ENVIRONMENTAL SYSTEMS ENGINEERING UNDERGRADUATE MAJOR

COVID-19-Related Degree Requirement Changes

For information on how Environmental Systems Engineering degree requirements have been affected by the pandemic, see the "COVID-19 Policies tab (http://exploredegrees.stanford.edu/schoolofengineering/civilandenvironmentalengineering/#covid19policiestext)" in the "Civil and Environmental Engineering" of this bulletin. For University-wide policy changes related to the pandemic, see the "COVID-19 and Academic Continuity (http://exploredegrees.stanford.edu/covid-19-policy-changes/)" section of this bulletin.

See the "Department of Civil and Environmental Engineering (http://exploredegrees.stanford.edu/schoolofengineering/civilandenvironmentalengineering/)" section of this bulletin for additional information on the department, and its programs and faculty.

The department offers a B.S. as well as a minor in Environmental Systems Engineering (see following), as well as a B.S. in Civil Engineering (http://exploredegrees.stanford.edu/soe-ug-majors/civilengineering/) and a minor in Civil Engineering (http://exploredegrees.stanford.edu/schoolofengineering/civilandenvironmentalengineering/#minortext).

Environmental Systems Engineering (EnvSE)

Completion of the undergraduate program in Environmental Systems Engineering leads to the conferral of the Bachelor of Science in Environmental Systems Engineering.

Mission of the Undergraduate Program in Environmental Systems Engineering

The mission of the undergraduate program in Environmental Systems Engineering is to prepare students for incorporating environmentally sustainable design, strategies and practices into natural and built systems and infrastructure involving buildings, water supply, and coastal regions. Courses in the program are multidisciplinary in nature, combining math/science/engineering fundamentals, and tools and skills considered essential for an engineer, along with a choice of one of three focus areas for more in-depth study: coastal environments, freshwater environments, or urban environments. This major offers somewhat more flexibility in the curriculum than the Civil Engineering degree program, and requires fewer units. The program of study, which includes a capstone experience, aims to equip engineering students to take on the complex challenges of the twenty-first century involving natural and built environments, in consulting and industry as well as in graduate school.

Degree Requirements

	Units
Mathematics and Science	
See Basic Requirement 1 and 2 [1]	36
Technology in Society (TiS)	
One 3-5 unit course required, course chosen must be on the SoE Approved Courses list at <ughb.stanford.edu> the year taken; see Basic Requirement 4 [4]	3-5
Engineering Fundamentals	
Two courses minimum (see Basic Requirement 3), including:	
CS 106A Programming Methodology	5
(or CS 106X)	
ENGR 14 Intro to Solid Mechanics	3
Fundamental Tools/Skills [2]	**9**
in visual, oral/written communication, and modeling/analysis	
Specialty Courses, in either	**40**
Coastal environments (see below)	
or Freshwater environments (see below)	
or Urban environments (see below)	
Total Units	**96-98**

1. Math must include CME 100 Vector Calculus for Engineers (or MATH 51 Linear Algebra, Multivariable Calculus, and Modern Applications), and either a Probability/Statistics course or CME 102 Ordinary Differential Equations for Engineers (or MATH 53 Ordinary Differential Equations with Linear Algebra). Science must include PHYSICS 41 Mechanics; and either CHEM 31B Chemical Principles II or CHEM 31M Chemical Principles: From Molecules to Solids (or PHYSICS 43 Electricity and Magnetism, for Urban focus area only).
2. Fundamental tools/skills must include:
   1. CEE 1 Introduction to Environmental Systems Engineering;
   2. at least one visual communication class from CEE 31 Accessing Architecture Through Drawing / CEE 31Q Accessing Architecture Through Drawing, DESINST 270 Visual Design Fundamentals, ME 101 Visual Thinking, ME 110 Design Sketching, ARTSTUDI 160 Intro to Digital / Physical Design, or OSPPARIS 44 EAP. Analytical Drawing and Graphic Art;
   3. at least one oral/written communication class from ENGR 103 Public Speaking, CEE 102W Technical and Professional Communication, ENGR 202W Technical Communication, CEE 151 Negotiation, EARTHSYS 191 Concepts in Environmental Communication or ORALCOMM 117 The Art of Effective Speaking;
   4. at least one modeling/analysis class from CEE 101D Computations in Civil and Environmental Engineering (or CEE 101S) if not counted as Math, CEE 120A Building Modeling for Design & Construction (online only), CEE 146S Engineering Economics and Sustainability (online only), CEE 118X Shaping the Future of the Bay Area, CEE 155 Introduction to Sensing Networks for CEE, CEE 226 Life Cycle Assessment for Complex Systems, CME 211 Software Development for Scientists and Engineers, CS 102 , EARTHSYS 140 , EARTHSYS 142 Remote Sensing of Land, EARTHSYS 144 Fundamentals of Geographic Information Science (GIS), or ESS 227 Decision Science for Environmental Threats
3. A course may only be counted towards one requirement; it may not be double-counted. All courses taken for the major must be taken for a letter grade if that option is offered by the instructor. Minimum Combined GPA for all courses in Engineering Fundamentals and Depth is 2.0.
4. Basic Requirement 4: Technology in Society (TiS) requirement.

Urban Environments Focus Area (40 units)

		Units
Required		
CEE 100	Managing Sustainable Building Projects	4
CEE 101B	Mechanics of Fluids	4
CEE 146S	Engineering Economics and Sustainability	3
CEE 176A	Energy Efficient Buildings	3
or		
CEE 176B	100% Clean, Renewable Energy and Storage for Everything	3-4
Electives (at least two of the 4 areas below must be included with at least 3 units from 2nd area)		
Building Systems		
CEE 102A	Legal / Ethical Principles in Design, Construction, Project Delivery	3
CEE 120B	Advanced Building Modeling Workshop	2-4

CEE 130	Architectural Design: 3-D Modeling, Methodology, and Process	5
or		
CEE 131C	How Buildings are Made -- Materiality and Construction Methods	4
CEE 156	Building Systems Design & Analysis	4
Energy Systems		
CEE 107A	Understanding Energy (or CEE 107S, Sum. 3-4 units)	4-5
CEE 176B	100% Clean, Renewable Energy and Storage for Everything ((if not counted as req'd course))	3-4
ENERGY 104	Sustainable Energy for 9 Billion	3
CEE 173S	Electricity Economics	3
or		
ENERGY 171	Energy Infrastructure, Technology and Economics	3
or		
ENERGY 191	Optimization of Energy Systems	3-4
Water Systems		
CEE 166A	Watershed Hydrologic Processes and Models	4
CEE 166B	Water Resources and Hazards	4
CEE 170	Aquatic and Organic Chemistry for Environmental Engineering	3
CEE 174A	Providing Safe Water for the Developing and Developed World	3
CEE 174B	Wastewater Treatment: From Disposal to Resource Recovery	3
Urban Planning, Design, Analysis		
CEE 6	Physics of Cities	3
CEE 136	Planning Calif: the Intersection of Climate, Land Use, Transportation & the Economy	3
or		
CEE 275D	Environmental Policy Analysis	3-4
or		
CEE 273B	The Business of Water	2
CEE 177L	Smart Cities & Communities	3
URBANST 113	Introduction to Urban Design: Contemporary Urban Design in Theory and Practice	5
or		
URBANST 164	Sustainable Cities	4-5
or		
URBANST 165	(alt. years)	4-5
ME 267	Ethics and Equity in Transportation Systems	3
Capstone (one class required)		
CEE 131D	Urban Design Studio ((or CEE 131E))	5
CEE 141A	Infrastructure Project Development	3
CEE 141B	Infrastructure Project Delivery	3
CEE 226E	Techniques and Methods for Decarbonized and Energy Efficient Building Design	2-3
CEE 218Y	Shaping the Future of the Bay Area	3-5
CEE 218Z	Shaping the Future of the Bay Area	3-5
CEE 243	Intro to Urban Sys Engrg	3
CEE 265F	Environmental Governance and Climate Resilience	3
CEE 199	Undergraduate Research in Civil and Environmental Engineering	3-4

Freshwater Environments Focus Area (40 units)

		Units
Required		
CEE 70	Environmental Science and Technology	3
CEE 101B	Mechanics of Fluids	4
CEE 177	Aquatic Chemistry and Biology ((or CEE 170))	4
CEE 166A	Watershed Hydrologic Processes and Models	4
or		
CEE 174A	Providing Safe Water for the Developing and Developed World	3
or		
CEE 162E	Rivers, Streams, and Canals	3
Electives		
CEE 162E	Rivers, Streams, and Canals (if not counted as a required course)	3
CEE 162F	Coastal Processes	3
CEE 166A	Watershed Hydrologic Processes and Models (if not counted as a required course)	4
CEE 166B	Water Resources and Hazards	4
CEE 136	Planning Calif: the Intersection of Climate, Land Use, Transportation & the Economy	3
or		
CEE 275D	Environmental Policy Analysis	3-4
or		
CEE 273B	The Business of Water	2
CEE 174A	Providing Safe Water for the Developing and Developed World ((prereq: CHEM 31B) (if not counted as a req'd course))	3
CEE 174B	Wastewater Treatment: From Disposal to Resource Recovery ((prereq: CEE 174A))	3
CEE 177L	Smart Cities & Communities	3
or		
CEE 260D	Remote Sensing of Hydrology (prerequisite CS 106A)	3
CEE 265A	Resilience, Sustainability and Water Resources Development (offered occasionally)	3
CEE 265D	Water and Sanitation in Developing Countries	3
BIOHOPK 150H	Ecological Mechanics (alternate years)	3
Capstone (1 class required)		
CEE 141A	Infrastructure Project Development (recommended prerequisite: CEE 136)	3
CEE 218Y	Shaping the Future of the Bay Area	3-5
CEE 218Z	Shaping the Future of the Bay Area	3-5
CEE 199	Undergraduate Research in Civil and Environmental Engineering (must petition CEE UG Committee for approval, prior to enrollment; must have completed at least 6 focus area classes, excluding Breadth)	3-4

Coastal Environments Focus Area (40 units)

		Units
Required		
CEE 70	Environmental Science and Technology	3
CEE 101B	Mechanics of Fluids	4
And two of the following 4 classes:		
CEE 162F	Coastal Processes	3
CEE 162D	Introduction to Physical Oceanography	4
CEE 162I	Atmosphere, Ocean, and Climate Dynamics: the Ocean Circulation	3
CEE 175A	California Coast: Science, Policy, and Law	3-4
Electives		
CEE 162D	Introduction to Physical Oceanography (if not counted as a required class)	4
CEE 162F	Coastal Processes (if not counted as a required class)	3
CEE 162I	Atmosphere, Ocean, and Climate Dynamics: the Ocean Circulation (if not counted as a req'd class)	3
CEE 166A	Watershed Hydrologic Processes and Models	4
CEE 136	Planning Calif: the Intersection of Climate, Land Use, Transportation & the Economy	3
or		
CEE 275D	Environmental Policy Analysis	3-4
or		
CEE 273B	The Business of Water	2
CEE 174A	Providing Safe Water for the Developing and Developed World	3
CEE 174B	Wastewater Treatment: From Disposal to Resource Recovery	3
CEE 175A	California Coast: Science, Policy, and Law	3-4
CEE 177	Aquatic Chemistry and Biology	4
or CEE 170	Aquatic and Organic Chemistry for Environmental Engineering	
CEE 272	Coastal Contaminants	3-4
BIOHOPK 150H	Ecological Mechanics	3
BIO 30	Ecology for Everyone	4
or		
BIO 81	Introduction to Ecology	4
or		
BIOHOPK 81	Introduction to Ecology	4
or		
EARTHSYS 116	Ecology of the Hawaiian Islands	4
or		
OSPAUSTL 32	Coastal Ecosystems	3
or		
OSPGEN 53		2
or		
OSPSANTG 85	Marine Ecology of Chile and the South Pacific	5
DESINST 250	Oceans by Design	3
ESS 8	The Oceans: An Introduction to the Marine Environment	4
or		
ESS 240	Advanced Oceanography	3
or		
BIOHOPK 182H	Stanford at Sea (Oceanography portion - only 4 units may count)	4
EARTHSYS 141	Remote Sensing of the Oceans	3-4
EARTHSYS 151	Biological Oceanography	3-4
to be taken concurrently with		
EARTHSYS 152	Marine Chemistry	3-4
Capstone (1 class required)		
CEE 141A	Infrastructure Project Development	3
CEE 218Y	Shaping the Future of the Bay Area	3-5
CEE 218Z	Shaping the Future of the Bay Area	3-5
CEE 199	Undergraduate Research in Civil and Environmental Engineering (must petition CEE UG Committee for approval, prior to enrollment; must have completed at least 6 focus area classes, excluding Breadth)	3-4

Honors Program

This program leads to a B.S. with honors for undergraduates majoring in Civil Engineering or in Environmental Systems Engineering. It is designed to encourage qualified students to undertake a more intensive study of civil and environmental engineering than is required for the normal majors through a substantial, independent research project.

The program involves an in-depth research study in an area proposed to and agreed to by a Department of Civil and Environmental Engineering faculty adviser and completion of a thesis of high quality. A written proposal for the research to be undertaken must be submitted and approved by the faculty advisor in the fourth quarter prior to graduation. At the time of application, the student must have an overall grade point average (GPA) of at least 3.3 for course work at Stanford; this GPA must be maintained to graduation. The thesis is supervised by a CEE faculty adviser and must involve input from the School of Engineering writing program by means of ENGR 202S Directed Writing Projects or ENGR 199W Writing of Original Research for Engineers. The written thesis must be approved by the thesis adviser. Students are encouraged to present their results in a seminar for faculty and students. Up to 10 units of CEE 199H Undergraduate Honors Thesis, may be taken to support the research and writing (not to duplicate ENGR 202S or ENGR 199W). These units are beyond the normal Civil Engineering or Environmental Systems Engineering major program requirements.

For additional information on the major, minor, honors, and sample programs see the Handbook for Undergraduate Engineering Programs (UGHB) (http://ughb.stanford.edu).

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10 units of CEE 199H Undergraduate Honors Thesis, may be taken to support the research and writing (not to duplicate ENGR 202S or ENGR 199W). These units are beyond the normal Civil Engineering or Environmental Systems Engineering major program requirements.

Environmental Systems Engineering (EnvSE) Minor

The Environmental Systems Engineering minor is intended to give students a focused introduction to one or more areas of Environmental Systems Engineering. Departmental expertise and undergraduate course offerings are available in the areas of environmental engineering and science, environmental fluid mechanics and hydrology, and atmosphere/energy. The minimum prerequisite for an Environmental Systems Engineering minor is MATH 19 Calculus (or MATH 20 Calculus or MATH 21 Calculus); additionally, many courses of interest require PHYSICS 41 Mechanics and/or MATH 51 Linear Algebra, Multivariable Calculus, and Modern Applications as prerequisites. Students should recognize that a minor in Environmental Systems Engineering is not an ABET-accredited degree program.

Since undergraduates having widely varying backgrounds may be interested in obtaining an Environmental Systems Engineering minor, no single set of course requirements is appropriate for all students. Instead, interested students are encouraged to propose their own set of courses within the guidelines listed below. Additional information on preparing a minor program is available in the Undergraduate Engineering Handbook (http://web.stanford.edu/group/ughb/cgi-bin/handbook/index.php/Handbooks/).

General guidelines are—

- An Environmental Systems Engineering minor must contain at least 24 units of course work not taken for the major, and must consist of at least six classes of at least 3 units each of letter-graded work, except where letter grades are not offered.
- The list of courses must represent a coherent body of knowledge in a focused area, and should include classes that build upon one another. Example programs are available on the CEE web site (https://cee.stanford.edu/academics/undergraduate-programs/minor/).

Professor Nicholas Ouellette (nto@stanford.edu) is the CEE undergraduate minor adviser in Environmental Systems Engineering. Students must consult with Professor Ouellette (https://cee.stanford.edu/people/nicholas-t-ouellette/) in developing their minor program, and obtain approval of the finalized study list from him.