CIVIL ENGINEERING, BACHELOR OF SCIENCE

College of Engineering

The civil engineering profession is responsible for designing, building, operating and maintaining the physical infrastructure and protecting the natural environment that together support human society in an economically and environmentally sustainable manner. The need to predict and mitigate the impact of complex human- and nature-induced stresses on large-scale, geographically-distributed systems has never been more evident than now. These challenges and inevitable societal changes result in a need to develop and adopt new technologies and improved efficiency into the infrastructure.

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

Students are encouraged to adhere carefully to all prerequisite requirements. The instructor is authorized to drop students from a course for which stated prerequisites have not been completed. Exclusive of General Education units, the minimum number of units required for the Civil Engineering major is 154.

Areas of Specialization

Environmental Engineering

Environmental Engineering focuses on understanding and management of physical, chemical, and biological processes in natural and engineered systems. Areas of emphasis include improvement of air, land, and water quality in the face of increasing population, expanding industrialization, and global climate change. Examples of environmental engineering include innovative analysis and design of air, water, wastewater, and solid waste treatment systems; mathematical modeling of natural and engineered systems; life cycle analysis; sampling, analysis, transport and transformation of natural and anthropogenic pollutants; and modeling of air pollutant emissions.

Suggested Advisors

Geotechnical Engineering

Geotechnical Engineering encompasses civil infrastructure and environmental problems that require characterization and utilization of geologic materials (soils and rocks) to develop, design, analyze and model engineered solutions. This includes, but is not limited to, foundations for buildings and bridges retaining structures, earthwork (e.g. dams, tunnels, highways), pavements, effects of earthquakes and other natural hazards (e.g. ground motions, liquefaction, soil-structure interaction, landslides, tsunamis), ground improvement methods (e.g. compaction, cement mixing), and geo-environmental problems (e.g. groundwater flow, subsurface contaminant transport and remediation).

Suggested Advisors
R.W. Boulanger, J.T. DeJong, J.T. Harvey, B. Jeremic, A. Martinez, K. Ziotopoulou

Structural Engineering & Structural Mechanics

Structural Engineering addresses the conception, design, analysis, construction, retrofit and modeling of all types of civil infrastructure, including buildings and bridges, dams, ports, highways, and industrial facilities subject to loadings ranging from gravity and earthquakes, to extreme environmental events, with consideration of safe, serviceable, and sustainable outcomes over the entire life-cycle. Structural Mechanics encompasses theories for solids and structures, and the associated methods of analysis, computation and materials characterization used in the practice of Structural Engineering. For both disciplines, materials of particular interest include steel, concrete, timber, advanced composites and particulate media.

Suggested Advisors

Transportation Planning & Engineering

Transportation Engineering deals with the movement of people and goods in a manner consistent with society’s environmental and socio-economic goals. Transportation engineering applies engineering, physical and mathematical sciences, economics, and behavioral social science principles to plan, analyze, design, and operate resilient and sustainable transportation systems, such as highways, transit, airfields and ports. Transportation planning involves the formulation and analysis of transportation policy, program, and project alternatives. Societal goals, budgetary constraints, socio-economic (such as safety, equity and mobility) and environmental (such as air and water quality, climate change, and clean energy) objectives, and technological feasibilities (such as vehicle, infrastructure, and information technologies) are considered.

Suggested Advisors
Y. Fan, J.T. Harvey, M.A. Jaller, A. Kendall, S. Nassiri, D. Sperling, H.M. Zhang

Water Resources Engineering

Water Resources Engineering includes hydrology, hydraulics, fluid mechanics, and water resources systems planning and design. Hydrology deals with quantifying and understanding all aspects of the hydrologic cycle, including the relationships between precipitation, runoff, groundwater, and surface water. Water quality and contaminant transport issues are linked to hydrologic conditions. Hydraulics and fluid mechanics deal with flows in pipes, open-channel water-distribution systems, and natural systems, such as lakes and estuaries. Water resources systems planning and design deals with the comprehensive development of water resources to meet the multiple needs of industry, agriculture, municipalities, recreation, and other activities.

Suggested Advisors

Additional information on areas of specialization and potential faculty advisors can be obtained from the departmental website.

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tr>
<td>MAT 021A</td>
<td>Calculus</td>
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<td>MAT 021B</td>
<td>Calculus</td>
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<tr>
<td>MAT 021C</td>
<td>Calculus</td>
<td>4</td>
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<tr>
<td>MAT 021D</td>
<td>Vector Analysis</td>
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</tr>
<tr>
<td>MAT 022A</td>
<td>Linear Algebra</td>
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### Civil Engineering, Bachelor of Science

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<tr>
<th>Course Code</th>
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<th>Units</th>
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<tr>
<td>MAT 022B</td>
<td>Differential Equations</td>
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<tr>
<td>PHY 009A</td>
<td>Classical Physics</td>
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<tr>
<td>PHY 009B</td>
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<tr>
<td>PHY 009C</td>
<td>Classical Physics</td>
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Choose one BIS 002A or GEL 050 & 050L:

- **BIS 002A** Introduction to Biology: Essentials of Life on Earth 5
- or **GEL 050 & 050L** Physical Geology and Physical Geology Laboratory 5

### Chemistry

- **CHE 002A** General Chemistry 5
- or **CHE 002AH** Honors General Chemistry 5
- **CHE 002B** General Chemistry 5
- or **CHE 002BH** Honors General Chemistry 5

### Civil Engineering

Choose 2-6 units:

- **ECI 003** Civil Infrastructure & Society 1
- **ECI 016** Spatial Data Analysis 1

### Engineering

- **ENG 035** Statics 4
- **ENG 006** Engineering Problem Solving 4
  - or **ECS 032A** Introduction to Programming 4
- **ENG 003** Introduction to Engineering Design 4

Choose one; a grade of C- or better is required:

- **ENL 003** Introduction to Literature 4
- **UWP 001** Introduction to Academic Literacies 4
- **UWP 001V** Introduction to Academic Literacies: Online 4
- **UWP 001Y** Introduction to Academic Literacies 4
- **COM 001** Major Works of the Ancient World 4
- **COM 002** Major Works of the Medieval & Early Modern World 4
- **COM 003** Major Works of the Modern World 4
- **COM 004** Major Works of the Contemporary World 4
- **NAS 005** Introduction to Native American Literature 4

### Lower Division Required Courses Subtotal

70-74

### Upper Division Requirements

#### Engineering

- **ENG 103** Fluid Mechanics 4
  - or **ECI 100** Introduction to Fluid Mechanics for Civil & Environmental Engineers 4
- **ENG 104** Mechanics of Materials 4
- **ENG 104L** Mechanics of Materials Laboratory 4
- **ENG 106** Engineering Economics 4
- **ENG 102** Dynamics 4
  - or **ENG 105** Thermodynamics 4

#### Civil Engineering

- **ECI 114** Probabilistic Systems Analysis for Civil Engineers 4
- **ECI 193A** Civil & Environmental Engineering Senior Design 4
- **ECI 193B** Civil & Environmental Engineering Senior Design 4

Choose one:

- **ECI 115** Computer Methods in Civil & Environmental Engineering 4
- **ECI 153** Deterministic Optimization & Design 4
- **MAT 118A** Partial Differential Equations: Elementary Methods 4

### Civil & Environmental Engineering Breadth

Choose one course from four of the following group options; to satisfy Geotechnical & Water Resources breadth area groups, both lecture and lab courses must be completed:

#### Environment

- **ECI 140A** Environmental Analysis of Aqueous Systems 4
- **ECI 140B** Chemical Principles for Environmental Engineers 4
- **ECI 148A** Water Quality Management 4
- **ECI/ATM 149** Air Pollution 4

#### Geotechnical

- **ECI 171** Soil Mechanics 4
- **ECI 171L** Soil Mechanics Laboratory 4

#### Structures

- **ECI 130** Structural Analysis 4

#### Transportation

- **ECI 161** Transportation System Operations 4
- **ECI/ESP 163** Energy & Environmental Aspects of Transportation 4
- **ECI 165** Transportation Policy 4

#### Water Resources

- **ECI 141** Engineering Hydraulics 4
- **ECI 141L** Engineering Hydraulics Laboratory 4

### Civil & Environmental Engineering Depth

Choose two courses from two of the following group options selected from Civil & Environmental Engineering Breadth:

#### Environment

- **ECI 140B** Chemical Principles for Environmental Engineers 4
- **ECI 140C** Biological Principles for Environmental Engineering 4
- **ECI 140D** Water & Wastewater Treatment System Design 4
- **ECI/ATM 149** Air Pollution 4

#### Geotechnical

- **ECI 173** Foundation Design 4
- **ECI 175** Geotechnical Earthquake Engineering 4
- **ECI 179** Pavement Engineering 4

#### Structures

- **ECI 131** Matrix Structural Analysis 4
- **ECI 132** Structural Design: Metallic Elements 4
- **ECI 133** Structure & Properties of Civil Engineering Materials 4
- **ECI 134** Structural Loads: Calculation & Modeling 4
- **ECI 135** Structural Design: Concrete Elements 4
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<tbody>
<tr>
<td>ECI 136</td>
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<td>ECI 138</td>
<td>Earthquake Loads on Structures</td>
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<td><strong>Transportation</strong></td>
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<tr>
<td>ECI 153</td>
<td>Deterministic Optimization &amp; Design</td>
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<tr>
<td>ECI 161</td>
<td>Transportation System Operations</td>
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<tr>
<td>ECI 179</td>
<td>Pavement Engineering</td>
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<td><strong>Water Resources</strong></td>
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<td>ECI 142</td>
<td>Engineering Hydrology</td>
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<tr>
<td>ECI 144</td>
<td>Groundwater Systems Design</td>
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<td>ECI 145</td>
<td>Hydraulic Structure Design</td>
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<td>ECI 146</td>
<td>Water Resources Simulation</td>
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<tr>
<td>ECI 155</td>
<td>Water Resources Engineering Planning</td>
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**Civil & Engineering Electives**

Civil & Environmental Engineering electives may include any upper division, letter-graded Civil & Environmental Engineering courses (i.e. not already used towards the ECI breadth, ECI depth and math analysis requirements)\(^3^,\(^4\))^ 16-20 units.

**Upper Division Composition Requirement**

Choose one: a grade of C- or better is required: 0-4 units.

- UWP 101 Advanced Composition
- UWP 101Y Advanced Composition
- UWP 102E Writing in the Disciplines: Engineering
- UWP 102G Writing in the Disciplines: Environmental Writing
- UWP 104A Writing in the Professions: Business Writing
- UWP 104AY Writing in the Professions: Business Writing
- UWP 104E Writing in the Professions: Science Writing
- UWP 104T Writing in the Professions: Technical Writing
- Passing the Upper Division Composition Exam.

**Upper Division Requirements Subtotal** 80-90 units

**Total Units** 150-164 units

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1. ECI 003 is designed for lower division students and is not open to upper division students; students who do not take this course will substitute 4 units of additional letter graded upper division Civil & Environmental Engineering (ECI) coursework; see Civil & Environmental Engineering Electives.

2. May include ENG 102 or ENG 105. If both ENG 102 and ENG 105 are completed, 4 units will be considered towards the ECI electives. Also can include, but not exceed, a combination of 6 units from ECI 198 and ECI 199. A maximum of 4 units of upper-division coursework outside of Civil & Environmental Engineering may be considered on a petition basis. Please consult with the undergraduate staff advisor.

3. If ECI 003 was not completed in the Lower Division requirements, 20 units of electives are required.