

# Department of Civil and Environmental Engineering

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## Purpose and Goals

Civil Engineers are involved in the planning, design, construction, and operation of facilities essential to modern life. These built systems include airports, water supply systems, bridges and roadways, water treatment plants, dams and reservoirs, space and aircraft structures, and power supply structures, to name a few. The mission of the Civil and Environmental Engineering Department is to produce Civil Engineers who will become innovative practitioners, leaders, researchers, and entrepreneurs. The department attracts and retains high-quality faculty and maintains state-of-the-art infrastructure to achieve excellence in teaching, research, and service. The department, through its rigorous curriculum, hands-on laboratory experiences, and design-oriented course projects, trains students in a broad range of civil engineering topics and engages them in research and service activities, so that they can make significant contributions to society and in improving the quality of life.

## Requirements for Civil Engineering as a Minor Field

Students have the option for a Civil Engineering Minor. Students can use a maximum of 9 hours from their major towards the minor requirements.

### Civil Engineering Minor

Students must complete 18 SCH to satisfy the minor requirements.

#### Required Courses

|           |                         |   |
|-----------|-------------------------|---|
| CVEG 2301 | Engineering Mechanics I | 3 |
| CVEG 2332 | Mechanics of Materials  | 3 |
| CVEG 3303 | Hydraulics              | 3 |

#### Technical Electives

|   |   |
|---|---|
| Approved 3000 and 4000 level CVEG courses | 9 |
|---|---|

#### Total Hours

18

## Honor Societies, Clubs, and Service Organizations

Student organizations play an important role in helping students adjust to the responsibilities and professional development requirements of their profession. Students are encouraged to become active members of the organizations sponsored by the Civil and Environmental Engineering department.

The *American Society of Civil Engineers (ASCE)* - Prairie View A&M University (PVAMU's) ASCE student chapter strives to promote the professional development of civil engineering students through professional development activities. The most notable of these activities is the annual ASCE Texas Regional Conference, in which students from several Texas and New Mexico universities compete in various team-oriented and individual competitions [for example, Concrete Canoe (including the design, presentation and canoe races), Steel Bridge (including design, fabrication and presentation), and the Daniel Mead paper].

The *Civil Engineering Honors Club (CEHC)* – CEHC's objectives are to promote scholarship, professionalism, sociability, character, and leadership among Civil Engineering students. Members of the Honors Club are inducted into *Texas A&M University's Chi Epsilon Chapter*, which is under the auspices of the *National Civil Engineering Honor Society*.

Students in the department are also eligible for membership in professional and honor societies approved by the Roy G. Perry College of Engineering and the university.

## Courses

### **CVEG 1101 Intro Engineering & Comp Sci: 1 semester hour.**

Introduction to basic engineering, computer science and technology concepts. Students will become aware of the various disciplines of engineering, computer science and technology, ethical and professional responsibilities in these fields, creativity and design.

Co-requisite: CVEG 1102.

### **CVEG 1102 Introduction to Civil Engineering Lab: 1 semester hour.**

Introduction to Civil Engineering as a profession, identification and discussion of the sub-fields of Civil Engineering, ethical responsibilities in engineering practice, concepts of design, laboratory demonstrations and problem-solving exercises that emphasize critical thinking skills. Leadership principles, the importance of professional licensure, life-long learning and membership in ASCE are discussed.

Co-requisite: CVEG 1101.

***CVEG 2100 Emerging Issues in Civil Engineering: 1 semester hour.***

An overview of emerging issues and state-of-the-art technologies commonly used in Civil Engineering practice. Computer-aided drafting (CAD) software and techniques are presented. Basic concepts in leadership, teamwork and team building are emphasized. Problem solving and the communication of engineering solutions using appropriate engineering design documentation and drawings, and the importance of professional licensure are reinforced. Prerequisites: CVEG 1101 or CVEG 1011 and (CVEG 1102 or CVEG 1021).

***CVEG 2101 Materials and Dynamics Lab: 1 semester hour.***

Determination of mechanical properties of engineering materials. Tensile testing, torsion, bending and deflection; standard testing methods and procedures; instrumentation and data acquisition techniques (for example using strain gages). Dynamics topics include: projectiles, conservation principles, linear and angular momentum, mass moment of inertia and vibration. Prerequisites: (ENGL 1302 or ENGL 1133) or (ENGL 2311 or ENGL 1143) and (CVEG 2301 or CVEG 2043).

***CVEG 2102 Surveying and Geospatial Concepts: 1 semester hour.***

Introduction to plane surveying: leveling, horizontal distance and measurements, vertical and horizontal angles, azimuths and bearings, traverse calculations, earthwork and volume computations, stadia, topographical surveys, construction boundaries, coordinate systems; trigonometry applications in civil engineering and pertinent computer software. The Global Positioning System (GPS) and Geographic Information Systems (GIS) are introduced. Prerequisites: (MATH 2413 or MATH 1124) and (CVEG 2304 or CVEG 2073).

***CVEG 2301 Engineering Mechanics I: 3 semester hours.***

Fundamental concepts and principles; vector algebra and applications; equilibrium of particles and rigid bodies in two and three dimensions, moments and couples; distributed forces, centroids, moments of inertia, friction, introduction to analysis of structures. Prerequisites: PHYS 2325 or PHYS 2513.

***CVEG 2302 Engineering Mechanics II: 3 semester hours.***

Kinematics and kinetics of particles and of rigid bodies as applied to engineering problems; Newton's laws of motion; work and energy; impulse and momentum; translations; rotation; plane motion; motion about a point; general motions; and periodic motions. Prerequisites: CVEG 2301 or CVEG 2043.

***CVEG 2304 Global Development Issues: 3 semester hours.***

An overview of global development issues and their importance. Global and regional developing goals, history, implementation and impact. Global and local dimensions of development, and the concept of sustainability. Ethical dimensions of development, management concepts for projects and related issues. Global issues related to energy, the environment, and the food-energy-water (FEW) nexus. Audience-appropriate visualization and documentation.

***CVEG 2332 Mechanics of Materials: 3 semester hours.***

Mechanical behavior of engineering materials, plane stress, plane strain, stress-strain relationship, shear and moment, torsion, flexural, column and combined loadings. Introduction to deflections; concepts of stresses at a point; stresses in pressured containers; and theories of failures and thermal stresses. Prerequisites: ((CVEG 2301 or CVEG 2043) or (CVEG 2454 or CVEG 2400)) and (MATH 2414 or MATH 2024).

***CVEG 2400 Statics and Dynamics: 4 semester hours.***

Fundamental concepts; equilibrium of particles and rigid bodies; centroids; moments of inertia; friction; introduction to analysis of structures. Kinematics and Kinetics of particles and of rigid bodies; equations of motion; work and energy; impulse and momentum. Prerequisites: PHYS 2325 or PHYS 2513.

***CVEG 3100 Concrete and Steel Laboratory: 1 semester hour.***

Hands-on experience in the design, fabrication and construction of concrete and steel prototypes and models, such as concrete beam, concrete canoe and steel trusses. Application of engineering mechanics and materials laboratory techniques and methods, testing, analysis of experimental results, and report writing. Prerequisites: (CVEG 2332 or CVEG 2063) and (CVEG 2101 or CVEG 2061).

***CVEG 3102 Professional Engineering I: 1 semester hour.***

Fundamentals of engineering, related science subjects, including computers, engineering economics, ethics, fluid mechanics, mathematics, probability and statistics, statics, mechanics of materials. Civil and Environmental Engineering topics include: environmental, water resources, structures, materials, geotechnical, transportation, construction management and surveying. Prerequisites: MATH 3302 or MATH 3023 and (MATH 4317 or MATH 4173) and (CVEG 3300 or CVEG 3023) and (CVEG 3100 or CVEG 3031) and (CVEG 3301 or CVEG 3043) and (CVEG 3302 or CVEG 3053) and (CVEG 3303 or CVEG 3063) and (CHEG 2308 or CHEG 2003).

***CVEG 3300 Geotechnical Engineering: 3 semester hours.***

Physical and mechanical properties of soil; moisture and its movement in soil; moisture density relationships; soil classification; settlement; consolidation; permeability; testing of soil physical and mechanical properties; and laboratory sessions. Prerequisites: CVEG 2101 or CVEG 2061 and (CVEG 2332 or CVEG 2063).

**CVEG 3301 Environmental Engineering: 3 semester hours.**

Review of the environmental chemistry and biology, introduction to environmental science and engineering, material balance, reaction kinetics, reactor design, introduction to solid and hazardous waste, water and wastewater quality characteristics, laboratory analysis of water and wastewater samples. Additional prerequisite: BIOL elective or course approved by the Department Head.

Prerequisites: (CHEM 1403 or CHEM 1034) or (CHEM 1303 or CHEM 1033) and (CHEM 1304 or CHEM 1043) and (CHEM 1112 or CHEM 1021) and (BIOL 1307 or BIOL 1073) or (BIOL 1308 or BIOL 1113) or (BIOL 1309 or BIOL 1123).

**CVEG 3302 Transportation Engineering: 3 semester hours.**

Principles of transportation engineering. Topics include: basic concepts in the planning, operation, management, and design of air, surface, and water transportation modal facilities; an introduction into the major aspects of regulatory requirements and economics related to transportation issues; and laboratory sessions in the various sub-areas of transportation engineering.

Prerequisites: MATH 2320 (may be taken concurrently) and (CHEG 2308 or CHEG 2003) and (CVEG 2102 or CVEG 2081) and (COMM 1311 or COMM 1003).

**CVEG 3303 Hydraulics: 3 semester hours.**

Fluid statics; pressure on submerged bodies; continuity equation; Bernoulli equation; principles of momentum and energy; fundamentals of hydraulic modeling; open channel flow; pressure conduit flow; flow measurement; laboratory sessions on selected topics.

Prerequisites: CVEG 2301 or CVEG 2043.

**CVEG 3304 Structural Analysis: 3 semester hours.**

Analysis of determinate structures; reactions, member forces of trusses, shears and bending moments of beams and frames; influence lines; moving loads; deflections; analysis of indeterminate structures by approximate method and energy method; computer application.

Prerequisites: CVEG 2332 or CVEG 2063.

**CVEG 3305 Steel Design: 3 semester hours.**

Analysis and design of tension and compression members, rolled steel beams, plate girders, riveted, welded, and pinned joints; and an introduction to design of trusses and multistory frames.

Prerequisites: CVEG 3304 or CVEG 3073.

**CVEG 3600 Civil Engineering Internship I: 6 semester hours.**

An internship program of work experience with an approved engineering oriented firm, agency or consulting firm or engineering public service agency serving the civil engineering profession. A comprehensive written report of the work-learning experience is required.

**CVEG 4100 Geotechnical Engineering Design Laboratory: 1 semester hour.**

Site investigation methods and the development of soil exploration reports, design of retaining structures, slope stability; design of shallow and deep foundations.

Prerequisites: CVEG 3300 or CVEG 3023.

**CVEG 4200 Senior Design and Professionalism - I: 2 semester hours.**

This is the first course of a two-semester capstone experience (CVEG 4482 must immediately follow 4472 or sequence must restart with 4472) involving engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice are integrated into the project experience. The project will include application of relevant engineering codes and standards, as well as realistic constraints. Design achievements are demonstrated with written reports, and oral presentation, and professional standards and ethics examinations.

Prerequisites: (CVEG 3300 or CVEG 3023) and (CVEG 3301 or CVEG 3043) and (CVEG 3302 or CVEG 3053) and (CVEG 3303 or CVEG 3063) and (CVEG 3304 or CVEG 3073).

**CVEG 4201 Senior Design and Professionalism - II: 2 semester hours.**

A continuation of CVEG 4472 with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Design project deliverables include an oral presentation, as well as a final written report. Professionalism education will, and a formal demonstration of prototype, or model of the design. Elements of professionalism reinforce the importance of professional engineering ethics, corporate culture, life-long learning, and globalization.

Prerequisites: CVEG 4200 or CVEG 4472.

**CVEG 4300 Reinforced Concrete: 3 semester hours.**

Properties of concrete and reinforcement, design methods, codes, load, flexure, shear, bonds, and deflections, analysis and design of beams and columns; introduction to design of footings, slabs, and retaining walls; and introduction to computer-aided design.

Prerequisites: (CVEG 3100 or CVEG 3031) and (CVEG 3073 or CVEG 3304).

**CVEG 4301 Environmental Engineering Design: 3 semester hours.**

Synthesis of environmental engineering fundamentals into an integrated system design which includes the design of physical, chemical, and biological unit operations and processes in water and wastewater treatment.

Prerequisites: CVEG 3301 or CVEG 3043.

**CVEG 4302 Transportation Engineering Design: 3 semester hours.**

Introduction of the transportation design process through a series of comprehensive transportation design projects. Emphasis is placed on the utilization of existing facilities and creation of efficient new facilities through transportation systems management techniques. Energy, environment, mobility and community impacts are considered as measures of effectiveness in the design process.

Prerequisites: CVEG 3302 or CVEG 3053.

***CVEG 4303 Water Resources Engineering: 3 semester hours.***

Control and utilization of water; flood control; water distribution systems; open channel flows; and hydraulic structures.

Prerequisites: CVEG 3303 or CVEG 3063.

***CVEG 4304 Systems Engineering: 3 semester hours.***

Formulation and solution of engineering optimization problems with uncertainty factors; inclusion of sensitivity and risk analyses in optimization problems; topics in engineering management.

Prerequisites: MATH 3302 or MATH 3023 and (CVEG 3302 or CVEG 3053).

***CVEG 4305 Special Topics: 3 semester hours.***

Selected current and emerging topics in Civil Engineering depending on need determined by the department.

***CVEG 4399 Independent Study: 1-3 semester hour.***

Readings, research, and/or field work in selected topics.

***CVEG 4600 Civil Engineering Internship II: 6 semester hours.***

An internship program of advanced work experience with an approved engineering oriented firm, agency, or consulting firm, or engineering public service agency providing practical work experience of the profession on the job. A comprehensive written report of the work-learning experience is required.

***CVEG 5300 Physical/Chemical Unit Operations in Water and Wastewater Treatment: 3 semester hours.***

Physical and chemical processes used in the water and wastewater treatment and applications of these processes to other environmental media.

Application of the principles of chemistry, rate processes, and process engineering to analyze and design water and wastewater treatment and other major environmental systems.

***CVEG 5301 Hazardous Waste Management: 3 semester hours.***

Environmental legislation, regulations concerning the identification, storage, transport, and disposal of hazardous wastes. Treatment processes; control mechanisms; landfill technology and disposal practices.

***CVEG 5302 Air Pollution Engineering: 3 semester hours.***

The nature of the air pollution problem and its effects on the public at large. Present legal and engineering controls to combat pollution. Techniques of air sampling and testing.

***CVEG 5303 Finite Element Analysis: 3 semester hours.***

Using numerical integration, Galerkin-weighted residual and variation approaches to formulate and solve one-and-two dimensional problems in solid mechanics, fluid flow, heat transfer, and electro-magnetism.

***CVEG 5304 Energy and Environmental Sustainability: 3 semester hours.***

Energy and the environment; energy and climate change; environmental impacts of energy production and use; concepts of sustainability in energy generation technologies of the future; energy conservation, and other development in the new energy economy.

***CVEG 5305 Prestressed Concrete Design: 3 semester hours.***

Principles and concepts of design in prestressed concrete including materials behavior, prestress loss, elastic and ultimate strength analyses for flexure, shear, torsion, bond and deflection.

***CVEG 5306 Geospatial Information Management: 3 semester hours.***

Introduction and use of geospatial information systems in engineering management. Geographic Information Systems, use of databases, geocoding, geospatial analysis in the context of a project.

***CVEG 5307 Water Resources Systems: 3 semester hours.***

Formulation of mathematical representations of complex water resources systems and their evaluation using linear programming, dynamic programming, non-linear programming or by the use of formal heuristics. Sample models include: optimal sewer design, optimal capacity expansion of projects, and reservoir systems planning and management.

Prerequisites: GNEG 5320 or GNEG 5302.

***CVEG 5309 GEOSCIENCES and GEOSPATIAL INFORMATION: 3 semester hours.***

Introduction of geosciences concepts for information management. Basic concepts in geosciences including Geographic Information Systems (GIS) and the application of geospatial analysis methods in engineering.

***CVEG 5322 Design of Bridges: 3 semester hours.***

Design of reinforced concrete and prestressed concrete, steel beam, continuous beam girder bridges; introduction to design of piers, abutments and bearings; bridge construction and fabrication.

Prerequisites: CVEG 5213 or CVEG 5305.

***CVEG 5363 Advanced Foundation Design: 3 semester hours.***

Introduction to Foundation Engineering, Subsoil Exploration techniques, Design of Shallow and Deep Foundation.