

# BACHELOR OF ENGINEERING IN CIVIL ENGINEERING

## Welcome from the Program Coordinator

Civil engineers are responsible for planning, designing, and supervising construction of infrastructure including buildings, bridges, highways, levees, dams, drinking water and wastewater treatment facilities, ports, railroads, airports, etc. The undergraduate program in Civil Engineering (CE) at YSU offers a Bachelor of Engineering (B.E.) in Civil Engineering degree through an ABET accredited curriculum designed for graduation in four years. Students receive a fundamental background in math and science to prepare for core courses in civil engineering. Our students not only learn from faculty lectures, but also gain real-world experience through co-ops/internships, undergraduate research and laboratory activities.

Civil engineers make the world better. With that philosophy in mind, we educate our students to undertake challenging civil engineering jobs and leadership roles in building our community and infrastructure. At the time of graduation, our students are well-prepared to enter the workforce in all five sub-disciplines of civil engineering including structural, transportation, geotechnical, water resources, and environmental. Faculty members have the highest degree in their respective sub-discipline and the professional engineering licensure that requires them to remain active in the profession through continuing education.

Our CE students are engaged in real-world projects through participating in the ASCE Student Chapter activities. They design and build steel bridges and concrete canoes from scratch every year, and compete in the regional and national competitions. YSU Steel Bridge team ranked third in the 2019 National Student Steel Bridge Competition. Moreover, CE students have plenty of networking opportunities through active participation in the chapter activities, internships and co-ops.

For more information about the CE program at YSU, please contact:

**Anwarul Islam, PhD, PE, F.ASCE**  
Professor and Program Coordinator  
Civil Engineering  
2415 Moser Hall  
One University Plaza  
Youngstown, OH 44555  
Tel: (330) 941-2421  
Fax: (330) 941-3265  
Email: aaislam@ysu.edu

## Mission

The mission of the Civil Engineering program is to:

- offer high-quality bachelor's degree in civil engineering that encompasses basic engineering sciences, as well as both traditional and emerging areas of the discipline;
- prepare graduates to adapt to global and domestic engineering challenges and changing industry practices;
- foster student-faculty relationships that enrich teaching and learning, develop scholarship, and encourage public service;
- maintain an academic structure characterized by integrity, and by respect for students, society, the environment, and the civil engineering profession;
- prepare graduates for, and facilitate, lifelong intellectual and professional development; and
- contribute to economic prosperity of the region, state, and nation by enhancing the size and competitiveness of the civil engineering workforce.

## Program Educational Objectives

The Civil Engineering program will provide graduates with the foundation of knowledge and skills necessary for productive and rewarding careers. The program prepares graduate to achieve the following educational objectives within a few years after graduation:

- Perform essential functions on multidisciplinary teams in their professional careers in civil engineering.
- Demonstrate necessary communication, management, leadership, and interdisciplinary technical skills to excel in engineering and non-engineering sectors.
- Continue their intellectual, social, and professional growth through lifelong learning.
- Obtain professional engineering licensure.

## Student Outcomes

The YSU undergraduate program in Civil Engineering adopted the following student outcomes that prepare its graduates to attain the program educational objectives listed above. At the time of graduation, the program graduates should have:

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;
- 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;
- an ability to communicate effectively with a range of audiences;
- 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;
- 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;
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## Program Description and Accreditation

In the first two years of the program, students take coursework in the fundamentals of engineering, mathematics and basic science in order to strengthen their technical background and develop intellectual maturity. They continue in a broad-based civil engineering program that helps them develop competence in a variety of areas within the discipline. Topics include structural, geotechnical, transportation, environmental, and water resources engineering, as well as surveying and construction management. In their last two years, students choose elective courses in various sub-disciplines of civil engineering based on their academic and career interests.

Instruction on the design process is fully integrated throughout the curriculum to foster the depth of understanding and self-confidence that students will need to think creatively and become productive engineers. The curriculum is based on the fundamental concept that students can best develop their creative skills through a series of progressively more demanding design experiences leading up to a major, comprehensive senior-level complex engineering design project.

Students in the CE program earn a Bachelor of Engineering in Civil Engineering degree. Graduates are prepared for advanced studies at the master's and doctoral levels in engineering, or for employment in the engineering profession.

The CE program offers the atmosphere of a small school in maintaining close contact between faculty and students. Faculty members serve as academic advisors and are engaged in all phases of instruction from freshman to

graduation. All of the facilities of the CE program are located within Moser Hall. The program maintains laboratories for strength of materials, concrete testing, soil mechanics, surveying, environmental engineering, and fluid mechanics – all in Moser Hall. A wide variety of equipment is available these laboratories to support both teaching and research activities.

The YSU undergraduate program in Civil Engineering has been accredited by the Engineering Accreditation Commission (EAC) of ABET, <http://www.abet.org>.

## Civil Engineering Faculty

### **Anwarul Islam, PhD, PE, FASCE**

Professor

Structural Engineering, Structural Health Monitoring

Moser 2413

(330) 941-2421

[aaislam@ysu.edu](mailto:aaislam@ysu.edu)

<http://aaislam.people.ysu.edu>

### **Shakir Husain, PhD, PE**

Professor

Transportation Engineering

Moser 2415

(330) 941-1742

[shusain@ysu.edu](mailto:shusain@ysu.edu) ([jkjung@ysu.edu](mailto:jkjung@ysu.edu))

### **Suresh Sharma, PhD, PE**

Associate Professor

Water Resources Engineering, Watershed Modeling

Moser 2440

(330) 941-1741

[ssharma06@ysu.edu](mailto:ssharma06@ysu.edu) ([aaislam@ysu.edu](mailto:aaislam@ysu.edu))

<http://ssharma06.people.ysu.edu> (<http://aaislam.people.ysu.edu>)

### **Richard Deschenes, Jr, PhD**

Assistant Professor

Structural Mechanics, Alkali Silica Reactions

Moser 2425

(330) 941-3029

[radeschenes@ysu.edu](mailto:radeschenes@ysu.edu) ([jkjung@ysu.edu](mailto:jkjung@ysu.edu))

### **Sahar Ehsani, PhD**

Assistant Professor

Environmental Engineering, Fate and Transport of Selenium

Moser 2430

(330) 941-1740

[sehsani@ysu.edu](mailto:sehsani@ysu.edu) ([jkjung@ysu.edu](mailto:jkjung@ysu.edu))

## Civil Engineering Annual Enrollment and Graduation Data

Term Enrollment

Fall 2015 78

Fall 2016 102

Fall 2017 103

Fall 2018 110

Fall 2019 108

Fall 2020 113

Academic Year Degrees Awarded

2014-2015 27

2015-2016 19

2016-2017 22

2017-2018 28

2018-2019 26

2019-2020 17

## Co-ops/Internships in Civil Engineering

The Civil Engineering program strongly encourages its students to participate in co-ops and internships. A co-op is defined as a structured developmental program with increasing responsibilities in a full time position. An internship is a project-specific learning program that lasts several weeks to a semester. Students can work full-time or part-time as an intern while attending classes. Appropriate academic credits are awarded for both co-ops and internships, although those credits are not counted towards the Civil Engineering degree. Students should register with the STEM Professional Services office in order to participate in co-ops and internships.

For more information on co-ops and internships, contact Anwarul Islam, Professor and Program Coordinator of Civil Engineering.

COURSE	TITLE	S.H.
<b>GENERAL ENGINEERING</b>		
ENGR 1500	Engineering Orientation	1
ENGR 1550	Engineering Concepts	2
ENGR 1560	Engineering Computing	2
<b>CIVIL ENGINEERING MAJOR</b>		
CEEN 2601	Statics	3
CEEN 2602	Strength of Materials	3
CEEN 2602L	Strength of Materials Lab	1
CEEN 2610	Surveying	3
CEEN 2610L	Surveying Laboratory	1
CEEN 2660	Computer Aided Design and Drafting	2
CEEN 3716	Fluid Mechanics	3
CEEN 3716L	Fluid Mechanics Lab	1
CEEN 3717	Hydraulic Design	4
CEEN 3720	Transportation Engineering	3
CEEN 3736	Fundamentals of Environmental Engineering	3
CEEN 3749	Structural Analysis 1	3
CEEN 3749L	Structural Analysis 1 Lab	1
CEEN 4812	Construction Management	3
CEEN 4863	Integrated Design Project	3
CEEN 4881	Geotechnical Engineering	3
CEEN 4881L	Geotechnical Lab	1
CEEN 5855	Reinforced Concrete Design	3
CEEN 5856	Steel Design	3
CEEN Elective 1: Must be a design elective. Select one course from –		3
CEEN 4835	Highway Design	
or CEEN 5820	Pavement Material and Design	
or CEEN 5837	Environmental Engineering Design	
or CEEN 5869	Design of Air Pollution Control Systems	
or CEEN 5882	Foundation Engineering	
or CEEN 5883	Bridge Engineering	
CEEN Electives 2 & 3: Select two courses from –		6
CEEN 3751	Water Quality Analysis	
& 3751L	and Water Quality Analysis Lab	
or CEEN 4835	Highway Design	
or CEEN 4879	Civil Engineering Analysis	

or CEEN 5820	Pavement Material and Design	
or CEEN 5829	Civil Engineering Materials - Concrete	
or CEEN 5832	Natural Systems Engineering	
or CEEN 5836	Environmental Water Chemistry	
or CEEN 5837	Environmental Engineering Design	
or CEEN 5849	Structural Analysis 2	
or CEEN 5869	Design of Air Pollution Control Systems	
or CEEN 5877	Systems Engineering and Project Management	
or CEEN 5882	Foundation Engineering	
or CEEN 5883	Bridge Engineering	
or CEEN 5884	Solid and Hazardous Waste Management	

**ENGINEERING FUNDAMENTALS**

MECH 2641	Dynamics	3
ISEN 3724	Engineering Economy	3

**MATHEMATICS**

MATH 1571	Calculus 1	4
MATH 1572	Calculus 2	4
MATH 2673	Calculus 3	4
MATH 3705	Differential Equations	3
ISEN 3710	Engineering Statistics	3
or STAT 3743	Probability and Statistics	

**BASIC SCIENCE**

CHEM 1515 & 1515L	General Chemistry 1 and General Chemistry 1 Laboratory	4
PHYS 2610	General Physics 1	4
GEOL 2611 or BIOL 2601	Geology for Engineers or General Biology 1: Molecules and Cells	3
CHEM 1516 & 1516L or PHYS 2611	General Chemistry 2 and General Chemistry 2 Laboratory or General Physics 2	4

**COMMUNICATION**

ENGL 1550 or ENGL 1549	Writing 1 or Writing 1 with Support	3
ENGL 1551	Writing 2	3
CMST 1545	Communication Foundations	3

**GENERAL EDUCATION**

**Arts and Humanities**

PHIL 2625 or PHIL 2626 or PHIL 2628	Introduction to Professional Ethics or Engineering Ethics or Business Ethics	3
Arts and Humanities Elective 2		3

**Social Science**

Social Science Elective 1		3
Social Science Elective 2		3

**Social and Personal Awareness**

Social and Personal Awareness Elective 1		3
Social and Personal Awareness Elective 2		3

<b>Total Semester Hours</b>		<b>127</b>
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**Year 1**

<b>Fall</b>		<b>S.H.</b>
YSU 1500	Success Seminar	1
ENGL 1550 or ENGL 1549	Writing 1 or Writing 1 with Support	3
CHEM 1515 & 1515L	General Chemistry 1 and General Chemistry 1 Laboratory	4
ENGR 1500	Engineering Orientation	1

ENGR 1550	Engineering Concepts	2
MATH 1571	Calculus 1	4
GER SS-1: Social Science Elective		3

<b>Semester Hours</b>		<b>18</b>
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**Spring**

ENGL 1551	Writing 2	3
ENGR 1560	Engineering Computing	2
MATH 1572	Calculus 2	4
CMST 1545	Communication Foundations	3
GER AH-1: Arts & Humanities Elective		3

<b>Semester Hours</b>		<b>15</b>
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**Year 2**

**Fall**

MATH 2673	Calculus 3	4
CEEN 2610	Surveying	3
CEEN 2610L	Surveying Laboratory	1
CEEN 2601	Statics	3
PHYS 2610	General Physics 1	4

<b>Semester Hours</b>		<b>15</b>
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**Spring**

MATH 3705	Differential Equations	3
CEEN 2602	Strength of Materials	3
CEEN 2602L	Strength of Materials Lab	1
GEOL 2611 or BIOL 2601	Geology for Engineers or General Biology 1: Molecules and Cells	3
CEEN 2660	Computer Aided Design and Drafting	2
PHYS 2611 or CHEM 1516 or CHEM 1516L	General Physics 2 or General Chemistry 2 and General Chemistry 2 Laboratory	4

<b>Semester Hours</b>		<b>16</b>
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**Year 3**

**Fall**

CEEN 3720	Transportation Engineering	3
CEEN 3716	Fluid Mechanics	3
CEEN 3716L	Fluid Mechanics Lab	1
CEEN 3749	Structural Analysis 1	3
CEEN 3749L	Structural Analysis 1 Lab	1
CEEN 3736	Fundamentals of Environmental Engineering	3
ISEN 3710	Engineering Statistics	3

<b>Semester Hours</b>		<b>17</b>
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**Spring**

CEEN 3717	Hydraulic Design	4
CEEN 4881	Geotechnical Engineering	3
CEEN 4881L	Geotechnical Lab	1
CEEN Elective-1: CE Design Elective		3
GER SS-2: Social Science Elective		3
GER SPA-1: Social & Personal Awareness Elective		3

<b>Semester Hours</b>		<b>17</b>
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**Year 4**

**Fall**

CEEN 5855	Reinforced Concrete Design	3
CEEN 5856	Steel Design	3
CEEN Elective-2: CE Elective		3
CEEN 4812	Construction Management	3
ISEN 3724	Engineering Economy	3

<b>Semester Hours</b>		<b>15</b>
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<b>Spring</b>		
CEEN 4863	Integrated Design Project	3
MECH 2641	Dynamics	3
CEEN Elective-3: CE Elective. May substitute with approval of CE Program Coordinator.		
GER AH-2: Arts & Humanities Elective. Select either		
PHIL 2625	Introduction to Professional Ethics	3
or PHIL 2626	or Engineering Ethics	
or PHIL 2628	or Business Ethics	
GER SPA-2: Social & Personal Awareness Elective		
<b>Semester Hours</b>		<b>15</b>
<b>Total Semester Hours</b>		<b>128</b>

## Student Outcomes

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- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
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- an ability to communicate effectively with a range of audiences
- 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
- 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
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

### 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 meaningful design experience that focuses attention on professional practice and is predicated on the accumulated background of curriculum components. Two hours of lecture and three hours of laboratory a week.

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

**Gen Ed:** Capstone.

**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.