Civil Engineering (CVEG)

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Andrew F. Braha, Assistant Professor
Rick Coffman, Associate Professor
Norman D. Dennis Jr., University Professor
Findlay Edwards, Associate Professor
Julian Fairey, Associate Professor
Eric Fernstrom, Instructor
Mary Fleck, Instructor
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Sarah Hernandez, Assistant Professor
Ernie Heymsfield, Associate Professor
Michael Johnson, Professor
Gary S. Prinz, Assistant Professor
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Civil engineering is the oldest of all the engineering fields, yet it is as contemporary as the need to provide solutions to today’s environmental, structural and transportation problems. The civil engineer plans, designs, builds, and operates projects for the advancement and well-being of society while coordinating and conserving human and natural resources. Civil engineering projects range from small to monumental and include public water systems, buildings, bridges, rail and highway networks, water and wastewater treatment plants, solid and hazardous waste disposal facilities, airports, and soil conservation and flood diversion controls.

The civil engineering profession offers a vast array of opportunities. Civil engineers may work in private employment or with public agencies. They may work indoors in activities such as planning and design, or outdoors in areas such as construction supervision. Employment is possible anywhere in the world.

The objective of the Civil Engineering undergraduate program is to produce graduates who are prepared to pursue:
- careers in the broad field of Civil Engineering
- licensure as a Professional Engineer
- advanced education

To fulfill this objective, all students must take courses in geotechnical, environmental, transportation, and structural engineering. Courses are designed to present “real world” applications without sacrificing conceptual and theoretical basics. Students complete design problems in each of these areas; and, as part of the senior year, they participate in two major design projects.

Requirements for B.S. in Civil Engineering Elective Courses
Students must select three 3-hour civil engineering elective courses in conference with their adviser. Normally, the civil engineering courses are selected from among the 4000-level elective CVEG courses. Exceptional students may be allowed to choose from the 5000 (graduate-level) course series.

Students must also choose one elective course in science, engineering, technology, or math (STEM) field.

Humanities and social science electives are selected from courses approved by the university which satisfy the University Core general education requirement. Lists of approved electives are on file in the department office.

Civil Engineering Design Electives
Students must complete two of the following four CVEG design project electives: CVEG 4812 Environmental Design Project (Sp), CVEG 4822 Geotechnical Design Project (Fa), CVEG 4832 Structural Design Project (Sp), and CVEG 4842 Transportation Design Project (Fa). Each design project elective is associated with a specific design-oriented course. The associated course must be taken at the same time as the design project elective. The associated courses may be taken alone but the design electives cannot.

STEM Electives
Students must also choose one elective course in science, engineering, technology, or math (STEM) from among the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCE 2004</td>
<td>Programming Foundations I (Sp, Fa)</td>
<td>4</td>
</tr>
<tr>
<td>ELEG 3903</td>
<td>Electric Circuits and Machines (Sp, Fa)</td>
<td>3</td>
</tr>
<tr>
<td>GNEG 3113</td>
<td>Special Topics-Study Abroad (Irregular)</td>
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<tr>
<td>GNEG 3811</td>
<td>Alternating Cooperative Education (Sp, Su, Fa)</td>
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<tr>
<td>MEEG 2013</td>
<td>Dynamics (Sp, Su, Fa)</td>
<td>3</td>
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<tr>
<td>MEEG 2403</td>
<td>Thermodynamics (Sp, Su, Fa)</td>
<td>3</td>
</tr>
<tr>
<td>MEEG 2703</td>
<td>Computer Methods in Mechanical Engineering (Sp, Su)</td>
<td>3</td>
</tr>
<tr>
<td>GEOS 3023</td>
<td>Introduction to Cartography (Fa)</td>
<td>3</td>
</tr>
<tr>
<td>GEOS 3543</td>
<td>Geospatial Applications and Information Science (Sp, Fa)</td>
<td>3</td>
</tr>
<tr>
<td>GEOS 4533</td>
<td>Introduction to Petroleum Geophysics (Fa)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3083</td>
<td>Linear Algebra (Sp, Su, Fa)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4363</td>
<td>Numerical Analysis (Fa)</td>
<td>3</td>
</tr>
<tr>
<td>Any 3000-level or above science, technology, engineering or math course. (It is recommended that students consult with their adviser when making this selection.)</td>
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</tbody>
</table>

Civil Engineering B.S.C.E. Eight-Semester Degree Program
The Civil Engineering B.S.C.E. program is eligible for freshman students who want to participate in an Eight-Semester Degree Program. See the Eight-Semester Degree Policy (http://...
catalog.uark.edu/undergraduateregulations/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy) for details of the program.

The following section contains the list of courses required for the Bachelor of Science in Civil Engineering degree and a suggested sequence. Not all courses are offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course prerequisites.

See the list of university core courses (http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore) available for engineering students.

### First Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Sp, Su, Fa)</td>
<td>4</td>
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<tr>
<td>PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034) (Sp, Su, Fa)</td>
<td>4</td>
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<tr>
<td>GNEG 1111 Introduction to Engineering I (Sp, Fa)</td>
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</tr>
<tr>
<td>CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture) (Su, Fa)</td>
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<tr>
<td>ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Sp, Su, Fa)</td>
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<tr>
<td>MATH 2564 Calculus II (ACTS Equivalency = MATH 2505) (Sp, Su, Fa)</td>
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<tr>
<td>GNEG 1121 Introduction to Engineering II (Sp, Fa)</td>
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<tr>
<td>Freshman Science Elective</td>
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<td>Freshman Science Elective Lab</td>
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<tr>
<td>ENGL 1023 Composition II (ACTS Equivalency = ENGL 1023) (Sp, Su, Fa)</td>
<td>3</td>
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</table>

Select one of the following:

- HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113) (Sp, Su, Fa) 3
- HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) (Sp, Su, Fa) 3

Year Total: 15 15

### Second Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tbody>
<tr>
<td>MATH 2574 Calculus III (ACTS Equivalency = MATH 2603) (Sp, Su, Fa)</td>
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<tr>
<td>CVEG 2015 Fundamentals of Mechanics for Civil Engineers (Sp, Fa)</td>
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<tr>
<td>CVEG 2053 Surveying Systems (Sp, Fa) &amp; CVEG 2051L Surveying Systems Laboratory (Sp, Fa)</td>
<td>4</td>
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<tr>
<td>Fine Arts Elective (from University/State Core list)</td>
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<tr>
<td>MATH 2584 Elementary Differential Equations (Sp, Su, Fa)</td>
<td>4</td>
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<tr>
<td>CVEG 2002 Introduction to Civil Engineering Plans and CADD (Sp, Su, Fa)</td>
<td>2</td>
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</tr>
<tr>
<td>CVEG 2113 Structural Materials (Sp, Fa)</td>
<td>3</td>
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</tr>
<tr>
<td>INEG 2313 Applied Probability and Statistics for Engineers I (Sp, Fa)</td>
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</tr>
<tr>
<td>GEOS 1113 General Geology (ACTS Equivalency = GEOL 1114 Lecture) (Sp, Su, Fa) &amp; GEOS 1111L General Geology Laboratory (ACTS Equivalency = GEOL 1114 Lab) (Sp, Su, Fa)</td>
<td>4</td>
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<tr>
<td>CVEG 2851 Engineering Professional Practice Issues (Sp, Fa)</td>
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Year Total: 16 17

### Third Year

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<thead>
<tr>
<th>Units</th>
<th>Fall</th>
<th>Spring</th>
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<tr>
<td>CVEG 3303 Structural Analysis (Sp, Fa)</td>
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<tr>
<td>CVEG 3213 Hydraulics (Sp, Fa)</td>
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<tr>
<td>CVEG 3413 Transportation Engineering (Fa)</td>
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<tr>
<td>INEG 2413 Engineering Economic Analysis (Sp, Fa)</td>
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<tr>
<td>STEM Elective</td>
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<tr>
<td>CVEG 4303 Reinforced Concrete Design I (Sp, Fa)</td>
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<tr>
<td>CVEG 3243 Environmental Engineering (Sp, Fa)</td>
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<tr>
<td>CVEG 3223 Hydrology (Sp, Fa)</td>
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<tr>
<td>CVEG 3133 Soil Mechanics (Sp, Fa)</td>
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<tr>
<td>CVEG 3131L Soil Mechanics Laboratory (Sp, Fa)</td>
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<tr>
<td>Social Science Elective (from University/State Core list)</td>
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Year Total: 15 16

### Fourth Year

<table>
<thead>
<tr>
<th>Units</th>
<th>Fall</th>
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<tbody>
<tr>
<td>CVEG 4143 Foundation Engineering (Sp, Fa)</td>
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<tr>
<td>CVEG 4423 Geometric Design (Sp, Fa)</td>
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<tr>
<td>Civil Engineering Elective*</td>
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<tr>
<td>Civil Engineering Design Elective</td>
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<td>Humanities Elective (from University/State Core List)</td>
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<tr>
<td>Social Science Elective (from University/State Core list)</td>
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<tr>
<td>CVEG 4890 Fundamentals of Engineering Seminar (Sp, Fa)</td>
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<td>CVEG 4513 Construction Management (Sp, Fa)</td>
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<tr>
<td>CVEG 4243 Environmental Engineering Design (Sp, Fa)</td>
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<td>Civil Engineering Design Elective</td>
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<tr>
<td>Civil Engineering Electives*</td>
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<tr>
<td>Social Science Elective (from University/State Core List)</td>
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</table>

Year Total: 17 17

Total Units in Sequence: 128

* See the elective list among the program requirements.
### Honors Program Requirements

Students enrolled in the Honors College who are to receive the Bachelor of Science in Civil Engineering must complete a minimum of 12 hours of honors credit. At least 6 hours must be completed within the Civil Engineering program including at least 3 hours resulting in an Honors Thesis. The CVEG honors courses are acceptable as engineering electives and in some cases may be substituted for required courses. The following Civil Engineering courses are offered for honors credit: CVEG 491VH Honors Studies in Geotechnical Engineering (Irregular), CVEG 492VH Honors Studies in Environmental Engineering (Irregular), CVEG 493VH Honors Studies in Structural Engineering (Irregular), CVEG 494VH Honors Studies in Transportation Engineering (Irregular), and CVEG 4983H Honors Undergraduate Thesis (Irregular).

### Courses

**CVEG 2002. Introduction to Civil Engineering Plans and CADD (Sp, Su, Fa). 2 Hours.**

Development and preparation of design and construction plans; plan terminology and features; introduction to computer-aided drafting and design (CADD) software. Corequisite: Drill component. Prerequisite: Civil Engineering major or departmental consent.

**CVEG 2051L. Surveying Systems Laboratory (Sp, Fa). 1 Hour.**

Laboratory exercises demonstrating the principles and practices of surveying systems. Corequisite: CVEG 2053.

**CVEG 2053. Surveying Systems (Sp, Fa). 3 Hours.**

Coordinate geometry, measurements, and total integrated surveying systems; total stations, electronic data collection, and reduction; error analysis; applications to civil engineering and surveying practice. Pre- or Corequisite: MATH 2554. Corequisite: CVEG 2051L.

**CVEG 2113. Structural Materials (Sp, Fa). 3 Hours.**

Production, properties, behavior, and structural applications of concrete, steel, timber, masonry, and plastic. Statistical analysis methods for quality control are also covered. Lecture 2 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: CVEG 2053 (formerly CVEG 2014) with a grade of C or better or MEEG 3013 with a grade of C or better.

**CVEG 2851. Engineering Professional Practice Issues (Sp, Fa). 1 Hour.**

Study of various issues related to the professional practice of engineering including ethics, professionalism, professional licensure, project procurement, social and political issues, globalization, and other legal issues.

**CVEG 3131L. Soil Mechanics Laboratory (Sp, Fa). 1 Hour.**

Index, strength, and consolidation properties of soils; test methods and specifications for soil sampling and testing. Corequisite: CVEG 3133.

**CVEG 3133. Soil Mechanics (Sp, Fa). 3 Hours.**

Introduction to geotechnical engineering. Properties of soils related to foundations, retaining walls, earth structures, and highways. Lecture 2 hours, laboratory 3 hours per week. Corequisite: CVEG 3131L. Pre- or Corequisite: CVEG 3213 and MATH 2584. Prerequisite: MEEG 3013 or CVEG 2014 and (GEOL 1113 or GEOL 3002) with grades of C or better.

**CVEG 3213. Hydraulics (Sp, Fa). 3 Hours.**

Study of incompressible fluids. Topics include fluid properties, fluid statics, continuity, energy and hydraulic gradients, fundamentals of flow in pipes and open channels. Hardy Cross analyses, measurement of flow of incompressible fluids, hydraulic similitude and dimensional analysis. Lecture 2 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: CVEG 2004 or MEEG 2003, either with a grade of C or better.

**CVEG 3223. Hydrology (Sp, Fa). 3 Hours.**

Flood routing procedures in storage reservoirs and channels. Hydrologic planning including storage reservoir design, frequency duration analysis, and related techniques. Prerequisite: CVEG 2053 or BENG 2643; and CVEG 3213 or MEEG 3503 or CHEG 2133 with grades of C or better.

**CVEG 3243. Environmental Engineering (Sp, Fa). 3 Hours.**

Introduction to theories and fundamentals of physical, chemical, and biological processes with emphasis on water supply and wastewater collection, transportation, and treatment. Lecture 2 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: MATH 2584 with a grade of C or better, and CHEM 1103 or CHEM 1113 with a grade of C or better.

**CVEG 3303. Structural Analysis (Sp, Fa). 3 Hours.**

Analysis and design of beams and frames, and effects of moving loads. Deformation of beams, frames, and trusses. Analysis of indeterminate structures by moment area, slope deflection, and moment distribution methods; approximate methods of analysis. Lecture 3 hours, drill 3 hours per week. Corequisite: Drill component. Prerequisite: MEEG 3013 or CVEG 2014, each with a grade of C or better.

**CVEG 3413. Transportation Engineering (Fa). 3 Hours.**

Introduction to highway and transportation engineering, planning, finance, economics, traffic, and geometric design of transportation facilities; theory and application of driver, vehicle and roadway characteristics as they relate to roadway and intersection design; safety, capacity, traffic operations, and environmental effects for highway engineering. Prerequisite: CVEG 2053 with a grade of C or better.

**CVEG 4053. Land Surveying (Irregular). 3 Hours.**

Historical background of property surveys. Detailed consideration of original surveys and the United States Public Land Surveys. Writing adequate land descriptions. Interpretation of old descriptions. Excess and deficiency. Riparian rights. Field practice in relocation of old corners. Prerequisite: Senior standing and CVEG 2053 with a grade of C or better.

**CVEG 4083. Control Surveys (Irregular). 3 Hours.**

Sun and Polaris observations for astronomic azimuth, solar access studies; control traversing, leveling, triangulation; state plane coordinate systems. Lecture 2 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: CVEG 2053 and CVEG 2051L with grades of C or better.

**CVEG 4143. Foundation Engineering (Sp, Fa). 3 Hours.**

Analysis and design of retaining walls, footings, sheet piles, and piles. Determination of foundation settlements in sand and clay. Prerequisite: CVEG 3133 with a grade of C or better.

**CVEG 4153. Earth Structures (Irregular). 3 Hours.**

The use of soil as a construction material including compaction, cement, lime, and fly ash stabilization. Special topics include seepage, slope stability, swelling, and collapsible soils. Prerequisite: CVEG 3133 with a grade of C or better.

**CVEG 4203. Environmental Regulations and Permits (Fa). 3 Hours.**

Topics include federal and state environmental regulations, the permitting process, permit requirements and related issues. Prerequisite: CVEG 3243 with a grade of C or better and senior standing.
CVEG 4223. Groundwater Hydrology (Fa). 3 Hours.
Detailed analysis of groundwater movement, well hydraulics, groundwater pollution and artificial recharge. Surface and subsurface investigations of groundwater and groundwater management, saline intrusion and groundwater modeling will be addressed. Prerequisite: CVEG 3223.

CVEG 4243. Environmental Engineering Design (Sp, Fa). 3 Hours.
Application of physical, biological, and chemical operations and processes to the design of water supply and wastewater treatment systems. Prerequisite: CVEG 3243 with a grade of C or better.

CVEG 4253. Small Community Wastewater Systems (Irregular). 3 Hours.
Design of innovative and alternative wastewater collection, transport, and treatment systems typically suited for rural and small community applications. Recitation 3 hours per week. Prerequisite: CVEG 3243.

CVEG 4263. Air Pollution Control (Sp). 3 Hours.
Fundamentals of air pollution causes, effects, and measurements; as well as, control methods with application to current industrial problems. Prerequisite: CVEG 3213 or MEEG 3503.

CVEG 4273. Open Channel Flow (Sp). 3 Hours.
Open Channel Flow includes advanced open channel hydraulics, flow measurement techniques, a hydrology review, culvert and storm drainage design, natural channel classification (fluvial geomorphology) and rehabilitation, computer methods and environmental issues. Prerequisite: CVEG 3213 and CVEG 3223.

CVEG 4303. Reinforced Concrete Design I (Sp, Fa). 3 Hours.
Design of reinforced concrete elements with emphasis on ultimate strength design supplemented by working stress design for deflection and crack analysis. Prerequisite: CVEG 2113 and CVEG 3304 with grades of C or better.

CVEG 4313. Structural Steel Design I (Sp, Fa). 3 Hours.
Design of structural steel elements by elastic design the Load and Resistance Factor Design method. Intensive treatment of tension members, beams, columns, and connections. Pre- or Corequisite: CVEG 2113. Prerequisite: CVEG 3304 with a grade of C or better.

CVEG 4323. Structural Loadings (Sp). 3 Hours.
Theoretical background to and practical code requirements for various structural loadings. These include dead loads, occupancy loads, roof loads and ponding, snow loads, granular loads, vehicular loads, wind loading, and seismic loads. Prerequisite: CVEG 3304 and CVEG 4303 (or CVEG 4313) with grades of C or better.

CVEG 4343. Reinforced Masonry Design (Irregular). 3 Hours.

CVEG 4353. Timber Design (Irregular). 3 Hours.
Selection of timber beams, columns, and beam-columns. Physical properties of wood, analysis and design of timber connections. Truss design, glulam members, timber bridge design, treatment for decay, and fire protection. Pre- or Corequisite: CVEG 2113. Prerequisite: CVEG 3304 with a grade of C or better.

CVEG 4393. Reinforced Concrete Design II (Irregular). 3 Hours.
Shear strength, minimum thickness requirements, and deflection calculations for reinforced concrete structural slabs. Design of one-way and two-way structural slabs by the direct design and equivalent frame methods. Prerequisite: CVEG 4303 with a grade of C or better.

CVEG 4413. Pavement Evaluation and Rehabilitation (Irregular). 3 Hours.
Introduction of concepts and procedures for pavement condition surveys; evaluation by nondestructive and destructive testing; maintenance strategies; rehabilitation of pavement systems for highway and airfields; pavement management systems. Prerequisite: CVEG 4433 with a grade of C or better.

CVEG 4423. Geometric Design (Sp, Fa). 3 Hours.
The geometric design of streets and highways, based on theory and application of driver and vehicle characteristics. Corequisite: Lab component. Prerequisite: CVEG 3413 with grade of C or better.

CVEG 4433. Transportation Pavements and Materials (Irregular). 3 Hours.
Study of the engineering properties and behavior of materials commonly used in transportation facilities as they relate to the design and performance of flexible and rigid pavement systems. Lecture 2 hours, laboratory 3 hours per week. Corequisite: Lab component. Prerequisite: CVEG 3133, CVEG 3413, and INEG 2313 with grades of C or better.

CVEG 4513. Construction Management (Sp, Fa). 3 Hours.
Introduction to methods and procedures for management of civil engineering construction projects including organization, plans and specs, cost estimating and bidding, project planning and finance, quality control/ assurance, construction safety, cost management, labor issues, change orders, and subcontractor issues. Prerequisite: Senior standing.

CVEG 4812. Environmental Design Project (Sp). 2 Hours.
Comprehensive engineering design project primarily related to environmental issues. Corequisite: CVEG 4243.

CVEG 4822. Geotechnical Design Project (Fa). 2 Hours.
Comprehensive engineering design project primarily related to geotechnical issues. Prerequisite: CVEG 4303 with a grade of C or better.

CVEG 4832. Structural Design Project (Sp). 2 Hours.
Comprehensive engineering design project primarily related to structural issues. Corequisite: CVEG 4323. Prerequisite: CVEG 4303 and CVEG 4313 with grades of C or better.

CVEG 4842. Transportation Design Project (Fa). 2 Hours.
Comprehensive engineering design project primarily related to transportation issues. Corequisite: CVEG 4423. Prerequisite: CVEG 4402 with a grade of C or better.

CVEG 4863. Sustainability in Civil Engineering (Irregular). 3 Hours.
Qualify and quantify the economic, environmental, societal, and engineering drivers behind sustainability in Civil Engineering. Justification of the feasibility and benefits of sustainability in environmental, geotechnical, structural, and transportation engineering through verbal and written communications. Prerequisite: Senior standing.

CVEG 488V. Special Problems (Irregular). 1-6 Hour.
Prerequisite: Senior standing. May be repeated for up to 6 hours of degree credit.

CVEG 488VH. Honors Special Problems (Irregular). 1-6 Hour.
Service Learning in Belize. Prerequisite: Senior standing. This course is equivalent to CVEG 488V.

CVEG 4890. Fundamentals of Engineering Seminar (Sp, Fa). 0 Hours.
Preparation for students taking the Fundamentals of Engineering (FE) examination, administered by the National Council of Examiners for Engineering and Surveying (NCEES). Concept review and problem-solving drills for topics covered on the FE-Civil examination. Prerequisite: Civil Engineering major and senior standing.

CVEG 491VH. Honors Studies in Geotechnical Engineering (Irregular). 1-6 Hour.
The study of advanced topics in the geotechnical engineering field. May include participation in geotechnical engineering courses normally available only to graduate students. Prerequisite: CVEG 3133 with a grade of C or better. May be repeated for up to 6 hours of degree credit.

CVEG 492VH. Honors Studies in Environmental Engineering (Irregular). 1-6 Hour.
The study of advanced topics in the environmental engineering field. May include participation in environmental engineering courses normally available only to graduate students. Prerequisite: CVEG 3243 with a grade of C or better. May be repeated for up to 6 hours of degree credit.
CVEG 493VH. Honors Studies in Structural Engineering (Irregular). 1-6 Hour.
The study of advanced topics in the structural engineering field. May include
participation in structural engineering courses normally available only to graduate
students. Prerequisite: CVEG 3304 with a grade of C or better. May be repeated for
up to 6 hours of degree credit.

CVEG 494VH. Honors Studies in Transportation Engineering (Irregular). 1-6
Hour.
The study of advanced topics in the transportation engineering field. May include
participation in transportation engineering courses normally available only to
graduate students. Prerequisite: CVEG 3413 with a grade of C or better. May be
repeated for up to 6 hours of degree credit.

CVEG 4983H. Honors Undergraduate Thesis (Irregular). 3 Hours.
Thesis research for civil engineering students enrolled in the honors college.
Prerequisite: Honors College.