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.

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<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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<tr>
<td>MAT 022A</td>
<td>Linear Algebra</td>
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</tr>
<tr>
<td>MAT 022B</td>
<td>Differential Equations</td>
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Physics

PHY 009A  Classical Physics  5
PHY 009B  Classical Physics  5
PHY 009C  Classical Physics  5

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

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

Chemistry

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

Civil Engineering

Choose 2-6 units:

ECI 003  Civil & Environmental Infrastructure & Society

ECI 016  Spatial Data Analysis

Engineering

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

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
or ENL 003V  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)

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
ENG 104  Mechanics of Materials  4
ENG 104L  Mechanics of Materials Laboratory  1
ENG 106  Engineering Economics  4
ENG 102  Dynamics  4
or ENG 105  Thermodynamics

Civil Engineering

ECI 114  Probabilistic Systems Analysis for Civil & Environmental 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
ECI 153  Deterministic Optimization & Design
MAT 118A  Partial Differential Equations: Elementary Methods

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:  15-17

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 (Discontinued)

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:  16

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 (Discontinued)

Geotechnical

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

Structures
<table>
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<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>ECI 131</td>
<td>Matrix Structural Analysis</td>
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<tr>
<td>ECI 132</td>
<td>Structural Design: Metallic Elements</td>
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<tr>
<td>ECI 133</td>
<td>Structure &amp; Properties of Civil Engineering</td>
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<td>Materials</td>
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<td>ECI 134</td>
<td>Structural Loads: Calculation &amp; Modeling</td>
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<td>ECI 135</td>
<td>Structural Design: Concrete Elements</td>
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<td>ECI 136</td>
<td>Building Design</td>
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<tr>
<td>ECI 138</td>
<td>Earthquake Loads on Structures</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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<td>ECI 179</td>
<td>Pavement Engineering</td>
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<td>ECI 142</td>
<td>Engineering Hydrology</td>
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<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 147</td>
<td>Water Resources Engineering Planning</td>
</tr>
<tr>
<td>ECI 148</td>
<td>Building Design</td>
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**Civil & Environmental 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)

**Upper Division Composition Requirement**

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

- UWP 101 Advanced Composition
- or UWP 101V Advanced Composition
- or 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
- or UWP 104AV Writing in the Professions: Business Writing
- or 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

Total Units: 150-164

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.