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
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, K.E. Watkins, 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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Units</th>
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<tbody>
<tr>
<td>MAT 021A</td>
<td>Calculus</td>
<td>4</td>
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<tr>
<td>MAT 021B</td>
<td>Calculus</td>
<td>4</td>
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<tr>
<td>MAT 021C</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MAT 021D</td>
<td>Vector Analysis</td>
<td>4</td>
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<td>MAT 022A</td>
<td>Linear Algebra</td>
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<tr>
<td>MAT 022B</td>
<td>Differential Equations</td>
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**Physics**

<table>
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<th>Course</th>
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<tr>
<td>PHY 009A</td>
<td>Classical Physics</td>
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<tr>
<td>PHY 009B</td>
<td>Classical Physics</td>
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</tr>
<tr>
<td>PHY 009C</td>
<td>Classical Physics</td>
<td>5</td>
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</tbody>
</table>

Choose one BIS 002A or GEL 050 & GEL 050L:

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

**Chemistry**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>CHE 002A</td>
<td>General Chemistry</td>
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<td>CHE 002AH</td>
<td>Honors General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHE 002B</td>
<td>General Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHE 002BH</td>
<td>Honors General Chemistry</td>
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</tbody>
</table>

**Civil Engineering**

Choose 2-6 units:

- ECI 003: Civil & Environmental Infrastructure & Society
- ECI 016: Spatial Data Analysis

**Engineering**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>ENG 035</td>
<td>Statics</td>
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<tr>
<td>ENG 006</td>
<td>Engineering Problem Solving</td>
<td>4</td>
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<tr>
<td>or ECS 032A</td>
<td>Introduction to Programming</td>
<td>4</td>
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<tr>
<td>ENG 003</td>
<td>Introduction to Engineering Design</td>
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</tr>
<tr>
<td>or ENG 003Y</td>
<td>Introduction to Engineering Design</td>
<td>4</td>
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</tbody>
</table>

Lower Division Composition/Writing; choose one; a grade of C- or better is required:

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

**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**

Choose one:

- ECI 140A: Environmental Analysis of Aqueous Systems
- ECI 140B: Chemical Principles for Environmental Engineers
- ECI 148A: (Discontinued)
- ECI/ATM 149: Air Pollution

**Geotechnical**

- ECI 171: Soil Mechanics
- ECI 171L: Soil Mechanics Laboratory

**Structures**

- ECI 130: Structural Analysis

**Transportation**

Choose one:

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

**Water Resources**

- ECI 141: Engineering Hydraulics
- ECI 141L: Engineering Hydraulics Laboratory

**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
- ECI 140C: Biological Principles for Environmental Engineering
- ECI 140D: Water & Wastewater Treatment System Design (Discontinued)
- ECI/ATM 149: Air Pollution

**Geotechnical**

- ECI 173: Foundation Design
- ECI 175: Geotechnical Earthquake Engineering
- ECI 179: Pavement Engineering

**Structures**

- ECI 131: Matrix Structural Analysis
- ECI 132: Structural Design: Metallic Elements
ECI 133  Structure & Properties of Civil Engineering Materials
ECI 134  Structural Loads: Calculation & Modeling
ECI 135  Structural Design: Concrete Elements
ECI 136  Building Design
ECI 138  Earthquake Loads on Structures

Transportation
ECI 153  Deterministic Optimization & Design
ECI 161  Transportation System Operations
ECI 179  Pavement Engineering

Water Resources
ECI 142  Engineering Hydrology
ECI 144  Groundwater Systems Design
ECI 145  Hydraulic Structure Design
ECI 146  Water Resources Simulation
ECI 155  Water Resources Engineering Planning

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

Upper Division Composition Requirement
Choose one: a grade of C- or better is required: 0-4

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>UWP 101</td>
<td>Advanced Composition</td>
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<tr>
<td>or UWP 101V</td>
<td>Advanced Composition</td>
</tr>
<tr>
<td>or UWP 101Y</td>
<td>Advanced Composition</td>
</tr>
<tr>
<td>UWP 102E</td>
<td>Writing in the Disciplines: Engineering</td>
</tr>
<tr>
<td>UWP 102G</td>
<td>Writing in the Disciplines: Environmental Writing</td>
</tr>
<tr>
<td>UWP 104A</td>
<td>Writing in the Professions: Business Writing</td>
</tr>
<tr>
<td>or UWP 104AY</td>
<td>Writing in the Professions: Business Writing</td>
</tr>
<tr>
<td>UWP 104E</td>
<td>Writing in the Professions: Science</td>
</tr>
<tr>
<td>UWP 104T</td>
<td>Writing in the Professions: Technical Writing</td>
</tr>
</tbody>
</table>

Passing the Upper Division Composition Exam.

Upper Division Requirements Subtotal 80-90

Total Units 150-164

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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.