



Biosystems Engineering **Undergraduate Handbook**

**Department of Environmental Engineering
and Earth Sciences**

College of Engineering, Computing and Applied Sciences

CLEMSON UNIVERSITY

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Introduction

Welcome to the Bachelor of Science (BS) degree program in Biosystems Engineering at Clemson University. Becoming a Biosystems Engineer is a great way to use your engineering talents for the betterment of our community and the world around us. As a Biosystems Engineer, you can help solve many of the problems faced by society by applying engineering design and analysis with principles of biology, chemistry, mathematics, and sustainability. We need a highly trained workforce ready to tackle our increasingly complex societal problems and design a healthier and more sustainable society. An undergraduate degree in Biosystems Engineering opens the door to a variety of rewarding career options.

This handbook is a guide to the curriculum and program. You can find additional information at: <http://www.clemson.edu/cecas/departments/ees/>

Program Administration

The Department of Environmental Engineering & Earth Sciences (EEES) has been an important part of Clemson University for over fifty years. In 2010, the Biosystems Engineering program was moved from the College of Agriculture, Forestry and Life Sciences into EEES. The EEES department is home to three undergraduate degrees: BS Biosystems Engineering, BS Environmental Engineering, and BS Geology. The department offers five graduate degrees: MS Biosystems Engineering, PhD Biosystems Engineering, MS Environmental Engineering & Science, PhD Environmental Engineering & Science, and MS Hydrogeology.

Dr. David Freedman is the Chair of the Environmental Engineering & Earth Sciences Department. Dr. Caye Drapcho is the Undergraduate Program Coordinator for the BS BE degree program. The Student Services Coordinator for the Biosystems Engineering undergraduate degree is Janet Lee. Her office is in 445 Brackett Hall.

Advising

Your academic advisor in Biosystems Engineering is assigned by the Undergraduate Program Coordinator. Students are required to see their advisor and obtain his or her signature for all changes regarding course selection, transfer courses, and course substitutions. This meeting includes the meeting every semester for registration advising. Students must meet with their advisor to be able to register.

Students interested in Co-ops should plan to start their co-op rotations in the spring of their sophomore or junior year, then complete the second rotation in the fall semester of the same year. Students interested in study abroad are encouraged to find programs that offer courses that transfer directly to Clemson. The [Sustainable Energy course offered in Trier Germany](#) provides 3 credits of engineering elective (BE 4400) and also provides 3 credits in Cross-Cultural Awareness (IS 2100). The impact of utilizing sustainable energy systems and pursuing a sustainable environment is instantly apparent as you explore Germany. Students should consult [Clemson Abroad website](#) for more information.

**BIOSYSTEMS ENGINEERING
2022 - 23 Curriculum**

FRESHMAN YEAR (Gen. Engr.)

CH 1010 General Chemistry	4	CH 1020 General Chemistry	4
ENGL 1030 Composition I or AP Test	3	General Education Requirement ³	3
ENGR 1020/1021 Engineering Disciplines and Skills ¹	2	ENGR 1410/1411 Programming and Problem Solving ⁴	3
MATH 1060 Calculus of One Variable I ²	4	MATH 1080 Calculus of One Variable II	4
General Education Requirement ³	3	PHYS 1220 Physics w/Calculus I	3
	16		17

¹ ENGR 1050 and ENGR 1060 or ENGR 1510 and ENGR 1520 may be substituted for ENGR 1020. Satisfies Gen Ed Global Challenges Requirement.

² MATH 1040 and MATH 1070 may be substituted for MATH 1060.

³ Choose courses to fulfill Arts/Humanities, Social Sciences, Global Challenges General Education requirements and REACH Act requirement.

⁴ ENGR 1640 or ENGR 1070, ENGR 1080, ENGR 1090 may be substituted for ENGR 1410.

BE 2100/2101 Introduction to Biosystems Engr.	2	BE 2120/2121 Fundamentals of BE	2
BIOL 1030/1050 or BIOL 1100	4	CE 2080 Dynamics	2
CE 2010 Statics ⁵	3	ENGL 3140 Technical Writing	3
MATH 2060 Calculus of Several Variables	4	MATH 2080 Intro. Ord. Diff. Equations	4
PHYS 2210 Physics w/Calculus II	3	MICR 3050/3501 General Microbiology	4
ENGR 2100 Engineering Graphics	2	COMM 2500 Public Speaking	3
	18		18

⁵ ME 2010 may be substituted for CE 2010 and CE 2080.

JUNIOR YEAR

BE 3100 or ME 3100	3	BE 3220 Watershed Hydrology/Sedimentology	3
BE 3200/3201 Principles Practices Geomatics	3	BE 4120 Heat and Mass Transport BE	3
BE 4100/4101 Biol. Kinetics/Reactor Modeling	3	BE 4380/4381 Bioprocess Engr Design	3
CE 3410/3411 Introduction to Fluid Mechanics	4	BE 4240 Ecological Engineering	3
ECE 2070 Basic Electrical Engineering	2	CH 2230 Organic Chemistry	3
ECE 2080 Electrical Engineering Lab I	1	CH 2270 Organic Chemistry Laboratory	1
	16		16

SENIOR YEAR - Bioprocess Engineering Emphasis

BE 4280 Biochem Engineering	3	BCHM 3050	3
BE 4150/4151 Instr. and Process Control for BE	3	Bioprocess Engineering Requirement ⁶	3
BE 4740 BE Capstone Design Project Mgmt	1	General Education Requirement ³	6
BE 4750 BE Capstone Design	3	Global Sustainability Requirement ⁷	3
BIOL 4410 General Ecology	3		
CE 2060/2061 Structural Mechanics	4		
	17		15

133 Total Semester Hours

⁶ Choose from BE, BIOE, BMOL, or MSE course 3000-level or above, excluding P/F courses.

⁷ Choose a course on Sustainability Minor list that also meets a 3000+ Global challenges requirement (if needed)

SENIOR YEAR - Ecological Engineering Emphasis

BE 4210/4211 Engr. Syst. Soil Water Management	3	Ecological Engineering Requirement ⁸	3
BE 4150/4151 Instr. and Process Control for BE	3	Ecological Requirement ⁹	3
BE 4740 BE Capstone Design Project Mgmt	1	General Education Requirement ³	6
BE 4750 BE Capstone Design	3	Global Sustainability Requirement ⁷	3
BIOL 4410 General Ecology	3		
CE 2060/2061 Structural Mechanics	4		
	17		15

133 Total Semester Hours

⁸ Ecological Engineering requirement: Choose from BE, CE, or EES, 3000-level or above, excluding P/F courses.

⁹ Ecological Requirement: Choose from BIOL, FOR, HORT, MICR, PES, WFB, 3000-level or above.

Notes:

A 2.0 engineering GPA required for graduation

Courses that are P/F or independent/honors research cannot count for any requirements.

We recommend FOR 4340 GIS for all Ecological Eng emphasis students. This could count as either Global Sust Option or Ecological option

2000-level courses can be taken at community colleges. Find course equivalencies at: <https://transferringcredits.app.clemson.edu/transferequivalency.pl>

The community college equivalent to Dynamics (CE 2080) is EGR 262 which substitutes for Clemson course EM 2020 (Dynamics)

Curriculum

The curriculum for the BS degree in Biosystems Engineering consists of 133 credit hours. At Clemson, engineering students are enrolled in General Engineering (GE) for the first year. Upon completion of the GE course requirements, students select an engineering major and follow the required curriculum for the major. All Biosystems Engineering students take the same set of courses during their sophomore and junior years. In the senior year, Biosystems Engineering students select an emphasis area in either ecological engineering or bioprocess engineering (see next page.) The most current curriculum (2015-2016) is shown on the next page.

Combined BS and MS Degree Program

Biosystems Engineering undergraduates at Clemson University may begin a Master's of Science (MS) degree program while completing their BS degree and use graduate courses to satisfy the requirements of both their undergraduate degree and an MS degree in either Biosystems Engineering or Environmental Engineering and Science. The BE undergraduate curriculum allows up to 8 credits of mutually acceptable graduate course credits to satisfy requirements of both degrees. Details on the BS/MS option can be found at:

<https://www.clemson.edu/cecas/departments/eees/academics/undrgrad/bsms.html>

Earning Graduate Credit as an Undergraduate

Any senior with a 3.0 or higher university grade-point ratio may take graduate courses in excess of the requirements for their undergraduate degree. They may request that these courses be included as part of their graduate program if they are later admitted to the Graduate School. 6000-level courses cannot be taken if the corresponding 4000-level course is required for undergraduate degree in the same academic major as the proposed graduate course.

General Education Requirements

The University has General Education requirements that must be satisfied prior to graduation. Some of these are built into the Biosystems Engineering curriculum. Others are satisfied by selecting the appropriate elective courses in the curriculum.

- I. Communications
 - a. English composition: ENGL 1030 in the curriculum
 - b. Advanced Writing: Satisfied through Biosystems Engineering courses in the curriculum
 - c. Oral communications: Satisfied through Biosystems Engineering courses in the curriculum.
- II. Mathematical, Scientific, and Technological Literacy

- a. Mathematics: Satisfied through the mathematics courses in the curriculum
 - b. Natural Science with Lab: Satisfied by General Chemistry or General Biology requirements in the curriculum
 - c. Mathematics or Natural Science: Satisfied by General Chemistry or General Biology requirements in the curriculum that was not used for Natural Science with Lab requirements
- III. Arts and Humanities
- a. Literature: 3 credits of approved courses in Section V of the General Education requirements
 - b. Non-Literature: 3 credits of approved courses in Section V of the General Education requirements
- IV. Social Sciences: 3 credits of approved course in Section V.
- V. Global Challenges

Students will demonstrate critical thinking through analysis of global challenges; evaluate how varying perspectives influence global challenges; and demonstrate the integration of ethics into analysis of global challenges.

An undergraduate student whose enrollment in a curriculum occurs after May 15, 2022, must fulfill the general education requirements in effect at that time. If a student withdraws from the University and subsequently returns or does not remain continuously enrolled (summers excluded), the student's curriculum year will be changed to the one in effect at the time of the return for students with fewer than 90 credits. The curriculum year will remain the same as when they were last enrolled for seniors (90 credits or more). The student's major department can approve an exception. Students should submit a Change of Academic Program Request via iROAR to request the approval.

Registration Requirements

A cumulative grade-point ratio of 2.0 or higher is required for registration in engineering courses at the 3000-level or higher. Priority for registration in engineering courses is given to those majors for whom the course is a degree requirement. Exceptions to this requirement may be granted by the department offering the course.

Graduation Requirements

In addition to other institutional requirements, candidates for a baccalaureate degree in Engineering are required to have a 2.0 or higher cumulative grade-point ratio in all engineering courses taken at Clemson. All courses with “Engineering” in the course designator (e.g., ENGR 1410, BE 2120, etc.) are used in this calculation. The student’s advisor or the student services coordinator can provide a student’s eGPA.

Senior Exit Interview

All Biosystems Engineering majors are encouraged to complete a Senior Exit Interview and Online Survey prior to graduation. Normally, graduating seniors are contacted toward the end of their final semester to schedule a date and time for the Senior Exit Interview.

The Exit Interview takes approximately 15 minutes and consists of a meeting with either the department chair or a representative. The meeting is a candid conversation about the program and its strengths and weaknesses with the topics being student-led. The online survey takes up to 20 minutes and asks students to evaluate the program and respond to specific questions and inquiries. These confidential ratings and accompanying comments are important as they are considered in degree program accreditation processes.

At the time of the Senior Exit Interview, you will also be asked to provide personal contact information. This is important as it allows us get in touch with you about job openings or other opportunities that may arise once you have left campus. Your name will also be placed on the mailing list of alumni; among other things, you will receive copies of the departmental newsletter, which will allow you to stay abreast of what is happening in the Department of Environmental Engineering and Earth Sciences.

FE Exam Partial Reimbursement

Students may be reimbursed for \$50 of the cost to take the FE exam. Students are strongly encouraged to take the exam and seek reimbursement while they are still enrolled as a student.

In order to receive reimbursement, an itemized receipt showing your registration, date of exam, and payment for the exam is required. Unless requested otherwise, the reimbursement will be sent to the official address the student has on file with the university. These requests are to be submitted to the main Brackett Hall office, room 445.

Students may still seek reimbursement after graduation, but will be required to register as a vendor in Clemson's procurement system, Buyways, in order to receive reimbursement. Students must submit any reimbursement requests within one year of graduation to qualify.

Student Groups

ASABE Clemson Student Branch

(<https://www.clemson.edu/cecas/departments/ees/students/student-orgs/be-club.html>)

The ASABE Clemson Student Branch is for undergraduates in the BS Biosystems Engineering program. The club provides a link between students, faculty, administration, and alumni to promote a network in the department and field. The student chapter holds meetings, on-campus activities, and field trips to stay engaged with one another and the community. Through activities, students are assisted in launching satisfying careers in Biosystems Engineering and other related fields. Overall, the club is a place for those with common interests in Biosystems Engineering to connect. Dr. Caye Drapcho is the faculty advisor for the student chapter and can be contacted for more information.

Faculty

Biosystems Engineering faculty members in EEES are listed on the Department's web site, under [People and Current Faculty](#). Faculty members who are predominantly affiliated with the Biosystems Engineering program include:

- **Dr. Christophe Darnault**
<https://www.clemson.edu/cecas/departments/ees/people/facultydirectory/darnault.html>
- **Dr. Caye Drapcho**
<https://www.clemson.edu/cecas/departments/ees/people/facultydirectory/drapcho.html>
- **Dr. Tom Owino**
<https://www.clemson.edu/cecas/departments/ees/people/facultydirectory/owino.html>
- **Dr. Terry Walker**
<https://www.clemson.edu/cecas/departments/ees/people/facultydirectory/walker.html>
- **Dr. Tom Dodd**
<https://www.clemson.edu/cecas/departments/ees/people/facultydirectory/dodd.html>

Staff

Staff members in EEES are listed on the Department's web site:

<https://www.clemson.edu/cecas/departments/eees/people/index.html>

The staff who work most closely with Biosystems Engineering undergraduate students include:

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