

Chemical, Biological & Environmental Engineering

COLLEGE OF **ENGINEERING**

<http://cbee.oregonstate.edu>

UNDERGRADUATE ADVISING GUIDE

ENVIRONMENTAL ENGINEERING



Our mission is to graduate students who are immediately prepared for professional practice.

Environmental Engineering

The Program

The Environmental Engineering Program provides undergraduate students with the background necessary to contribute to the solution of challenging societal problems in the air, water, and subsurface environments. The curriculum is founded on a sound background in basic sciences (chemistry, physics, biology) and mathematics (calculus, differential equations), and strengthened with engineering science fundamentals (engineering mechanics, fluid mechanics, heat and mass transfer). Upper division coursework in environmental engineering includes analysis and design of water and wastewater treatment systems, hazardous substance management and regulations, air pollution control technologies, and fate and transport of chemicals in the environment. All students participate in a capstone design experience meant to foster interaction and communication between different engineering disciplines while applying environmental engineering principles to a real world problem.

The excellence of the program is evident in that a large majority of the students have either received offers of employment or decided to pursue graduate education. Graduates of the Environmental Engineering Program work in design, production, research and development, management, and regulatory and compliance positions. A few of the employers of OSU ENVE Alumni over the last three years are:

AECOM Inc.
Amec Foster Wheeler
Boeing
Carollo Engineers
CDM Smith
CH2M Hill
City of Corvallis
Clarus Water Solutions
Clean Water Services
Confederated Tribe of the Umatilla Indian Reservation
Cornerstone Environmental Group LLC
EPA
Flint Hills Resources
HDR
Intel
Keller Associates
Keyence Corporation of America
Landau Associates
Lane County Circuit Court
Langan Treadwell Rollo
MB-technology LLC
NYSDEC
Orenco Systems
SLR International Corporation
Tectronix
The Sandberg Group, Inc.
US Air Force
WesTech Engineering Inc.

For those students whose professional goals include higher level engineering positions, engineering research, or engineering education, the environmental engineering curricula provides an excellent background for graduate school. Over the last three years about 20% of our graduates have continued on at Oregon State for graduate study or have gone on to study at other graduate institutions across the nation.

Program educational mission and objectives. The Environmental Engineering Program's undergraduate educational mission is to provide a high quality engineering program that prepares students for successful careers, lifelong learning, and service to their profession and society. OSU environmental engineering graduates will be known for their technical competence, creative thinking, OSU environmental engineering graduates will be known for their technical competence and creativity; for their ability to apply, adapt, and extend their knowledge to solve a wide variety of problems; and for their effective communication skills. Their education will provide them with an understanding of the ways in which the humanities, social sciences, basic services, and technology interact to affect society. This program will foster an environment that stimulates learning and promotes diversity.

Our Mission is to graduate students immediately prepared for professional practice.

The educational objectives of the Environmental Engineering undergraduates program are that our graduates will:

1. Be prepared for either immediate employment in the field of Environmental Engineering or continuation into a graduate program with a specialty of Environmental Engineering.
2. Be proficient at mathematics, basic sciences and engineering sciences relevant to environmental engineering, including fundamental concepts, experimental techniques, methods of analysis, and computational applications.
3. Be able to formulate and solve problems, synthesize and evaluate information, and will be prepared for modern environmental engineering design.
4. Communicate effectively and work collaboratively in diverse teams.
5. Have knowledge of contemporary societal issues and the challenge of meeting social, environmental, and economic constraints within a global community.

Curriculum

The requirements for the BS degree in Environmental Engineering are a combination of general requirements established by the College of Engineering (COE) and Oregon State University, and specific requirements established by the School of Chemical, Biological, and Environmental Engineering. The School determines the specific requirements for graduation and audits those courses to ensure that the standards of the **Accreditation Board for Engineering and Technology (ABET)** are met by every student who receives a degree.

ABET is the national organization that accredits—or certifies—engineering and technology degree programs. ABET’s Engineering Accreditation Commission (EAC) applies standards set by practicing engineers and engineering educators to specify the general form and content of engineering programs. The School of Chemical, Biological and Environmental Engineering, with the input from advisory boards comprised of practicing engineers in industry, consulting, and government service, determines the courses needed to help the student develop the knowledge and skills required of the modern environmental engineer. In several situations the School’s regulations are more restrictive than the University’s regulation.

The University (OSU) establishes a set of core requirements, called the Baccalaureate Core, which all undergraduate degree programs at OSU must incorporate. These requirements help the student develop the values, knowledge, and skills that all university graduates should possess. The current requirements are published each quarter in the Schedule of Classes for that quarter.

The following pages list the Environmental Engineering curriculum by the categories that are used for ABET accreditation. In both the *Oregon State University Bulletin* and the OSU College of Engineering *Advising Guide* (<http://www.engr.oregonstate.edu/advising/>), you will find the same curricula. Copies of the Curriculum Check Sheet for the environmental engineering curriculum and the Curriculum Block Diagrams are included in this guide. The official checklist is maintained in the main office. Please note that just because a course is required or recommended in the curriculum does not mean that it will be offered every term. Also, most courses have prerequisites, courses that must be completed satisfactorily before the desired course can be taken. Always consult the *Oregon State University Bulletin* or the OSU *Schedule of Classes*, or check with the appropriate department for availability and prerequisites before registering for a course. Required technical coursework may not be taken S/U.

Explanation of ENVE Curriculum

Mathematics.

Along with the natural and social sciences, mathematics provides an important foundation for the formulation and solution of many environmental engineering problems. Required mathematics department courses cover calculus through differential equations. Statistics for Engineers (ST 314) includes material on probability and statistics, two important tools used by environmental engineers in the analysis of process data. Students having completed a strong high school program in mathematics typically begin at the level of differential calculus (MTH 251). Students with a limited background in math should first complete preparatory coursework prior to taking MTH 251, such as MTH 111 College Algebra or MTH 112 Elementary Functions. Unfortunately, credit earned in such preparatory courses cannot be used to fulfill the math credit requirements for the environmental engineering program. NO mathematics course may be taken S/U.

Basic Science.

ENVE students are expected to have had a strong chemistry background in high school and are required to take CH 221, 222 and 223, which are 5 credit courses offered by the Chemistry department specifically for chemistry and chemical engineering majors during their first year of study. In some cases transfer students may have prior credit for CH 121-123, CH 201-202, or some combination of these courses, but not CH 221- 223. These students may fulfill the CH 221-223 requirement by ensuring they have completed 15 credits of general chemistry or a combination of general chemistry and upper-division chemistry. This combination must be articulated and sent through the formal petition process. If you are transferring into the Environmental Engineering Program and have already taken some of these other first year chemistry courses, you must consult with your advisor to determine appropriate additional chemistry work. In addition to the core chemistry series, CH 221-223, ENVE students must take two terms of Organic Chemistry (CH 331 and 332).

All engineering majors are required to take PH 211, PH 212 and PH 213, calculus-based physics courses. These courses are part of the pre-engineering core and must be completed before entering the professional engineering program.

The ENVE program does not require completion of the introductory biology series (BI 211-213), mainly a result of the limited number of credit hours available, and the program's focus on the molecular and cellular biology. Environmental engineering students are better served by completing a microbiology course, MB 230, General Microbiology.

NO science course, required or elective, may be taken with S/U grading.

Engineering Topics: *Engineering Science & Design.*

These courses comprise the bulk of the Environmental Engineering curriculum and cover concepts and techniques that are essential to engineering analysis and design. More importantly they cover the *philosophy and process* of engineering problem solving. In particular, students develop a comprehensive understanding of engineering fundamentals and applications by taking a minimum of 72-credit hours of engineering coursework, including courses that cover:

- Policy and regulations, emerging areas in environmental engineering, computer tools, technical communications, engineering economics and project management (CCE 201, ENVE 322 and 456, CBEE 102)
- Mechanics, dynamics and strength of materials (ENGR 211, 212, and 213)
- Material and energy balances, fundamentals of thermal sciences, momentum, mass and energy transfer, Hydraulic or Geotechnical Engineering (CBEE 211&212, CHE 311, CHE 331,332,333,334, CE 313 or 372)
- Professionalism and engineering ethics (CBEE 320)
- Design, evaluation, and application (ENVE 421, 422, 425, and 431, CE 412, BIOE 457, CBEE 414, ENVE 415, ENVE 490)

NO engineering topics course may be taken S/U.

Communication Skills.

The best technical work is worthless if it cannot be communicated to others for evaluation and implementation. Many engineers find that they spend more time communicating – meeting and working with colleagues, writing memos and reports, and giving presentations – than they do in technical problem solving. For that reason, the environmental engineering curricula requires courses in basic writing, technical report writing, and public speaking. Every undergraduate at OSU must complete an upper-division course (in their discipline), which meets the requirements for “writing-intensive” status. A choice of tracks in the ENVE program allow either CE 454, Civil and Environmental Engineering Professional Practice, or ChE 414, Chemical Engineering Laboratory, to serve as the writing-intensive course for environmental engineering students. NO communication skills course may be taken S/U.

Humanities and Social Sciences:

It is the University's role to prepare students to take an active, constructive part in society. To fulfill that role, it must provide engineering students with the technical knowledge and skill that they will need to function as engineers. But engineers must have more than just technical skills. Like any citizen, engineers have a great responsibility to society. To meet that responsibility, they must have a basic understanding of individual and social behavior and values and cultures of the society. For that reason, each engineering curricula requires courses in humanities and social sciences.

The baccalaureate core is part of every undergraduate program at OSU, and emphasizes writing, creative thinking, cultural diversity, the arts, sciences, literature, lifelong fitness and global awareness. Substantial coursework within this core deals with humanities and social sciences. ABET requires that at least 24 credits of humanities and social science courses be taken. For purposes of graduation with a BS in Environmental Engineering, the satisfaction of the OSU Baccalaureate Core (BACC) is considered to be sufficient to satisfy the ABET requirements. See the *Oregon State University Bulletin* and the *OSU Schedule of Classes* for more information on BACC Requirements.

Perspectives Courses:

A total of 5 Perspectives courses, totaling at least 15 credits, must be taken. This includes a minimum of 1 course in each of the following categories: Western Culture, Cultural Diversity, Literature and the Arts, Social Processes and Institutions, and Difference, Power and Discrimination.

Synthesis Courses:

Two Synthesis courses must be taken: one course in Contemporary Global Issues and one course in Science, Technology, and Society. In the Environmental Engineering Program, GEO 300, Environmental Conservation and Sustainability, is a required course that fulfills one of the two synthesis requirements. Since GEO 300 is acceptable in either the Contemporary Global Issues or the Science, Technology, and Society category, one additional synthesis course of the students choosing must be completed.

Except for GEO 300, Humanities and Social Sciences courses may be taken S/U. An absolute maximum of 36 credits of S/U may be taken if a student has four years of full-time study at OSU. For transfer students the maximum is 3 times the number of quarters of full-time residency at OSU.

Fitness:

The OSU Baccalaureate Core requires that all OSU students take HHS 231 and HHS 24x, Lifetime Fitness Lab. HHS 231 and 24x may be taken S/U.

Engineering Electives:

Environmental Engineering students are required to take 7 credits of Engineering Electives. A list of these elective options can be found in MyDegrees, an online graduation audit system used by Oregon State University.

Curriculum Block Diagrams for BS Program:

The 192 course credits required for the B.S. degree in Environmental Engineering are listed in Table 1. Block diagrams following this table provide examples of how a program might be constructed, term by term.

In the block diagrams, each column represents one academic quarter. The first two years in the program are the pre-engineering program. The yellow shaded courses comprise the "core" courses used to calculate a GPA used for admission to the professional program. The courses shaded in blue represent classes needed to satisfy the general education requirements. The sequence of courses in the third and fourth years represents the professional program. These flowcharts represent idealized schedules, and most students' actual schedules will differ in sequence and number of quarters required to satisfy all requirements. In particular, students interested in the MECOP program, (and/or other work opportunities) must carefully plan their schedules with the MECOP advisor to ensure timely graduation.

Grade Requirements:

Students must achieve a 'C' or better in all required courses (exceptions are HHS, PAC, perspectives, synthesis classes), or the course will be considered 'missing' for a prerequisite or graduation requirement.

Pre-core GPA calculation for professional program admission: Both OSU and transfer grades are included, and in the case of repeated classes, the grade from the second take, no matter where the class was taken, will be used in the pre-core GPA calculation.

Curriculum Check Sheet Environmental Courses (192 cr total)

Student's Name: _____ Form Completed by: _____

Student ID #: _____ Date: _____

Required ENVE Required Courses (84 credits)

CBEE 101 (3) _____
CBEE 102 (3) _____
CBEE 211 (3) _____
CBEE 212 (3) _____
CBEE 213 (4) _____
ENVE 322 (4) _____
CBEE 414 (3) _____
ENVE 415 (3) _____
ENVE 421 (4) _____
ENVE 422 (4) _____
ENVE 431 (4) _____
ENVE 425 (3) _____
ENVE 456 (3) _____
ENVE 490 (4) _____
BIOE 457 (3) _____
CCE 201 (3) _____
CE 313 or CE 372 (4) _____
CE 412 (4) _____
CHE 311 (3) _____
Tech elec (3) _____
Tech elec (4) _____
CHE 331 (4) _____
CHE 332 (3) _____
CHE 333 (3) _____
CHE 334 (2) _____

Engineering Topics (9 credits)

ENGR 211 (3) _____
ENGR 212 (3) _____
ENGR 213 (3) _____

Engineering Ethics (3 credits)

CBEE 320 (3) _____

Advanced Chemistry (8 credits)**

CH 331 (4) _____
CH 332 (4) _____

Mathematics (20 credits)

MTH 251 (4) _____
MTH 252 (4) _____
MTH 306 (4) _____
MTH 254 (4) _____
MTH 256 (4) _____

Basic Science (27 credits)

CH 231/261(5) _____
CH 232/262(5) _____
CH 233/263(5) _____
PH 211 (4) _____
PH 212 (4) _____
PH 213 (4) _____

Earth Science (4credits)

GEO 221 (4) _____

Biological Science (4 credits)

MB 230 (4) _____

Communication Skills (9 credits)

WR 121 (3) _____
WR 327 (3) _____
COMM 111/114 (3) _____

Fitness (3 credits)

HHS 231 (2) _____
HHS 24x or PAC(1) _____

Humanities and Social Sciences (21 credits)

Perspectives (15 credits)

Western Culture () _____
Cultural Diversity () _____
Literature & Arts () _____
Soc. Proc. & Inst. () _____
Diff., Power, Disc. () _____

Synthesis (6 credits)

Cont. Global Issues () _____
Sci., Tech. & Soc. () _____

**The entire organic chemistry sequence CH 334,335,336
can be used in place of the entire sequence CH 331, 332

ENVIRONMENTAL ENGINEERING (192 credits) - Revised 2/16/2017

Cr.	First Year = 46 credits			Second Year = 50 credits			Third Year = 49 credits				Fourth Year = 47 credits		
	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	
1													
2	Chemistry CH 231 (4FW)	Chemistry **CH 232 (4WS)	Chemistry CH 233 (4S)	Organic Chemistry CH 331 (4FW)	Organic Chemistry CH 332 (4WS)	GEO 221 (4S)	Transport I (Fluids) CHE 331 (4F)	Transport II CHE 332 (3W)	Tech Writing WR 327 (3FWS)	W & WW I ENVE 421 (4F)	W & WW II ENVE 422 (4W)	Sust Water Resources ENVE 456 (3S)	
3													
4													
5	CH Lab 261 (1)	CH Lab 262(1)	CH Lab 263 (1)										
6													
7	Diff Calc MTH 251 (4FWS)	Integral Calculus MTH 252 (4FWS)	Vector Calculus MTH 254 (4FWS)	Diff Eqs MTH 256 (4FWS)	Matrix Power Series MTH 306 (4FWS)	Dynamics ENGR 212 (3FWS)	Thermo Prop. CHE 311 (3F)	Persp #3 (3FWS)	Transport III CHE 333 (3S)	Bioreactors I BIOE 457 (3F)	Fate & Transport ENVE 431 (4W)	Synthesis #1 (3FWS)	
8													
9													
10													
11	Orientation CBEE 101 (3F)	Engr Comp CBEE 102 (3W)	Physics PH 211 (4FWS)	Physics PH 212 (4FWS)	Physics PH 213 (4WS)	Strength of Materials ENGR 213 (3FWS)	Engr Ethics CBEE 320 (3F)	Hydraulic CE 313 (4WS) or Geotechnical CE 372 (4W)	Transport Lab CHE 334 (2S)	General Microbiology MB 230 (4FWS)	Enve Lab ENVE 415 (3W)	Synthesis #2 (3FWS)	
12													
13													
14	Eng Comp WR 121 (3FWS)	COMM 111/114 (3FWS)	Life Fitness HHS 231	Material Balances CBEE 211 (3F)	Energy Balances CBEE 212 (3W)	Process Analysis CBEE 213 (4S)	Graphics & Design CCE 201 (3FW)	Intro ENVE ENVE 322 (4W)	Hydrology CE 412 (4FS)	Persp #5 (3FWS)	Engineering Elective (4FWS)	Capstone Design ENVE 490 (4S)	
15													
16													
17													
18													

^ W/C F,W,S = Multiple terms in which same course is offered
 ONLY PERSPECTIVE, SYNTHESIS, HHS and PAC can be taken with S/U grading
 course required for entrance to professional school (and used for pre-GPA calculation)

MECOP

The Multiple Engineering Co-op Program (MECOP) is a five-year undergraduate program which is intended to give the EnvE student “hands on” experience to compliment classroom study. The program offers students a high quality, paid engineering work experience and related academic activities while pursuing a degree at OSU. MECOP is a program with sponsorship and support from the College of Engineering and from industry, consulting firms, and municipalities. Each student is provided with two internships at different companies/municipalities so that the student gets exposure to contrasting work environments.

Selection into the MECOP program is competitive. Applications are available online in early March and are due April 10th of the Sophomore year with professional school applications. Those students who qualify will be invited to the Selection Interview in May. In this process, the student undergoes a 20 minute group interview with Sponsorship Board Members and the EnvE MECOP Advisor. The basis for selection is academic performance, written and oral communication skills, and motivation.

Placement with a company/municipality occurs in a separate interview process in the winter before the corresponding internship. Internships are in the Spring (and Summer) Term of the third year and the (Summer and) Fall Term of the fifth year. Each student’s curriculum must be adjusted accordingly. Some of the key required courses, offered only one term each year, are shown below in a typical partial schedule.

Additional information may be obtained from the Program web site at <http://mecop.orst.edu/index.html> or by contacting the EnvE MECOP Advisor or the MECOP Coordinator in the Undergraduate Dean’s Office.

ENVE MECOP	FALL	WINTER	SPRING
Junior	CHE 331 CHE 311 CCE 201 ENGR 407 CBEE 320	CHE 332 CHE 399 ENVE 322 CE 313 or CE 372	INTERNSHIP
Senior I	ENVE 421 BIOE 457 CBEE 414	ENVE 415 ENVE 422 ENVE 431	ENVE 45 CHE 334 ENVE 490
Senior II	INTERNSHIP	ENGR ELECTIVE ENGR ELECTIVE	CE 412 ENVE 425



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