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 Bachelor of Science is accredited by the Engineering Accreditation Commission of ABET (http://www.abet.org/) under the commission's General Criteria and Program Criteria for Civil and Similarly Named Engineering Programs.

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.

Areas of Specialization

Construction Engineering & Management

Construction engineering and management focuses on the role of civil engineers in the construction of all types of civil infrastructure. Construction engineering involves finding engineered solutions for sourcing, transporting, processing, assembling, fabricating, and testing materials and systems used to construct buildings, as well as transportation, water resources, geotechnical, and environmental infrastructure. Project management involves developing and executing plans to manage people, financial, and material resources in order to deliver projects with the correct scope, on time, within budget, and meeting engineering performance, environmental impact, and stakeholder expectations. While primarily applied to civil infrastructure projects, these principles are also applicable to many other fields.

Suggested Advisors

J. Harvey, S. Miller, J. Bolander, S. Nassiri

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, C. DeFinnda, A. Kendall, M.J. Kleeman, F.J. Loge, J. Pena, 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, M.H. Gardner, J.T. Harvey, B. Jeremic, A. Martinez, S. Nassiri, 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, L. Cheng, J.T. Harvey, B. Jeremic, A.M. Kanvinde, S.K. Kunnath, S.A. Miller, 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. Jenn, 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. Escriva-Bou, A.L. Forrest, J.D. Herman, M.L. Kavvas, V.L. Morales, H.J. Oldroyd, B.A. Younis

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

The major requirements below are in addition to meeting University Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/university-degree-requirements/) & College Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/college-degree-requirements/); unless otherwise noted. The minimum number of units required for the Civil Engineering Bachelor of Science is 150.

Code	Title	Units
Lower Division Required Courses		
Mathematics		
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
Physical, Biological & Data Science Requirement		*4-5*
Choose One:		
ATM 060	Introduction to Atmospheric Science	
ATM 133	Biometeorology	
BIS 002A	Introduction to Biology: Essentials of Life on Earth	
BIS 002B	Introduction to Biology: Principles of Ecology & Evolution	
GEL 050 & 050L	Physical Geology and Physical Geology Laboratory	
ECS 111	Applied Machine Learning for Non-Majors	
ECS 115	Computer Networks for Non-Majors	
ECS 116	Databases for Non-Majors	
ECS 117	Algorithms for Data Science	
ECS 171	Machine Learning	
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		*2-6*
ECI 016	Spatial Data Analysis	
AND choose one: [1]		
ECI 003	Civil & Environmental Infrastructure & Society	
OR		
ECI 101	Transfer Transition for Civil & Environmental Engineering	
Engineering		
ENG 003	Introduction to Engineering Design	4
or ENG 003Y	Introduction to Engineering Design	
ENG 006	Engineering Problem Solving	4
or ECS 032A	Introduction to Programming	
or ECS 032AV	Introduction to Programming	
ENG 035	Statics	4
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	
or NAS 005V	Introduction to Native American Literature	
UWP 001	Introduction to Academic Literacies	
or UWP 001V	Introduction to Academic Literacies: Online	
or UWP 001Y	Introduction to Academic Literacies	
Lower Division Required Courses Subtotal		69-74
Upper Division Requirements		
Engineering		
ECI 100	Introduction to Fluid Mechanics for Civil & Environmental Engineers	4
or ENG 103	Fluid Mechanics	
ENG 102	Dynamics	4
or ENG 105	Thermodynamics	
If both ENG 102 & ENG 105 are completed, the additional 4 units will be considered towards the ECI elective requirement.		
ENG 104	Mechanics of Materials	4
or ENG 104V	Mechanics of Materials	
ENG 104L	Mechanics of Materials Laboratory	1
ENG 106	Engineering Economics	4
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
Numerical Methods Requirement; choose one:		*4*
ECI 115	Computer Methods in Civil & Environmental Engineering	
ECI 131	Matrix Structural Analysis	
ECI 146	Water Resources Simulation	
ECI 153	Deterministic Optimization & Design	
Civil & Environmental Engineering Breadth		
Choose one course from five of the following group options:		16-18

To satisfy Geotechnical & Water Resources breadth area groups, both lecture and lab courses must be completed.		
Construction Engineering & Management		
ECI 137	Construction Principles & Project Management	
ECI 153	Deterministic Optimization & Design	
Environment		
ECI 140A	Environmental Analysis of Aqueous Systems	
ECI 140B	Chemical Principles for Environmental Engineers	
ECI/ATM 149N	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 162	Transportation Infrastructure Design	
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
Construction Engineering & Management		
ECI 133	Structure & Properties of Civil Engineering Materials	
ECI 137	Construction Principles & Project Management	
ECI 153	Deterministic Optimization & Design	
ECI 178	Pavement Engineering & Design	
ECI 179	Pavement Management, Evaluation, & Rehabilitation	
ECI 181	Construction Cost Estimation & Analysis	
ECI 182	Buildings: Assemblage & Construction Quality Management	
Environment		
ECI 140B	Chemical Principles for Environmental Engineers	
ECI 140CN	Water & Wastewater Treatment System Design	
ECI/ATM 149N	Air Pollution	
Geotechnical		
ECI 173	Foundation Design	
ECI 175	Geotechnical Earthquake Engineering	
ECI 179	Pavement Management, Evaluation, & Rehabilitation	
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 (Discontinued) **	
ECI 138	Earthquake Loads on Structures	
Transportation		
ECI 153	Deterministic Optimization & Design	
ECI 161	Transportation System Operations	
ECI 162	Transportation Infrastructure Design	
ECI 164	Introduction to Electric Vehicles	
ECI 179	Pavement Management, Evaluation, & Rehabilitation	
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 & Environmental Engineering Electives [2]		
Civil & Environmental Engineering electives may include any upper division, letter-graded Civil & Environmental Engineering courses; e.g., not already used towards the ECI breadth, ECI depth, and Numerical Methods requirements.		12-16
Civil Engineering Competency Requirement		
No additional units are necessary as students can count these as competency and another major requirement.		
Material Science Competency; complete one of the following options:		*0-4*
ECI 133	Structure & Properties of Civil Engineering Materials	
OR		
Complete two of the following courses:		
ECI 132	Structural Design: Metallic Elements	
ECI 135	Structural Design: Concrete Elements	
ECI 171	Soil Mechanics	
ECI 173	Foundation Design	
ECI 178	Pavement Engineering & Design	
ECI 140	(Discontinued for winter 2024) **	
ECI 145	Hydraulic Structure Design	
ECI 149L	Air Pollution Lab	
ECI 162	Transportation Infrastructure Design	
ECI 173	Foundation Design	
ECI 178	Pavement Engineering & Design	
Design Competency; complete one of the following:		*0-4*
ECI 140CN	Water & Wastewater Treatment System Design	
ECI 145	Hydraulic Structure Design	
ECI 149L	Air Pollution Lab	
ECI 162	Transportation Infrastructure Design	
ECI 173	Foundation Design	
ECI 178	Pavement Engineering & Design	

Career Development Competency; complete one of the following:		*0-1*
Internship or Relevant Work Experience; minimum ECI 192, 1 unit.		
Research experience with faculty member; minimum ECI 199, 1 quarter.		
Participation in an Engineering Student Professional Organization in a design team or organizing a major event; e.g., ASCE, EWB, AWWA, etc., ECI 198 at least 1 unit.		
CEE Career Development Seminar; winter quarter – 10 weeks, 1 unit		
Construction Engineering & Management Seminar; fall, spring – 10 weeks, 1 unit.		
Upper Division Composition Requirement		
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		77-90
Total Units		**150-164**

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ECI 003 is designed for lower-division students. Transfer students and junior-level students will take ECI 101 if they have not taken ECI 003. Students who change into the major and who do not take either of these courses by their senior year will substitute four units of additional letter graded upper-division Civil & Environmental Engineering (ECI) coursework.

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Also can include, but not exceed, a combination of 6 units from ECI 198 & ECI 199.

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Course(s) discontinued; see your advisor for course options.