Civil and Environmental Engineering

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.

The Department of Civil and Environmental Engineering, a component of the Roy G. Perry College of Engineering, subscribes to and supports the goals of the College and the University. One objective of the program is to produce civil engineers for leadership in the profession. As such, a primary focus of the department is excellence in civil engineering education with the ultimate goal of promoting graduate research, excellence in civil engineering practice, and professional registration in civil engineering. The Civil Engineering Program Educational Objectives (PEOs) are provided below.

Civil Engineering program graduates will:

1. Have careers in civil engineering or related fields that lead to increasing levels of responsibility and leadership;
2. Obtain professional licensure/certification;
3. Complete graduate studies in civil engineering or related fields;
4. Engage in professional development and service.

Admission Requirements

Table 1. First-time Freshmen Requirements for Admission to the Civil Engineering Program

<table>
<thead>
<tr>
<th>Academic Major</th>
<th>Meet PVAMU Admission Standards</th>
<th>High School GPA</th>
<th>SAT/ACT</th>
<th>High School Rank</th>
<th>THEA Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering</td>
<td>Yes</td>
<td>3.00</td>
<td>New Sat: 950/18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Transfer Students Requirements for Admission to the Civil Engineering Program

<table>
<thead>
<tr>
<th>Academic Major</th>
<th>Meet PVAMU Admission Standards</th>
<th>Transfer Grades</th>
<th>Transfer GPA (Math; Science and Engineering)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering</td>
<td>Yes</td>
<td>“C” or greater</td>
<td>2.50</td>
</tr>
</tbody>
</table>

These tables represent a summary of admission requirements. For detailed admission requirements, see the section in the catalog pertaining to the Roy G. Perry College of Engineering under College Admission and Academic Requirements.

Accreditation Status

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

Bachelor of Science in Civil Engineering Degree Program Requirements

Core Curriculum

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1124 Calculus with Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2024 Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1021 Inorganic Chemistry Laboratory II</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 1034 and Chemistry for Engineers</td>
<td>2</td>
</tr>
<tr>
<td>MATH 4173 Advanced Math for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3023 Probability and Statistics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2511 University Physics Lab I and University Physics Lab II</td>
<td>2</td>
</tr>
<tr>
<td>&amp; PHYS 2521</td>
<td>2</td>
</tr>
<tr>
<td>CVEG 1011 Intro Engineering &amp; Comp Sci and Introduction to Civil Engineering Lab</td>
<td>2</td>
</tr>
<tr>
<td>&amp; CVEG 1021</td>
<td>2</td>
</tr>
<tr>
<td>GNEG 1121 Engineering Lab II for Mathematics and Engr Lab III for Math</td>
<td>2</td>
</tr>
<tr>
<td>&amp; GNEG 2021</td>
<td>2</td>
</tr>
<tr>
<td>CVEG 2043 Engineering Mechanics I</td>
<td>3</td>
</tr>
</tbody>
</table>
### Major Requirements

- **CVEG 2001**: Emerging Issues in Civil Engineering
- **CVEG 2061**: Materials and Dynamics Lab
- **CVEG 2063**: Mechanics of Materials
- **CVEG 2081**: Surveying and Geospatial Concepts
- **CVEG 3023**: Geotechnical Engineering
- **CVEG 3031**: Concrete and Steel Laboratory
- **CVEG 3043**: Environmental Engineering
- **CVEG 3053**: Transportation Engineering
- **CVEG 3063**: Hydraulics
- **CVEG 3073**: Structural Analysis
- **CVEG 3083**: Steel Design
- **CVEG 4013**: Reinforced Concrete
- **CVEG 4021**: Geotechnical Engineering Design Laboratory
- **CVEG 4043**: Environmental Engineering Design
- **CVEG 4053**: Transportation Engineering Design
- **CVEG 4063**: Water Resources Engineering
- **CVEG 4072**: Systems Engineering and Uncertainty
- **CVEG 4141**: Engineering Management and Ethics

### Science Elective (Select one from the list below):

- BIOL 1073: General Microbiology
- BIOL 1113: College Biology I
- BIOL 1123: College Biology II

### Technical Electives (CVEG or Other)

- CVEG 4093: Systems Engineering
- CVEG 4103: Special Topics
- CVEG 4113: Energy and Environment
- CVEG 4123: Hydrology
- CVEG 4143: Engineering Construction
- CVEG 4223: Waste Management
- CVEG 4233: Water Quality Modeling
- CVEG 4243: Fundamentals of Air Pollution and Control
- MATH 4063: Numerical Analysis
- MATH 4083: Advanced Calculus I
- MATH 4223: Introduction to Complex Analysis
- MCEG 4063: Dynamic Systems and Controls
- ARCH 4443: CAD Construction Documents and Codes

### Total Hours

128

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1. All Civil Engineering Core Curriculum requirements are shown in the suggested degree program.

### Civil Engineering Suggested Technical Electives

- CVEG 4093: Systems Engineering
- CVEG 4103: Special Topics
- CVEG 4113: Energy and Environment
- CVEG 4123: Hydrology
- CVEG 4143: Engineering Construction
- CVEG 4223: Waste Management
- CVEG 4233: Water Quality Modeling
- CVEG 4243: Fundamentals of Air Pollution and Control
- MATH 4063: Numerical Analysis
- MATH 4083: Advanced Calculus I
- MATH 4223: Introduction to Complex Analysis
- MCEG 4063: Dynamic Systems and Controls
- ARCH 4443: CAD Construction Documents and Codes

Technical elective courses must be 3000 level or above and must be taken with the approval of the Academic Advisor and the Department Head. Internship and Co-op courses are not acceptable as technical electives.
Technical Electives through Five-Year BS/MS Degree Plan Option

Students may, upon acceptance into the Five-Year BS/MS Degree Plan Option (see Roy G. Perry College of Engineering Academic Programs and Degree Plans), apply up to six semester-credit hours of graduate courses toward technical electives requirements.

Eligibility To Take Upper Division College Courses

The Roy G. Perry College of Engineering applies an eligibility standard for students to take upper division college courses. Students must have completed or be currently enrolled in all lower division (1000 and 2000 level) courses in English, mathematics, science, and engineering to be eligible to enroll in upper division (3000 or 4000 level) courses in the Roy G. Perry College of Engineering. Students in the Civil Engineering Program must complete the prescribed courses listed below with a minimum Grade Point Average (GPA) of 2.5 in order to be eligible to enroll in upper division (3000 or 4000 level) courses in the College. Students transferring to the Roy G. Perry College of Engineering with 60 or more semester hours from another institution will be allowed a period of one semester to comply. The following list of courses must be completed prior to enrolling in upper division courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVEG 1011</td>
<td>Intro Engineering &amp; Comp Sci</td>
<td>1</td>
</tr>
<tr>
<td>CVEG 1021</td>
<td>Introduction to Civil Engineering Lab</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 1034</td>
<td>Chemistry for Engineers</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1021</td>
<td>Inorganic Chemistry Laboratory II</td>
<td>1</td>
</tr>
<tr>
<td>ENGL 1143</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2513</td>
<td>University Physics I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 2511</td>
<td>University Physics Lab I</td>
<td>1</td>
</tr>
<tr>
<td>MATH 1124</td>
<td>Calculus with Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2024</td>
<td>Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>ELEG 1043</td>
<td>Computer Applications in Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

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.

Requirements for Civil Engineering as a Minor Field

Students have two options for the Civil Engineering Minor. Option 1: Civil Engineering and Option 2: Environmental Engineering. Students can use a maximum of 9 hours from their major towards the minor requirements.

Option 1: Civil Engineering Minor

Students must complete 18 SCH to satisfy the minor requirements.

Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVEG 2043</td>
<td>Engineering Mechanics I</td>
<td>3</td>
</tr>
<tr>
<td>CVEG 2063</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>CVEG 3063</td>
<td>Hydraulics</td>
<td>3</td>
</tr>
</tbody>
</table>

Technical Electives

| Approved 3000 and 4000 level CVEG courses | 9 |

Total Hours 18
**Option 2: Environmental Engineering Minor**

Students must complete 18 SCH to satisfy the minor requirements.

### Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVEG 3043</td>
<td>Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MCEG 2013</td>
<td>Thermodynamics I</td>
<td>3</td>
</tr>
<tr>
<td>or CHEG 2043</td>
<td>Chemical Engineering Thermodynamics I</td>
<td></td>
</tr>
<tr>
<td>CVEG 4043</td>
<td>Environmental Engineering Design</td>
<td>3</td>
</tr>
</tbody>
</table>

### Technical Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVEG 4223</td>
<td>Waste Management</td>
<td>3</td>
</tr>
<tr>
<td>CVEG 4233</td>
<td>Water Quality Modeling</td>
<td>3</td>
</tr>
<tr>
<td>CVEG 4243</td>
<td>Fundamentals of Air Pollution and Control</td>
<td>3</td>
</tr>
</tbody>
</table>

or other related electives with the approval of the Academic Advisor

**Total Hours** 18

### Courses

**CVEG 1011 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 1021 [Link](http://catalog.pvamu.edu/search/?P=CVEG%201021).

**CVEG 1021 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 1011 [Link](http://catalog.pvamu.edu/search/?P=CVEG%201011).

**CVEG 2001 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 1011 [Link](http://catalog.pvamu.edu/search/?P=CVEG%201011) and CVEG 1021 [Link](http://catalog.pvamu.edu/search/?P=CVEG%201021).

**CVEG 2043 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 2513 [Link](http://catalog.pvamu.edu/search/?P=PHYS%202513).

**CVEG 2053 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 2043 [Link](http://catalog.pvamu.edu/search/?P=CVEG%202043).

**CVEG 2061 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 1133 [Link](http://catalog.pvamu.edu/search/?P=ENGL%201133) or ENGL 1143 [Link](http://catalog.pvamu.edu/search/?P=ENGL%201143) and CVEG 2043 [Link](http://catalog.pvamu.edu/search/?P=CVEG%202043).

Co-requisite: CVEG 2063 [Link](http://catalog.pvamu.edu/search/?P=CVEG%202063).

**CVEG 2063 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 2043 [Link](http://catalog.pvamu.edu/search/?P=CVEG%202043) or CVEG 2454 [Link](http://catalog.pvamu.edu/search/?P=CVEG%202454)) and MATH 2024 [Link](http://catalog.pvamu.edu/search/?P=MATH%202024).
CVEG 2081 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 1124 (http://catalog.pvamu.edu/search/?P=MATH%201124) and CVEG 2001 (http://catalog.pvamu.edu/search/?P=CVEG%202001).

CVEG 2454 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 2513 (http://catalog.pvamu.edu/search/?P=PHYS%202513).

CVEG 3023 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 2063 (http://catalog.pvamu.edu/search/?P=CVEG%202063) and CVEG 2081 (http://catalog.pvamu.edu/search/?P=CVEG%202081) and CVEG 3031 (http://catalog.pvamu.edu/search/?P=CVEG%203031).

CVEG 3031 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 2063 (http://catalog.pvamu.edu/search/?P=CVEG%202063) and CVEG 2061 (http://catalog.pvamu.edu/search/?P=CVEG%202061).

CVEG 3043 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 1034 (http://catalog.pvamu.edu/search/?P=CHEM%201034) and CHEM 1021 (http://catalog.pvamu.edu/search/?P=CHEM%201021).

CVEG 3051 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 3023 (http://catalog.pvamu.edu/search/?P=MATH%203023) and MATH 4173 (http://catalog.pvamu.edu/search/?P=MATH%204173) and CVEG 3023 (http://catalog.pvamu.edu/search/?P=CVEG%203023) and CVEG 3023 (http://catalog.pvamu.edu/search/?P=CVEG%203023) and CVEG 3063 (http://catalog.pvamu.edu/search/?P=CVEG%203063) and CVEG 3043 (http://catalog.pvamu.edu/search/?P=CVEG%203043) and CVEG 3053 (http://catalog.pvamu.edu/search/?P=CVEG%203053) and CHEG 2003 (http://catalog.pvamu.edu/search/?P=CHEG%202003).
Co-requisites: CVEG 3083 (http://catalog.pvamu.edu/search/?P=CVEG%203083), CVEG 4013 (http://catalog.pvamu.edu/search/?P=CVEG%204013).

CVEG 3053 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 2043 (http://catalog.pvamu.edu/search/?P=MATH%202043) (may be taken concurrently) and CHEG 2003 (http://catalog.pvamu.edu/search/?P=CHEG%202003) and CVEG 2081 (http://catalog.pvamu.edu/search/?P=CVEG%202081) and COMM 1003 (http://catalog.pvamu.edu/search/?P=COMM%201003).

CVEG 3063 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 2043 (http://catalog.pvamu.edu/search/?P=CVEG%202043).

CVEG 3073 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 2063 (http://catalog.pvamu.edu/search/?P=CVEG%202063).

CVEG 3083 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 3073 (http://catalog.pvamu.edu/search/?P=CVEG%203073).

CVEG 3156 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 4013 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 3073 (http://catalog.pvamu.edu/search/?P=CVEG%203073).

**CVEG 4021 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 3023 (http://catalog.pvamu.edu/search/?P=CVEG%203023).

**CVEG 4043 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 3043 (http://catalog.pvamu.edu/search/?P=CVEG%203043).

**CVEG 4053 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 3053 (http://catalog.pvamu.edu/search/?P=CVEG%203053).

**CVEG 4063 Water Resources Engineering: 3 semester hours.**
Control and utilization of water; flood control; water distribution systems; open channel flows; and hydraulic structures.
Prerequisites: CVEG 3063 (http://catalog.pvamu.edu/search/?P=CVEG%203063).

**CVEG 4072 Systems Engineering and Uncertainty: 2 semester hours.**
Introduction to systems analysis; problem modeling; optimization methods; linear programming; mixed integer linear programming; dynamic programming; multi-objective optimization; formulation and solution of engineering optimization problems with uncertainty factors and the evaluation of design solutions via sensitivity and risk analysis.
Prerequisites: MATH 3023 (http://catalog.pvamu.edu/search/?P=MATH%203023) and CVEG 3053 (http://catalog.pvamu.edu/search/?P=CVEG%203053).

**CVEG 4093 Systems Engineering: 3 semester hours.**
Introduction to systems analysis and design; problem modeling; optimization; linear programming; dynamic programming; network analysis; critical path; economic analysis; and decision theory.
Prerequisites: MATH 3023 (http://catalog.pvamu.edu/search/?P=MATH%203023) and CVEG 3053 (http://catalog.pvamu.edu/search/?P=CVEG%203053).

**CVEG 4103 Special Topics: 3 semester hours.**
Selected current and emerging topics in Civil Engineering depending on need determined by the department.

**CVEG 4113 Energy and Environment: 3 semester hours.**
Introduction to climate and climate change, the carbon cycle, air and water pollution from energy systems, impacts and implications of energy use for human health, current energy and energy-related environmental policies to foster the development of sustainable energy technologies, fuels, and practices, energy alternatives for the future and their impact on the local and global environment.

**CVEG 4123 Hydrology: 3 semester hours.**
Hydrologic cycle; precipitation; runoff; infiltration; hydrological analysis; unit hydrograph; statistical methods; surface and groundwater; flood forecasting; flood routing; flood control; and computer applications.
Prerequisites: CVEG 3063 (http://catalog.pvamu.edu/search/?P=CVEG%203063).

**CVEG 4141 Engineering Management and Ethics: 1 semester hour.**
Introduction to engineering project development and management with a particular emphasis on project systems integration and process execution. Ethical dimensions in Engineering [and economic] decision making with regard to code of ethics, professional liability sustainability and sustainable design, will be introduced.
Prerequisites: CVEG 3053 (http://catalog.pvamu.edu/search/?P=CVEG%203053).

**CVEG 4143 Engineering Construction: 3 semester hours.**
Modern construction methods; history, organization management, planning, and machinery; importance of working drawings programming and economy of good planning; and importance of inspection and checks, including visits to work sites and reports on such visits.
Prerequisites: CVEG 3031 (http://catalog.pvamu.edu/search/?P=CVEG%203031).

**CVEG 4156 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 4223 Waste Management: 3 semester hours.
Evolution, legislative trends and regulations for solid and hazardous waste management; sources, characteristics and engineering principles of solid and hazardous waste; and treatment and disposal methods for solid and hazardous wastes.
Prerequisites: CVEG 3043 (http://catalog.pvamu.edu/search/?P=CVEG%203043).

CVEG 4224 Water Quality Modeling: 3 semester hours.
Water quality overview: movement of contaminants in the environment; contaminant interactions with soil, air, and water; and mathematical models to describe the movement of contaminants in various bodies of water including rivers, lakes, oceans and groundwater.
Prerequisites: CVEG 3043 (http://catalog.pvamu.edu/search/?P=CVEG%203043).

CVEG 4234 Fundamentals of Air Pollution and Control: 3 semester hours.
Fundamentals of air pollution; regulatory aspects; effects and sources of air pollution; atmospheric physics and chemistry; simple air quality models; and basics of air pollution control.
Prerequisites: CVEG 3043 (http://catalog.pvamu.edu/search/?P=CVEG%203043).

CVEG 4242 Senior Design and Professionalism - I: 2 semester hours.
This is the first course of a two-semester capstone experience (CVEG 4242 must immediately follow 4241 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, oral presentation, and professional standards and ethics examinations.
Prerequisites: CVEG 3023 (http://catalog.pvamu.edu/search/?P=CVEG%203023) and CVEG 3043 (http://catalog.pvamu.edu/search/?P=CVEG%203043) and CVEG 3053 (http://catalog.pvamu.edu/search/?P=CVEG%203053) and CVEG 3063 (http://catalog.pvamu.edu/search/?P=CVEG%203063) and CVEG 3073 (http://catalog.pvamu.edu/search/?P=CVEG%203073).

CVEG 4243 Senior Design and Professionalism - II: 2 semester hours.
A continuation of CVEG 4242 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 4472 (http://catalog.pvamu.edu/search/?P=CVEG%204472).

CVEG 4244 Independent Study: 1-3 semester hour.
Readings, research, and/or field work in selected topics.

CVEG 5123 Structural Dynamics: 3 semester hours.
Single and multi-degree systems, linear nonlinear systems, damped or forced random vibrations, self-introduced vibrations, numerical and phase plane solutions, modal analysis, formulation by flexibility and stiffness matrices, response spectra, and computer applications.

CVEG 5134 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 5144 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 5154 Biological Unit Operations in Environmental Engineering: 3 semester hours.
Major concepts of biology and microbiology as they apply to biological processes. Theory and design of various biological unit operations in Environmental Engineering. The course will be focused on biological processes used in wastewater treatment; however the application of these processes to other environmental media will be discussed.

CVEG 5164 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 5174 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 5184 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 5194 Pretressed 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 5313 Management of Engineering Projects: 3 semester hours.
The course is divided into six components: planning, organizing, financing, execution, and evaluation. It uses the principles of engineering management as well as the tools, skills, and knowledge necessary to successfully manage projects and processes.

CVEG 5613 Transportation Asset Management: 3 semester hours.
This course covers the principles, techniques, and tools used to managing transportation assets; reviews the most cutting-edge strategies designed to help agencies advance the management of their transportation assets; provides an understanding performance measures and concepts related to cost-effective resource allocation among competing asset needs; and applies a strategic framework to produce an action plan for transportation related agencies.

CVEG 5713 Optimization and Uncertainty Analysis: 3 semester hours.
Formulation and solution of engineering optimization problems with uncertainty factors; inclusion of sensitivity and risk analyses in optimization problems. Prerequisites: GNEG 5023.

CVEG 5753 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 5763 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 5023.