ATMOSPHERE/ENERGY UNDERGRADUATE MAJOR

COVID-19-Related Degree Requirement Changes

For information on how Atmosphere/Energy (A/E) 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.

Atmosphere/Energy (A/E)

Completion of the undergraduate program in Atmosphere/Energy leads to the conferral of the Bachelor of Science in Engineering. The subplan "Atmosphere/Energy" appears on the transcript and on the diploma.

Mission of the Undergraduate Program in Atmosphere/Energy

Atmosphere and energy are strongly linked: fossil-fuel energy use contributes to air pollution, global warming, and weather modification; and changes in the atmosphere feed back to renewable energy resources, including wind, solar, hydroelectric, and wave resources. The mission of the undergraduate program in Atmosphere/Energy (A/E) is to provide students with the fundamental background necessary to understand large- and local-scale climate, air pollution, and energy problems and solve them through clean, renewable, and efficient energy systems. To accomplish this goal, students learn in detail the causes and proposed solutions to the problems, and learn to evaluate whether the proposed solutions are truly beneficial. A/E students take courses in renewable energy resources, indoor and outdoor air pollution, energy efficient buildings, climate change, renewable energy and clean-vehicle technologies, weather and storm systems, energy technologies in developing countries, electric grids, and air quality management. The curriculum is flexible. Depending upon their area of interest, students may take in-depth courses in energy or atmosphere and focus either on science, technology, or policy. The major is designed to provide students with excellent preparation for careers in industry, government, and research; and for study in graduate school.

Requirements

		Units
Mathematics and Science (45 units minimum):		
Mathematics		**23**
23 units minimum, including at least one course from each group:		
Group A		
MATH 53	Ordinary Differential Equations with Linear Algebra	
CME 102	Ordinary Differential Equations for Engineers	
Group B		
CME 106	Introduction to Probability and Statistics for Engineers	
STATS 60	Introduction to Statistical Methods: Precalculus	
STATS 101	Data Science 101	
STATS 110	Statistical Methods in Engineering and the Physical Sciences	
Science		**20**
20 units minimum, including all of the following:		
PHYSICS 41	Mechanics	
PHYSICS 43	Electricity and Magnetism	
or PHYSICS 45	Light and Heat	
CHEM 31B	Chemical Principles II	
or CHEM 31M	Chemical Principles: From Molecules to Solids	
CEE 70	Environmental Science and Technology [1]	
Technology in Society (1 course)		**3-5**
One 3-5 unit course required; must be on School of Engineering Approved List the year taken.		
Writing in the Major (WIM)		
One 3-5 unit course required. Choose a TiS course that fulfills a WIM:		
BIOE 131	Ethics in Bioengineering	
COMM 120W	The Rise of Digital Culture	
OR a Skills course:		
CEE 102W	Technical and Professional Communication	
CEE 136	Planning Calif: the Intersection of Climate, Land Use, Transportation & the Economy	
Fundamentals and Depth: At least 40 units total must be from the School of Engineering		
Engineering Fundamentals		
Two courses minimum (recommend 3), including at least one of the following:		7-9
ENGR 50E	Introduction to Materials Science, Energy Emphasis (ENGR 25E also accepted (no longer offered))	
Plus at least one of the following:		
ENGR 10	Introduction to Engineering Analysis	
A third Fundamental is optional but recommended (3-4 units)		
CS 106A	Programming Methodology	
Engineering Depth		
Required: 6-8 units. Introductory seminars may not count toward Engineering Depth [2]		
CEE 64	Air Pollution and Global Warming: History, Science, and Solutions (cannot also fulfill science requirement)	3
CEE 107A	Understanding Energy	3-5
or CEE 107S	Understanding Energy - Essentials	
34- 36 units from the following with at least four courses from each group; at least 40 of the units in ENGR Fundamentals and Depth must be from the School of Engineering:		36
Group A: Atmosphere		
AA 100	Introduction to Aeronautics and Astronautics	
CEE 63	Weather and Storms	
CEE 101B	Mechanics of Fluids	
or ME 70	Introductory Fluids Engineering	
CEE 161I	Atmosphere, Ocean, and Climate Dynamics: The Atmospheric Circulation	
CEE 162I	Atmosphere, Ocean, and Climate Dynamics: the Ocean Circulation	
CEE 172	Air Quality Management	
CEE 178	Introduction to Human Exposure Analysis	
EARTHSYS 111	Biology and Global Change [5]	
EARTHSYS 142	Remote Sensing of Land [5]	
or EARTHSYS 144	Fundamentals of Geographic Information Science (GIS)	
EARTHSYS 159	Economic, Legal, and Political Analysis of Climate-Change Policy	

EARTHSYS 188	Social and Environmental Tradeoffs in Climate Decision-Making [5]
PHYSICS 199	The Physics of Energy and Climate Change [5]
EARTH 2	Climate and Society [5]
EARTHSYS 196	Implementing Climate Solutions at Scale [5]
Group B: Energy	
CEE 107R	E^3: Extreme Energy Efficiency
CEE 156	Building Systems Design & Analysis
CEE 173S	Electricity Economics
CEE 176A	Energy Efficient Buildings
CEE 176B	100% Clean, Renewable Energy and Storage for Everything
CEE 177S	Engineering and Sustainable Development
EARTHSYS 101	Energy and the Environment [5]
EARTHSYS 102	Fundamentals of Renewable Power [5]
ENERGY 104	Sustainable Energy for 9 Billion
ENGR 50E	Introduction to Materials Science, Energy Emphasis [3]
MATSCI 144	Thermodynamic Evaluation of Green Energy Technologies
MATSCI 156	Solar Cells, Fuel Cells, and Batteries: Materials for the Energy Solution
ME 182	Electric Transportation
POLISCI 73	Energy Policy in California and the West [5]
OSPSANTG 29	Sustainable Cities: Comparative Transportation Systems in Latin America [5]
Total Units	95-101

[1] Can count as a science requirement or Engineering Fundamental, but not both.

[2] CEE 64 can count as a science requirement or as Engineering Depth, but not both.

[3] ENGR 50E can count as Engineering Fundamental or Engineering Depth, but not both.

[4] 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.

[5] Courses outside of the School of Engineering (SoE) do not count toward the 40 units of engineering coursework required in the Fundamentals plus Depth categories.

Honors Program

The A/E honors program offers eligible students the opportunity to engage in guided original research, or project design, over the course of an academic year. Interested student must adhere to the following requirements:

1. Prospective honors students write up and submit a 1-2 page letter applying to the honors program in A/E describing the problem to be investigated. The letter must be signed by the student, the current primary adviser, and the proposed honors adviser, if different, and submitted to the student services office in the Department of Civil and Environmental Engineering (CEE). The application must include an unofficial Stanford transcript. Applications must be received in the fourth quarter prior to graduation. It is strongly suggested that prospective honors students meet with the proposed honors adviser well in advance of submitting an application.
2. Students must maintain a GPA of at least 3.5.
3. Students must complete an honors thesis or project over a period of three quarters. The typical length of the written report is 15-20 pages. The deadline for submission of the report is to be decided by the honors adviser, but should be no later than the end of the third week in May.
4. The report must be read and evaluated by the student's honors adviser and one other reader. It is the student's responsibility to find and obtain both the adviser and the reader. At least one of the two must be a member of the Academic Council in the School of Engineering.
5. Students must present the completed work in an appropriate forum, e.g. in the same session as honors theses are presented in the department of the adviser. All honors programs require some public presentation of the thesis or project.
6. Students may take up to 10 units of CEE 199H Undergraduate Honors Thesis(optional). However, students must take ENGR 202S Directed Writing Projects or its equivalent (required). Units for the writing class are beyond those required for the A/E major.
7. Two copies of the signed thesis must be provided to the CEE student services office no later than two weeks before the end of the student's graduation quarter. A pdf of the thesis, including the signature page signed by both readers, should be submitted to the student services officer by May 15. Students will be sent email instructions on how to archive a permanent electronic copy in Terman Engineering library.

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