

Environmental Engineering (BSEN)

BSEN in Environmental Engineering Mission

Mission:

The Department of Environmental Engineering Sciences (EES) mission statement is as follows: The mission of EES is to provide quality undergraduate and graduate educational programs in environmental engineering sciences, to conduct an internationally recognized environmental research program that will substantially contribute to the benefit of the earth, and to provide authoritative guidance to individuals and organizations charged with preventing and solving local, state, national and global environmental problems. EES serves as a leader in multi-department programs aimed at solving environmental problems and as a major on-campus crucible for conceptualization and solution of environmental problems. The EES mission statement aligns with the College of Engineering mission statement: The College of Engineering fosters and provides world-class programs in engineering education, research and service to enhance the economic and social well-being of the citizens of Florida, the nation and the world. The EES mission statement aligns with the University of Florida mission statement, a portion of which is provided below: The university welcomes the full exploration of its intellectual boundaries and supports its faculty and students in the creation of new knowledge and the pursuit of new ideas. Teaching is a fundamental purpose of this university at both the undergraduate and graduate levels. Research and scholarship are integral to the educational process and to the expansion of our understanding of the natural world, the intellect and the senses. Service reflects the university's obligation to share the benefits of its research and knowledge for the public good. The university serves the nation's and the state's critical needs by contributing to a well-qualified and broadly diverse citizenry, leadership and workforce.

Program Type and Level: Bachelor (includes all bachelors level degrees)

Start: 07/01/2021

End: 06/30/2022

Program: Environmental Engineering (BSEN)

Program CIP: 14.1401

Site Information:

If Other Site: :

Responsible Roles: Treavor Boyer (thboyer@ufl.edu)

PG 1 Instill desire to learn and apply knowledge to prevent and solve problems

Goal: To instill in students a desire to learn and apply their knowledge and skills to prevent and solve environmental problems.

Program: Environmental Engineering (BSEN)

Evaluation Method:

Evaluative tools in the classroom such as homework, tests, and course evaluations. Direct assessment statistics and examples managed in "outcomes folders"

Student exit interviews.

National exams such as the Fundamentals of Engineering (FE) exam taken before graduation and the Professional Engineers Exam taken by graduates 4 or more years after graduation.

Results:

Means for department course evaluations for undergraduate courses (n=571) were around 4.57 (4.50 for Fall 2021 and 4.65 for Spring 2022 for instructor overall, and 4.41 for Fall 2021 and 4.48 for Spring 2022 for course overall) on a scale of 5. The evaluations were slightly higher than those for the college (n=24203) of 4.36. ENV4101 Elements Atmospheric Pollution and ENV4501 Environment Hydrology 1 had lower ratings; no course has lower ratings in Spring 2021. The Department Head has discussed the evaluations with these instructors to identify any issues and strategies for improvements.

Student exit interviews (n=37) showed that students were pleased with the program and rated their performance as successful. This was supported by the exit interview results that the average scores for all categories were all greater than 3.5 (4.25 out of 5). Topics with scores lower than 3.95 were Earth science (3.89 out of 5), Knowledge of Mathematics through Differential Equations (3.71 out of 5) Fluid mechanics (3.87 out of 5) and Material and Energy Balances (3.60 out of 5).

Fundamentals of Engineering (FE) exam is the first step in professional licensure. The Fundamentals of Engineering scores were evaluated with respect to the number of students passing and student performance relatively to other ABET institutions. EES students taking the Fundamentals of Engineering have historically performed with a very high passing rate. In Fall 2021, the passing rate was 85% (vs. ABET comparator of 70%), while in Spring 2021, the passing rate was 77% (vs. ABET comparator of 71%). In the Fall of 2021, all of the topic areas the EES student ratio scores (ratio of institution average performance index to ABET comparator average performance index) of the Fundamentals of Engineering exam were above 1. In the Spring of 2022 three topic areas (Engineering Economics, Environmental Chemistry, Thermodynamics were below 0.95 (ratio score = 0.92, 0.92, 0.91 respectively). Those between 0.95 and 0.99 were Probability and Statistics, Fluid Mechanics and hydraulics, Surface Water Resources and Hydrology, Water and Wastewater, Air Quality and Control, (ratio score = 0.97, 0.99, 0.99, 0.98, 0.98 respectively). Overall, all most of them were within uncertainty.

PG 2 Educational experiences to prepare for productive careers

Goal:

To provide students with educational experiences in science, analysis and design, as well as in social and cultural studies that will prepare them for productive careers in the environmental engineering profession as well as other professions.

Program: Environmental Engineering (BSEN)

Evaluation Method:

Direct assessment statistics and examples managed in "outcomes folders".

Student evaluations of courses and instructors.

National rankings of undergraduate engineering programs (US News).

Results of the Fundamentals of Engineering Exam, a national test taken by graduating seniors as the first step in licensure as a professional engineer.

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Based on the review of student work on exam problems along with the exit interview results (4.33 out of 5) to the outcome "An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics," the committee concluded that EES BS students continued to meet this program goal. In the Fall of 2021, all of the topic areas the EES student ratio scores (ratio of institution average performance index to ABET comparator average performance index) of the Fundamentals of Engineering exam were above 1. In the Spring of 2022 three topic areas (Engineering Economics, Environmental Chemistry, Thermodynamics were below 0.95 (ratio score = 0.92, 0.92, 0.91 respectively). Those between 0.95 and 0.99 were Probability and Statistics, Fluid Mechanics and hydraulics, Surface Water Resources and Hydrology, Water and Wastewater, Air Quality and Control, (ratio score = 0.97, 0.99, 0.99, 0.98, 0.98 respectively). Overall, all most of them were within uncertainty.

National ranking of EES was No. 10 in the US News for public institutions. This ranking has been relatively stable.

PG 3 Educational experiences to enable students to communicate

Goal: To provide students with educational experiences that will enable them to work effectively with other professionals and to communicate their ideas clearly and concisely.

Program: Environmental Engineering (BSEN)

Evaluation Method:

Capstone design course outcomes review by the EES Faculty Evaluation committee indicates excellent student performance in both written and oral presentations of the team designs. Teamwork continues to be emphasized in all capstone design courses. Additionally other design courses employ the use of teams and require complete written reports of designs. The lab courses, Environmental Analysis and Environmental Biology Lab both require written lab reports that are critically reviewed and annotated by the instructor.

Results:

Capstone design course outcomes reviewed by the EES Faculty Evaluation committee indicated excellent student performance in both written and oral presentations of the team designs. Teamwork continued to be emphasized in all capstone design courses. Written lab reports of the lab courses, Environmental Analysis and Ecological Engineering Lab, were critically reviewed and annotated by the instructor.

The EES faculty curriculum committee encouraged the continued use of communication requirements, both written and oral, and critical review of student work. Examples include project proposal, report, presentation, and YouTube videos. Review of capstone project reports by professional engineers outside the university was encouraged. To enhance communications with the general public instead of professional members, presentations to a non-scientific audience were also part of some classes, such as ENV 4101 Elements of Atmospheric Pollutants. EES plans to recontinue, following COVID organizing an ESSIE student poster competition in Spring semester to provide a platform for students to give public presentation to professional engineers.

PG 4 Increase the awareness of environmental issues

Goal: To increase the awareness of environmental issues on an international/global basis.

Program: Environmental Engineering (BSEN)

Evaluation Method:

Exit interviews of graduating seniors

Faculty assessment of student work.

Results:

Faculty addressed environmental issues in all of the upper division coursework. Capstone projects and course assessment results gave excellent examples of bringing environmental issues into the classroom.

In exit interviews students rated their performance in "An ability to acquire and apply new knowledge as needed, using appropriate learning strategies" with a mean of 3.93 on a scale of 1 to 5 with 5 being the highest. They also reported their performance in "Design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles and environmental impacts" and "Roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations" with a mean of 4.33 and 4.29, respectively.

SLO 1 Apply Knowledge

Outcome: Apply knowledge of mathematics, science and engineering principles to environmental engineering problems.

SLO Area (select one): Content (UG)

Assessment Methods Checklist: Faculty developed examination(s)/test(s)

Third-party examination (e.g. ETS, etc. - requires approval by the Academic Assessment Committee)

Faculty Evaluation/Review

Exit interview

Assessment Method Narrative:

Exam questions; Fundamentals of Engineering (FE) Exam; Exit survey

Faculty-developed rubric employed for the assessment committee.

SLO Not Assessed This Year:

Threshold of Acceptability: 80

How many students did you assess for this outcome?: 37

How many students met the outcome?: 31

What percentage of students met the outcome?: 84

Does this meet your threshold of acceptability?: Yes

Results:

The criterion for success was 80%. The committee evaluated the Fundamentals of Engineering exam results with respect to the number of students passing and student performance relatively to other ABET institutions. EES students taking the Fundamentals of Engineering have historically performed with a very high passing rate and this continued. In the Fall 2021 semester, 17 out of 20 EES students taking the exam passed; the passing percentage was higher than the ABET competitor data (85% vs 70%). In the Spring 2022 semester, 10 out of 13 EES students taking the exam passed; the passing percentage was greater than the ABET competitor data (77% vs 71%). In total, 27 students out of 33 students passed the assessment for a percentage of 82%. These results met the criterion for success.

Based on the review of student work on exam problems along with the exit interview results (4.33 out of 5) to the outcome "An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics," the committee concluded that EES BS students continued to meet this student outcome. This was also supported by EES student performance on the Fundamentals of Engineering exam. In the Fall of 2021, all of the topic areas the EES student ratio scores (ratio of institution average performance index to ABET comparator average performance index) of the Fundamentals of Engineering exam were above 1. In the Spring of 2022 three topic areas (Engineering Economics, Environmental Chemistry, Thermodynamics were below 0.95 (ratio score = 0.92, 0.92, 0.91 respectively). Those between 0.95 and 0.99 were Probability and Statistics, Fluid Mechanics and hydraulics, Surface Water Resources and Hydrology, Water and Wastewater, Air Quality and Control, (ratio score = 0.97, 0.99, 0.99, 0.98, 0.98 respectively). Overall, all most of them were within uncertainty.

SLO 2 Content Knowledge

Outcome: Design and conduct environmental engineering experiments, as well as analyze and interpret the data.

SLO Area (select one): Content (UG)

Assessment Methods Checklist: Paper(s) - includes reports, plans, other documents
Faculty Evaluation/Review
Exit interview

Assessment Method Narrative:

Lab reports; Exit survey
Faculty-developed rubric employed by the assessment committee

SLO Not Assessed This Year:

Threshold of Acceptability: 80

How many students did you assess for this outcome?: 48

How many students met the outcome?: 42

What percentage of students met the outcome?: 88

Does this meet your threshold of acceptability?: Yes

Results:

The results were reviewed by the faculty evaluation committee (curriculum committee which also served as the ABET and SACSCOC accreditation committee). The criterion for success was 80%, or 4 on a scale of 5 in student evaluation. Based on their review of student work on lab reports, the committee concluded that EES BS students continued to meet this student learning outcome. 90% of students (40 out of 45) achieved the outcome (#11 in ABET outcome evaluation was considered here), meeting the criterion. An assessment of the graduating senior responses in exit interview to the outcome "An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions" found that mean performance score for 2021-2022 was 4.62, i.e. meeting the criterion for success.

SLO 3 Design a component or process

Outcome:

Design an environmental engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints.

SLO Area (select one): Critical Thinking (UG)

Assessment Methods Checklist: Third-party examination (e.g. ETS, etc. - requires approval by the Academic Assessment Committee)
Paper(s) - includes reports, plans, other documents
Faculty Evaluation/Review
Exit interview

Assessment Method Narrative:

Design reports; Fundamentals of Engineering Exam; Exit survey
Faculty-developed rubric employed by the assessment committee

SLO Not Assessed This Year:

Threshold of Acceptability: 80

How many students did you assess for this outcome?: 155

How many students met the outcome?: 130

What percentage of students met the outcome?: 84

Does this meet your threshold of acceptability?: Yes

Results:

The results were reviewed by the faculty evaluation committee (curriculum committee which also served as the ABET and SACSCOC accreditation committee). The criterion for success was 80%, or 4 on a scale of 5 in student evaluation. One hundred thirty students passed the assessment out of a total of 155 students for a percentage of 84% (Outcome #2 in ABET evaluation). The student assessment was 4.33. These results met the criterion for success.

The results of the capstone engineering design reports demonstrated to the committee that EES students continued to effectively design environmental engineering projects within realistic constraints. Student teams continued to be successful at competitions based on their capstone projects and presentations. These results were further supported by the student outcomes on the exit interview for the outcome "An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors" with a score of 4.8 out of 5. Student provided a score on a scale of 1 – 5 with 3-5 representing successful outcomes and 1-2 representing unsuccessful outcomes. These results met the criterion for success.

SLO 4 Communicate technical data

Outcome: Communicate technical data and design information effectively in writing and in speech to other environmental engineers.

SLO Area (select one): Communication (UG)

Assessment Methods Checklist: Paper(s) - includes reports, plans, other documents
Faculty Evaluation/Review
Exit interview

Assessment Method Narrative:

Design reports; Exit survey
Faculty-developed rubric employed by the assessment committee

SLO Not Assessed This Year:

Threshold of Acceptability: 80

How many students did you assess for this outcome?: 155

How many students met the outcome?: 134

What percentage of students met the outcome?: 86

Does this meet your threshold of acceptability?: Yes

Results:

The results were reviewed by the faculty evaluation committee (curriculum committee which also served as the ABET and SACSCOC accreditation committee). The results of the project presentations, laboratory reports and the capstone engineering design reports demonstrated to the committee that EES students continued to effectively communicate in writing. One hundred thirty four students passed the assessment out of a total of 155 students for a percentage of 86%. These results met the criterion for success. Observations by committee members of student oral presentations demonstrated to the committee that EES students continued to effectively communicate in speech. These results were further supported by the student outcomes on the exit interview for the outcome "An ability to communicate effectively with a range of audiences" with a score of 4.69 out of 5. Student provided a score on a scale of 1 – 5 with 3-5 representing successful outcomes and 1-2 representing unsuccessful outcomes. These results met the criterion for success.

Environmental Engineering (BSEN) Use of Results for Improvement

Improvement Types Checklist: Revised the Undergraduate Curriculum Map.

Modified one or more courses.

Added one or more courses

Modified the program curriculum or curriculum sequence.

Use of Results for Improvement Narrative - Required:

The results have been reviewed by the department's curriculum committee. It was decided to renovate the lab for Environmental Analysis Lab with a suite of new equipment. Dr. Morrison, a faculty member who joined the department in 2020, was assigned to handle this task together with Dr. Deliz who taught the course previously. The committee also decided to encourage faculty to incorporate statistics in various courses so that students get to know how to apply the statistics principles they learned to practical problems.

For the courses with low course evaluations, Department Head discussed with instructors to identify issues and sought for improvements.

EES faculty have started to implement the significantly revised curriculum. The first 4 credit CORE course started in Spring 2022. The four faculty involved will meet and look at ways to improve the CORE course for the next cohort which will take the first CORE in Spring 2023.

Program Results Not Reported This Year:

Program Results Reporting Complete: true

BSEN in Environmental Engineering Detail

Providing Department: Environmental Engineering (BSEN)

Assessment Cycle:

The SLOs in Environmental Engineering represent a subset of 18 SLOs used in connection with Engineering Accreditation as required through the Accreditation Board for Engineering and Technology (ABET). The ABET accreditation cycle is 6 years, but the assessments are carried out every year, so the same assessment frequency is used for the assessment methods outlined in Figure 2. The review analysis and interpretation of assessment data is performed by committee in late fall or early spring, with improvement actions by late spring and implementation slated for the fall semester in time for each new Undergraduate Catalog cycle.

Analysis and Interpretation: November-January

Improvement Actions: Completed by May 1

Dissemination: Completed by August 15

Year	17-18	18-19	19-20	20-21	21-22	22-23
SLOs						
Content Knowledge						
#1	x	x	x	x	x	x
#2	x	x	x	x	x	x
Critical Thinking						
#3	x	x	x	x	x	x
Communication						
#4	x	x	x	x	x	x

SLO Assessment Rubric:

Assessment Oversight:

Oversight of the assessment process is the primary responsibility of the Department Head with the cooperation of the Environmental Engineering Sciences ABET Committee. The Environmental Engineering Sciences Department resides within the Engineering School of Sustainable Infrastructure and Environment (ESSIE) which is led by a Director who is also in charge of the Department of Civil and Coastal Engineering. The contact information for the Department Head of Environmental Engineering Sciences and the Director of ESSIE are provided below:

Contact Information

Department Head: Dr. Chang-Yu Wu

Department of Environmental Engineering Sciences

Engineering School of Sustainable Infrastructure and Environment

217 Black Hall, P.O. Box 116450

University of Florida

Gainesville, FL 32611-6450

Phone: (352) 392-0845

FAX: (352) 392-3076

e-mail: cywu@ufl.edu

ESSIE Director: Dr. Kirk Hatfield, Professor

Engineering School of Sustainable Infrastructure and Environment
Department of Civil and Coastal Engineering
365 Weil Hall, P.O. Box 116580
University of Florida
Gainesville, FL 32611
Phone: (352)-392-9537
FAX: (352)-392-3394
e-mail: khh@ce.ufl.edu

Methods and Procedures - Undergraduate and All Certificate Programs:

Assessment Method - For each SLO, please enter the assessment method you are using – exam (course, internal, or external), project, paper, presentation, performance, etc.

Measurement – list the measurement procedure you use for this outcome. It can be a faculty-developed rubric with the minimum acceptable level identified, an exam score and the minimum passing score, or other measurement.

Student Learning Outcome	Assessment Method	Measurement Procedure
Apply knowledge of mathematics, science and engineering principles to environmental engineering problems.	Exam questions; FE Exam; Exit survey	faculty-developed rubric used by the assessment committee
Design and conduct environmental engineering experiments, as well as analyze and interpret the data.	Lab reports; Exit survey	faculty-developed rubric used by the assessment committee
Design an environmental engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints.	Design reports; FE Exam; Exit survey	faculty-developed rubric used by the assessment committee
Communicate technical data and design information effectively in writing and in speech to other environmental engineers.	Design reports; Exit survey	faculty-developed rubric used by the assessment committee

The four SLOs are assessed through the following direct and indirect methods: Direct Methods:

1. Coursework-based assessment in Environmental Engineering courses
2. Fundamentals of Engineering (FE) Examination

The Fundamentals of Engineering Examination provides an objective third-party assessment which is nationally-normed. The NCEES examination reports provide such overall passing rates results plus individual exam topic subscores. The FE exam cannot be used to assess all four of the SLOs; the rubric for assignment of FE exam results to the various SLOs is shown below:

SLO #1: Overall result plus morning (4-hour) exams in the following topic areas: Mathematics, Probability & Statistics, Chemistry, Electricity & Magnetism, Engineering Mechanics, Fluid Mechanics, Thermodynamics.

SLO #2: N/A

SLO #3: Afternoon (4-hour) exam in the following topic areas: Air Quality Engineering, Solid and Hazardous Waste, Water and Wastewater Engineering, and Water Resources

SLO #4: N/A

Indirect Methods:

Senior Exit Survey: Student self-assessment of achievement of SLOs performed each semester by graduating seniors.

The Senior Exit Survey, completed by students in their final semester, is a graduation requirement recorded in ISIS audits, so we are able to achieve survey rates of 100%. The students are asked to self-assess their performance in achieving the outcomes on a 1-5 scale as they complete their UF careers.

Assessment Method	Administered By	When Administered
Direct Assessments		
Student Performance in Courses	Environmental Engineering Faculty Committee	Every semester
Student Performance on FE Exam	NCEES	1. Semi-Annually (April, October)
Indirect Assessments		
Senior Exit Survey	Department and Advisors(Self-Assessment)	Every semester to graduating seniors

Curriculum Map - Undergraduate Degree Programs:

Key: Introduced Reinforced Assessed

Courses	CHM 2046	CHM 2046L	ENC 3254	MAP 2302	EES 4203	EMV 3040C	EES 4201	EES 4103	EES 4102L	ENV 4041C	EMV 4514C	EMV 4121	ENV 4351	ENV4432 or ENV4532 or ENV4122 or ENV4353 or ENV4913	FE Exam	Exit Survey
Content Knowledge																
#1	I			I	R	A Exam Question	A Exam Question								A	A
#2		I			R		R	R	A Lab Report	A Lab Report						A
Critical Thinking																
#3											I	R	R	A Design Report	A	A
Communication																
#4			I						R	R	A Design Report			A Design Report		A

Research :

SLO Measures - Graduate and Professional Programs:

Assessment Timeline - Graduate and Professional Programs: