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/eees/

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 (http://terradotta.app.clemson.edu/index.cfm?FuseAction=Programs.ViewProgram&Program_ID=12264) 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 the following websites for more information: http://www.clemson.edu/studyabroad/ and https://www.clemson.edu/cecas/global-engagement/undergraduate-programs/index.html

**Curriculum**

The curriculum for the BS degree in Biosystems Engineering consists of 126 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 are found at: https://www.clemson.edu/cecas/departments/eees/documents/BS-MS_BE_EES.pdf

**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.
<table>
<thead>
<tr>
<th>Underlined courses</th>
<th>require a C grade or better</th>
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**BIOSYSTEMS ENGINEERING**

**2015-2016 Curriculum**

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### FRESHMAN YEAR (Gen. Engr.)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGR 1050</td>
<td>Engineering Disciplines and Skills I</td>
<td>1 (0.2)</td>
</tr>
<tr>
<td>ENGR 1050A</td>
<td>Engineering Disciplines and Skills II</td>
<td>1 (0.2)</td>
</tr>
<tr>
<td>CH 1010</td>
<td>General Chemistry</td>
<td>4 (3.3)</td>
</tr>
<tr>
<td>MATH 1101</td>
<td>Calculus of One Variable I</td>
<td>4 (4.0)</td>
</tr>
<tr>
<td>ENGL 1090</td>
<td>Composition I or AP Test</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>Arts/Hum/SS</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PHYS 1210</td>
<td>Physics w/Calculus I</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>PHYS 1210A</td>
<td>Physics w/Calculus II</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>ENGR 2100</td>
<td>Engineering Graphics</td>
<td>2 (1.3)</td>
</tr>
</tbody>
</table>

**Total:** 16

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### SOPHOMORE YEAR

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 2100/2101</td>
<td>Fundamentals of BE</td>
<td>2 (1.3)</td>
</tr>
<tr>
<td>CE 2010</td>
<td>Statics</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>MATH 2090</td>
<td>Calculus of Several Variables</td>
<td>4 (4.0)</td>
</tr>
<tr>
<td>PHYS 2210</td>
<td>Physics w/Calculus II</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>Biology Requirement</td>
<td>4 (3.3)</td>
<td></td>
</tr>
</tbody>
</table>

**Total:** 16

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### JUNIOR YEAR

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BE 3200/3201</td>
<td>Principles Practices Geomatics</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>BE 4100/4101</td>
<td>Biol Kinetics/Reactor Modeling</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>BE 3410/3411</td>
<td>Introduction to Fluid Mechanics</td>
<td>4 (3.2)</td>
</tr>
<tr>
<td>ECE 2070</td>
<td>Basic Electrical Engineering</td>
<td>2 (2.0)</td>
</tr>
<tr>
<td>ECE 2080</td>
<td>Electrical Engineering Lab I</td>
<td>1 (0.2)</td>
</tr>
<tr>
<td>BIOL 4410</td>
<td>General Ecology</td>
<td>3 (3.0)</td>
</tr>
</tbody>
</table>

**Total:** 16

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### SENIOR YEAR - Bioprocess Engineering Emphasis

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 4740</td>
<td>BE Capstone Design/Project Mgmt</td>
<td>2 (1.3)</td>
</tr>
<tr>
<td>BE 4750</td>
<td>Biosystems Engr Capstone Design</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>ECE 3850/3851</td>
<td>Bioprocess Engr Design</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>CHM 3050</td>
<td>Biochemistry</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>BIOL 4340/4341</td>
<td>Biol. Chem. Tech Lab</td>
<td>2 (1.3)</td>
</tr>
<tr>
<td>BE 3360/3361</td>
<td>Structural Mechanics</td>
<td>4 (3.3)</td>
</tr>
</tbody>
</table>

**Total:** 16

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### SENIOR YEAR - Ecological Engineering Emphasis

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 4740</td>
<td>BE Capstone Design/Project Mgmt</td>
<td>2 (1.3)</td>
</tr>
<tr>
<td>BE 4750</td>
<td>Biosystems Engr Capstone Design</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>BE 4210</td>
<td>Ecology, Soil Water Management</td>
<td>2 (1.3)</td>
</tr>
<tr>
<td>ECO 3850/3851</td>
<td>Ecological Requirement</td>
<td>3 (3.0)</td>
</tr>
<tr>
<td>Arts/Hum/SS</td>
<td>Requirement</td>
<td>3 (3.0)</td>
</tr>
</tbody>
</table>

**Total:** 16

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### Special Notes:

* A "C" engineering GPA required for graduation.
* The 2015-2016 BS degree program includes the following courses: ENGR 1050, ENGR 1050A, CH 1010, MATH 1101, ENGL 1090, PHYS 1210, PHYS 1210A, ENGR 2100.
* Additional courses must be completed in the major areas of study, including fundamental courses in biology, chemistry, and physics.
* The program offers opportunities for students to pursue advanced degrees or careers in the biosystems engineering field.

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*Students should choose courses to fulfill Arts/Hum/SS, Social Sciences, Cross-Cultural Awareness, Science/Technology in Society, General Education requirements.*

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**Total Semester Hours:**

*Engineering course 2000-level or above or other approved course (Minimum 6000-level for BS degree).*  
*Global Sustainability Requirement: Choose from Sustainability/Minor courses or other approved course.*

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*Engineering course 2000-level or above or other approved course (Minimum 6000-level for BS degree).*  
*Global Sustainability Requirement: Choose from Sustainability/Minor courses or other approved 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. Cross-Cultural Awareness: A course in Section VI of the General Education requirements or a University-approved cross-cultural experience

VI. Science and Technology in Society: Approved courses satisfy the University’s Science and Technology in Society requirements

VII. Distributed Courseworks: 2 credits Satisfied by the Biosystems Engineering curriculum
   i. Academic and Professional Development: Satisfied through Biosystems Engineering courses
   ii. Distributed Competencies
Arts/Humanities and Social Sciences Policy

The program of study must include a minimum of 12 credits in the Arts/Humanities and Social Sciences.

Cultural Awareness Requirement

Students desiring to minimize total credits required to graduate can do so by strategically choosing their Non-Literature Arts and Humanities course, or Social Science Courses to fulfill the Cross Cultural Awareness requirement. Students should meet with their academic advisor to check that all general education requirements are being met.

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.

Student Groups
Biosystems Engineering Club

The Biosystems Engineering club 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:
https://www.clemson.edu/cecas/departments/eees/people/facultydirectory/index.html

Faculty members who are predominantly affiliated with the Biosystems Engineering program include:

- **Dr. Christophe Darnault**
  https://www.clemson.edu/cecas/departments/eees/people/facultydirectory/darnault.html

- **Dr. Caye Drapcho**
  https://www.clemson.edu/cecas/departments/eees/people/facultydirectory/drapcho.html

- **Dr. Tom Owino**
  https://www.clemson.edu/cecas/departments/eees/people/facultydirectory/owino.html

- **Ms. Jazmine Taylor**
  https://www.clemson.edu/cecas/departments/eees/people/facultydirectory/taylor.html

- **Dr. Terry Walker**
  https://www.clemson.edu/cecas/departments/eees/people/facultydirectory/walker.html

- **Dr. Yi Zheng**
  https://www.clemson.edu/cecas/departments/eees/people/facultydirectory/zheng.html

Staff
Staff members in EEES are listed on the Department’s web site, under People and Current Faculty:
The staff who work most closely with Biosystems Engineering undergraduate students include:

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Location</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Janet Lee</td>
<td>Undergraduate Coordinator</td>
<td>445 Brackett Hall</td>
<td>656-0470 <a href="mailto:ingle6@Clemson.edu">ingle6@Clemson.edu</a></td>
</tr>
<tr>
<td>Briana Peele</td>
<td>Administrative Assistant</td>
<td>445 Brackett Hall</td>
<td>656-3438  @clemson.edu</td>
</tr>
</tbody>
</table>

https://www.clemson.edu/cecas/departments/ees/people/staff.html