

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, A. Kendall, M.J. Kleeman, F.J. Loge, 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

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, 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

F.A. Bombardelli, A.L. Forrest, J.D. Herman, M.L. Kavvas, 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

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:		5
BIS 002A	Introduction to Biology: Essentials of Life on Earth	
or GEL 050 & 050L	Physical Geology 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:		2-6
ECI 003	Civil & Environmental Infrastructure & Society ¹	
ECI 016	Spatial Data Analysis	

Engineering

ENG 035	Statics	4
ENG 006	Engineering Problem Solving	4
or ECS 032A	Introduction to Programming	
ENG 003	Introduction to Engineering Design	4
or ENG 003Y	Introduction to Engineering Design	
Lower Division Composition/Writing; choose one; a grade of C- or better is required:		4

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:		4

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	
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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

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	
<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 104AV	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

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

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.