent of instructor.

CEEN 4812 Construction Management 3 s.h.

Fundamentals of construction management: contracts, bonding, estimating, organization, finance; cost and productivity of equipment, material, and labor; and project planning and scheduling.

Prereq.: CEEN 3717 or CEEN 4881.

CEEN 4835 Highway Design 3 s.h.

Methods of highway route location; design methods and standards for highways, intersections, freeways, and interchanges. Includes extensive use of computer-aided design.

Prereq.: CEEN 3720.

CEEN 4863 Integrated Design Project 3 s.h.

Students will be required to complete a culminating design experience that focuses attention on professional practice and is predicated on the accumulated background of curriculum components. Three hours of lecture.

Prereq.: CEEN 5855 and GPA of 2.0 or better.

Coreq.: CEEN 4863L.

CEEN 4863L Integrated Design Project Lab 1 s.h.

Students will be required to complete a meaningful design experience that focuses attention on professional practice and is predicated on the accumulated background of curriculum components. Three hours of laboratory a week. **Coreq.:** CEEN 4863. 0.

CEEN 4879 Civil Engineering Analysis 3 s.h.

Application of mathematical and numerical methods to the systematic analysis and development of problems in the field of Civil Engineering.

Prereq.: CEEN 3749.

CEEN 4881 Geotechnical Engineering 3 s.h.

Properties of soil, classification, capillarity, seepage, permeability, stresses, consolidation, shear strength; analysis and design of foundation structures, retaining walls, piles, drilled piers, sheet pile walls, special footings, stability.

Prereq.: MATH 2673; CEEN 3749.

CEEN 4881L Geotechnical Lab 1 s.h.

Typical soil testing procedures and physical testing of soil samples.

Prereq.: Concurrent with: CEEN 4881.

CEEN 5820 Pavement Material and Design 3 s.h.

Design methods for flexible, rigid and other wheel-supporting pavements to include investigation, testing and preparation of subgrade, base course and pavement materials, design of various pavement mixtures, stresses in pavements, pavement design, and strengthening existing pavements.

Prereq.: CEEN 3720 and CEEN 4881.

CEEN 5829 Civil Engineering Materials - Concrete 3 s.h.

A course designed to broaden the student's understanding of Portland Cement Concrete as a construction material. Topics include the study of cement, hydration of cement, aggregates, admixtures for concrete, mix design handling and placing, curing and properties of Portland Cement Concrete. Testing of Concrete, quality control and special concretes are also included. A library research paper on a concrete-related topic of the student's choice is required.

Prereq.: CEEN 3749 or permission of instructor.

CEEN 5832 Natural Systems Engineering 3 s.h.

Introduction to the features, functions and values of natural aquatic systems, and engineering approaches to analysis and restoration design. Focus on wetlands and streams. Topics include regulations, wetland delineation, constructed wetland design, basic stream geomorphology, and stream restoration design.

Prereq.: CEEN 3736 or permission of instructor.

CEEN 5836 Environmental Water Chemistry 3 s.h.

Fundamental principles and calculations of major chemical reactions and equilibria that occur in aquatic environments, and water/wastewater treatment processes.

Prereq.: CEEN 3736.

CEEN 5837 Environmental Engineering Design 3 s.h.

Theory and design of unit operations and processes for treatment of drinking water and municipal wastewater.

Prereq.: CEEN 3736.

CEEN 5849 Structural Analysis 2 3 s.h.

Analysis of statically indeterminate beams, trusses, bents and multistory frames, utilizing concepts of strain energy, virtual work, slope-deflection, and moment distribution. Introduction to matrix methods of analysis using force and displacement methods.

Prereq.: CEEN 3749.

CEEN 5855 Reinforced Concrete Design 3 s.h.

An introduction to the behavior, analysis, and design of reinforced concrete members. Included are singly and doubly reinforced beams, tee-beams, slabs, short and long columns.

Prereq.: CEEN 3749.

CEEN 5856 Steel Design 3 s.h.

An introduction to the behavior and design of steel structures. Included is the design of rolled and built-up tension members, beams, columns, beam-columns, welded and bolted connections.

Prereq.: CEEN 3749.

CEEN 5869 Design of Air Pollution Control Systems 3 s.h.

Engineering analysis, procedures, and techniques for the selection, applications and operation of air pollution control methods in various operational situations.

Prereq.: CEEN 3736.

CEEN 5877 Systems Engineering and Project Management 3 s.h.

Systems approach to engineering design; non-linear models; linear programming; dynamic programming; network analysis; project management.

Prereq.: MATH 3705.

CEEN 5880 Advanced Hydraulics 3 s.h.

Application of hydraulic principles for one dimensional river modeling; understanding the fundamental processes of open channel hydraulics; application of HEC-RAS/HEC-GeoRAS models for river system modeling.

Prereq.: A "C" or better in CEEN 3717.

CEEN 5882 Foundation Engineering 3 s.h.

Analysis and design of various foundations, including abutments, piers, piles, and footings; slope stability of embankments.

Prereq.: CEEN 4881 and CEEN 5855.

CEEN 5883 Bridge Engineering 3 s.h.

Analysis and design of concrete and steel bridges; specifications and code requirements; design detailing; effects of natural and man-made hazards on bridges; implications of bridge failures.

Prereq.: CEEN 5855 and CEEN 5856.

CEEN 5884 Solid and Hazardous Waste Management 3 s.h.

Sources, characteristics, handling and disposal options for solid waste and hazardous waste; topics include regulations, health effects, waste minimization, collection systems, landfill design, treatment and processing methods, and site assessment.

Prereq.: CEEN 3736.

Chemical Engineering

CHEN 2650 Computer Methods in Chemical Engineering 2 s.h.

Application of computational software packages and spreadsheets to solve chemical engineering problems. Utilization of process simulation packages. Real-time computing applications in laboratory automation.

Prereq.: ENGR 1550, ENGR 1550H or consent of instructor.

CHEN 2683 Chemical Engineering Principles 1 3 s.h.

Engineering units and dimensions. Hydrostatics. Material balances for non-reacting and reacting processes. Ideal and non-ideal gas relationships. Ideal multi-phase equilibrium calculations.

Prereq.: MATH 1571, MATH 1571H or MATH 1585H, CHEM 1515.

CHEN 2684 Chemical Engineering Principles 2 3 s.h.

Energy balances on reacting and non-reacting processes. Utilization of energy balances on multi-phase processes. Mass and energy balances on transient processes.

Prereq.: CHEN 2683.

CHEN 2688 Energy Assessment 3 s.h.

Concept of energy assessment. Technology of energy production that includes coal gasification, liquefaction, magnetohydrodynamics, utilization of shale oil, solar, geothermal, and chemical energy. Nuclear energy utilization. Fuel from wastes. Energy resource distribution and future supply and demand. Simple calculations relating to fuel saving, production, and consumption. Primarily for non-engineering students.

CHEN 3700 Measurements and Instrumentation 3 s.h.

Sensors, measurements, and instrumentation are the cornerstones of hands-on learning in engineering, which prepares students for careers and advanced research. This course is much more about measurement science than about computer science or scientific computing. It helps students make the most productive use of computers in the engineering research laboratory. Understand and implement the techniques of computer-based real-time instrumentation and design operational and analytical software using Laboratory Virtual Instrument Engineering Workbench (LabVIEW) for Data Acquisition (DAQ) device and simulation of engineering laboratory measurement instruments. Measure physical and chemical properties with various sensors and interfacing LabVIEW and DAQ device.

Prereq.: CHEN 2683.

CHEN 3718 Women, Science, and Technology 3 s.h.

An overview of the role women have played in scientific and technological advances. Problems unique to women entering scientific professions will be addressed, information about scientific and technical careers and job opportunities and contacts with professionals in the community will be provided.

Prereq.: ENGL 1550.

CHEN 3721 Engineering Plastics 3 s.h.

Preparation, characterization, manufacture, properties and applications of commercial polymers.

Prereq.: CHEN 2684 and CHEM 3719; or consent of instructor.

CHEN 3726 Elementary Nuclear Reactor Engineering 3 s.h.

Basic engineering science to serve as background material for nuclear reactor design. Nuclear fission as an energy source. Reactor use and classification. Comprehensive discussion of reactor design problems such as neutron distribution in the core, type of moderator, heat removal, and radiation protection.

Prereq.: MATH 2673, PHYS 2610.

CHEN 3771 Chemical Engineering Thermodynamics 1 3 s.h.

Development of the concepts and formalisms of thermodynamics and their applications to chemical engineering systems. Real and ideal behavior of single and multicomponent systems. Introduction to the thermodynamics of phase equilibria. Analysis and design of thermal systems. Additional topics include applications in transport phenomena and plant design.

Prereq.: MATH 2673 or MATH 2686H and CHEN 2684.

CHEN 3785L Transport Phenomena Laboratory 1 s.h.

Experimental studies of transport properties and momentum, energy and mass transfer using industrial type equipment. Correlation of data and comparison with theory. Oral presentations and preparation of technical reports. Three hours laboratory.

Prereq.: CHEN 3786 or concurrent.

CHEN 3786 Transport Phenomena 1 4 s.h.

Mathematical formulation of conversion laws. Dimensional analysis. Mechanism and fundamentals of momentum and energy transfer with selected applications to analysis and design of chemical engineering equipment. Three hours lecture and three hours computational lab per week.

Prereq.: MATH 2673 or MATH 2686H and CHEN 2684.

CHEN 3787 Transport Phenomena 2/Unit Operations 1 3 s.h.

Mass transfer processes. Diffusional operations and separation processes with emphasis on evaporation, humidification and drying. Derivation of design equations from mass and energy balances, and application to equipment design. Solution of simultaneous differential equations of mass, momentum, and energy.

Prereq.: CHEN 3786.

CHEN 3787L Unit Operations Laboratory 1 1 s.h.

Experiments in absorption, cascade operations, reaction kinetics, mixing and other chemical engineering operations employing industrial and pilot plant size equipment and instrumentation. Treatment of experimental data, correlations and comparison with theory. Oral presentations and preparation of technical reports. Three hour laboratory.

Prereq.: CHEN 3787.

CHEN 4801 Chemical Engineering Projects 3 s.h.

Chemical engineering projects under the guidance of a faculty member. Literature search, design and construction of apparatus, experimentation and preparation of a comprehensive report.

Prereq.: Consent of instructor.

CHEN 4802 Chemical Engineering Projects 3 s.h.

Chemical engineering projects under the guidance of a faculty member. Literature search, design and construction of apparatus, experimentation and preparation of a comprehensive report.

Prereq.: Consent of instructor.

CHEN 4803 Chemical Engineering Projects 3 s.h.

Chemical engineering projects under the guidance of a faculty member. Literature search, design and construction of apparatus, experimentation and preparation of a comprehensive report.

Prereq.: Consent of instructor.

CHEN 4815 Unit Operations 2 3 s.h.

Gas absorption and desorption, interphase mass transfer processes, liquid extraction and leaching. Physical separation processes including filtration, settling, and size reduction. Derivation of the design equations for the above processes, and applications of the design equations to equipment design.

Prereq.: CHEN 3787.

CHEN 4815L Unit Operations Laboratory 2 1 s.h.

Experiments in absorption, cascade operations, reaction kinetics, mixing and other chemical engineering operations employing industrial and pilot plant size equipment and instrumentation. Treatment of experimental data, correlations and comparison with theory. Oral presentations and preparation of technical reports. Three hour laboratory.

Prereq.: CHEN 4815.

CHEN 4815R Unit Operations 2 Applications 1 s.h.

Utilizing computer programs for gas absorption and desorption, interphase mass transfer processes, liquid extraction and leaching. Includes applications of the design equations to equipment design.

Prereq.: CHEN 3787.

CHEN 4822 Reinforced Polymer Structures 3 s.h.

Survey of raw materials, manufacturing methods, and design of products utilizing reinforcing materials combined with an elastomer or polymer binder.

Prereq.: CHEN 2684 or consent of instructor.

CHEN 4840 Biochemical Engineering Fundamentals 3 s.h.

Design of biological reactors, bioremediation schemes, methods for the purification and mass production of chemical species from living organisms or cultures, extraction, and fermentation. Technologies and processing of recombinant DNA, antibiotics, antibodies, vitamins, steroids, and methane are included. Essentials of microbiology, biochemistry, and genetics will precede industrial applications. **Prereq.:** junior standing.

Prereq.: CHEN 2684 or consent of instructor.

CHEN 4880 Chemical Reactor Design 1 3 s.h.

Chemical reaction equilibria. Theoretical developments and methods of interpreting experimental data pertaining to chemical kinetics. General design principles and construction features of reactors with application of these principles to the design of specific reactors.

Prereq.: CHEN 3771.

CHEN 4880R Reactor Design Applications 1 s.h.

Utilizing computer programs for determination of chemical reaction equilibria, chemical kinetics, and designing reactors.

Prereq.: CHEN 3771.

CHEN 4881 Chemical Reactor Design 2 3 s.h.

Chemical reaction equilibria. Theoretical developments and methods of interpreting experimental data pertaining to chemical kinetics. General design principles and construction features of reactors with application of these principles to the design of specific reactors.

Prereq.: CHEN 4880.

CHEN 4882 Process Dynamics 3 s.h.

Introduction to automatic control and control loop concepts. Laplace transform techniques. Linear open-loop and closed-loop systems. Root-locus and frequency response methods. Design of control systems.

Prereq.: CHEN 3786.

CHEN 4887 Process and Plant Design 1 3 s.h.

An examination of engineering economic analysis to include: cost estimation, profitability, optimum design, principles of fixed and operating costs, materials and site selection, and general and specialized design techniques.

Prereq.: CHEN 3787 Minimum grade of C, CHEN 4880 Minimum grade of C and unrecalculated GPA of 2.0 or better in major courses.

CHEN 4888 Process and Plant Design 2 3 s.h.

The application of chemical engineering and cost principles to the component design and selection of process equipment. The application of chemical engineering and cost principles to the design of chemical plants and processes including societal aesthetic, environmental, and safety considerations.

Prereq.: CHEN 4887 minimum grade of C.

Gen Ed: Capstone.

CHEN 5800 Special Topics 1-4 s.h.

Special topics and new developments in chemical engineering. Subject matter, credit hours, and special prerequisites to be announced in advance of each offering.

Prereq.: Consent of instructor.

CHEN 5805 Principles of Biomedical Engineering 3 s.h.

Application of engineering principles and methods of analysis to processes in the human body. Rheological, physical and chemical properties of body fluids. Dynamics of the circulatory system. The human thermal system. Transport through cell membranes. Analysis and design of artificial organs.

Prereq.: CHEN 2684 or consent of instructor.

CHEN 5811 Advanced Transport Phenomena 3 s.h.

Development of basic differential balance equations for mass, momentum and energy. Analytical and approximate solutions to the equation of change with application to the analysis of common engineering problems.

Prereq.: CHEN 3786.

CHEN 5820 Industrial Pollution Control 3 s.h.

Types, sources and effects of industrial and hazardous waste; principles of industrial and hazardous waste control; discussion and design of biological, physical, and chemical treatment processes.

Prereq.: CHEN 2684 or consent of instructor.

CHEN 5821 Fundamentals of Polymer Science 3 s.h.

The survey of polymerization mechanisms, polymer structure-property relationships, transport properties, flammability-related plasticizers and solvents as well as design applications.

Prereq.: CHEN 2684 or consent of instructor.

CHEN 5830 Nuclear Reactors 3 s.h.

Neutron interactions and scattering; moderation ratio, the steady state reactor core and four factor equation, the diffusion equation for various reactor geometries and the reflected reactor core.

Prereq.: CHEN 3726 or consent of instructor.

CHEN 5835 Introduction to Nuclear Fusion 3 s.h.

Fusion reactors; the kinetics of fusion reactions. Plasma confinement technology.

Prereq.: CHEN 3726.

CHEN 5845 Corrosion Engineering 3 s.h.

Introduction to causes and forms of corrosion, corrosion rate calculations, electrode potentials, electrochemistry, corrosion testing, and effects of corrosion on mechanical properties. Theory and use of corrosion inhibition methods.

Prereq.: CHEN 2684.

CHEN 5850 Industrial Processes 3 s.h.

A fundamental approach to the design of industrial chemical processes. Emphasis upon flow-charting, chemical reactions, separations involved, thermodynamics, and economic considerations. Food and pharmaceutical processing is a major focus.

Prereq.: CHEN 2684 or consent of instructor.

CHEN 5854 Corrosion Engineering 3 s.h.

Introduction to causes and forms of corrosion, corrosion rate calculations, electrode potentials, electro-chemistry, corrosion testing, and effects of corrosion on mechanical properties. Theory and use of corrosion inhibition methods.

Prereq.: Junior or Senior Standing or Approval of the Instructor.

CHEN 5883 Mathematical Methods in Chemical Engineering 3 s.h.

The applications of advanced mathematics to the solution of chemical engineering problems. Topics covered include treatment and interpretation of engineering data, modeling of chemical engineering systems and formulation of ordinary and partial differential equations governing chemical engineering operations and their solutions by use of numerical and analytical techniques.

Prereq.: CHEN 3786.

CHEN 5886 Nuclear Reactor Design 3 s.h.

The steady state reactor core; four-factor equation, resonance escape probability, neutron flux distribution in various geometrics, two-group and multigroup theories. Transient reactor behavior and control; effect of delayed neutrons, fission product poisoning, nuclear fuels, nuclear heat transfer and burnout problems, reactor economy; fuel burnup and power cost. Thermal breeder and fast reactors. Neutron flux distribution measurements. Radiation detection and monitoring.

Prereq.: CHEN 3726 or consent of instructor.