

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

H.N. Bischel, C.E. Bronner, C. D. Cappa, R. Corsi, J.L. Darby, A. Kendall, M.J. Kleeman, F.J. Loge, J.R. Lund, J. Pena, S.G. Schladow, T.M. Young

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

M. Barbato, J.E. Bolander, Y.H. Chai, L. Cheng, J.T. Harvey, B. Jeremic, A.M. Kanvinde, S.K. Kunnath, S.A. Miller, M.M. Rashid, N. Sukumar

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

F.A. Bombardelli, J.L. Darby, A.L. Forrest, J.D. Herman, M.L. Kavvas, J.R. Lund, V.L. Morales, H.J. Oldroyd, S.G. Schladow, B.A. Younis

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

Code	Title	Units
Lower Division Required Courses		
<i>Mathematics</i>		
MAT 021A	Calculus	4
MAT 021B	Calculus	4
MAT 021C	Calculus	4
MAT 021D	Vector Analysis	4
MAT 022A	Linear Algebra	3

MAT 022B	Differential Equations	3	Choose one:	4
<i>Physics</i>			ECI 115	Computer Methods in Civil & Environmental Engineering
PHY 009A	Classical Physics	5	ECI 153	Deterministic Optimization & Design
PHY 009B	Classical Physics	5	MAT 118A	Partial Differential Equations: Elementary Methods
PHY 009C	Classical Physics	5	<i>Civil & Environmental Engineering Breadth</i>	
Choose one BIS 002A or GEL 050 & 050L:		5	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
BIS 002A	Introduction to Biology: Essentials of Life on Earth		<i>Environment</i>	
or GEL 050 & 050L	Physical Geology and Physical Geology Laboratory		Choose one:	
<i>Chemistry</i>			ECI 140A	Environmental Analysis of Aqueous Systems
CHE 002A	General Chemistry	5	ECI 140B	Chemical Principles for Environmental Engineers
or CHE 002AH	Honors General Chemistry		ECI 148A	Water Quality Management (Discontinued)
CHE 002B	General Chemistry	5	ECI/ATM 149	Air Pollution
or CHE 002BH	Honors General Chemistry		<i>Geotechnical</i>	
<i>Civil Engineering</i>			ECI 171	Soil Mechanics
Choose 2-6 units:		2-6	ECI 171L	Soil Mechanics Laboratory
ECI 003	Civil Infrastructure & Society ¹		<i>Structures</i>	
ECI 016	Spatial Data Analysis		ECI 130	Structural Analysis
<i>Engineering</i>			<i>Transportation</i>	
ENG 035	Statics	4	Choose one:	
ENG 006	Engineering Problem Solving	4	ECI 161	Transportation System Operations
or ECS 032A	Introduction to Programming		ECI/ESP 163	Energy & Environmental Aspects of Transportation
ENG 003	Introduction to Engineering Design	4	ECI 165	Transportation Policy
Choose one; a grade of C- or better is required:		4	<i>Water Resources</i>	
ENL 003	Introduction to Literature		ECI 141	Engineering Hydraulics
UWP 001	Introduction to Academic Literacies		ECI 141L	Engineering Hydraulics Laboratory
UWP 001V	Introduction to Academic Literacies: Online		<i>Civil & Environmental Engineering Depth</i>	
UWP 001Y	Introduction to Academic Literacies		Choose two courses from two of the following group options selected from Civil & Environmental Engineering Breadth:	16
COM 001	Major Works of the Ancient World		<i>Environment</i>	
COM 002	Major Works of the Medieval & Early Modern World		ECI 140B	Chemical Principles for Environmental Engineers
COM 003	Major Works of the Modern World		ECI 140C	Biological Principles for Environmental Engineering
COM 004	Major Works of the Contemporary World		ECI 140D	Water & Wastewater Treatment System Design
NAS 005	Introduction to Native American Literature		ECI/ATM 149	Air Pollution
Lower Division Required Courses Subtotal		70-74	<i>Geotechnical</i>	
Upper Division Requirements			ECI 173	Foundation Design
<i>Engineering</i>			ECI 175	Geotechnical Earthquake Engineering
ENG 103	Fluid Mechanics	4	ECI 179	Pavement Engineering
or ECI 100	Introduction to Fluid Mechanics for Civil & Environmental Engineers		<i>Structures</i>	
ENG 104	Mechanics of Materials	4	ECI 131	Matrix Structural Analysis
ENG 104L	Mechanics of Materials Laboratory	1	ECI 132	Structural Design: Metallic Elements
ENG 106	Engineering Economics	4	ECI 133	Structure & Properties of Civil Engineering Materials
ENG 102	Dynamics	4	ECI 134	Structural Loads: Calculation & Modeling
or ENG 105	Thermodynamics		ECI 135	Structural Design: Concrete Elements
<i>Civil Engineering</i>				
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		

ECI 136	Building Design	
ECI 138	Earthquake Loads on Structures	
<i>Transportation</i>		
ECI 153	Deterministic Optimization & Design	
ECI 161	Transportation System Operations	
ECI 179	Pavement Engineering	
<i>Water Resources</i>		
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	
<i>Civil & Engineering Electives</i>		
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
<i>Upper Division Composition Requirement</i>		
Choose one: a grade of C- or better is required:		0-4
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 104AY	Writing in the Professions: Business Writing	
UWP 104E	Writing in the Professions: Science	
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.