

Date Submitted: 05/17/18 9:43 am

Viewing: **BENGBS : Biological Engineering,
Bachelor of Science in Biological Engineering**

Last approved: 03/27/18 10:03 am

Last edit: 10/18/18 11:23 am

Changes proposed by: tac

Catalog Pages Using
this Program

[Biological Engineering B.S.B.E.](#)

[Biological and Agricultural Engineering.\(BAEG\)](#)

Submitter: User ID: crsleaf1 Phone:
575-2351

Program Status Active

Academic Level Undergraduate

Type of proposal Major/Field of Study

Select a reason for this modification

Adding an Option, Concentration or Emphasis--(LON 3)

Are you adding a concentration?

Yes ~~No~~

Concentration(s):

In Workflow

1. ENGR Dean Initial
2. Provost Initial
3. Director of Program Assessment and Review
4. Registrar Initial
5. Institutional Research
6. BAEG Chair
7. ENGR Curriculum Committee
8. ENGR Faculty
9. AFLS Dean
10. ARSC Dean
11. ENGR Dean
12. Global Campus
13. Provost Review
14. University Course and Program Committee
15. Faculty Senate
16. Provost Final
17. Provost's Office-- Documentation sent to System Office
18. Higher Learning Commission
19. Board of Trustees
20. ADHE Final
21. Provost's Office-- Notification of Approval
22. Registrar Final
23. Catalog Editor Final

Approval Path

1. 04/19/18 3:37 pm
Norman Dennis
(ndennis): Approved
for ENGR Dean
Initial
2. 04/20/18 7:25 am
Terry Martin
(tmartin): Approved
for Provost Initial
3. 05/04/18 2:37 pm
Alice Griffin
(agriffin): Rollback
to Initiator
4. 06/05/18 11:27 pm
Norman Dennis
(ndennis): Approved
for ENGR Dean
Initial
5. 07/05/18 2:00 pm
Terry Martin
(tmartin): Approved
for Provost Initial
6. 07/07/18 7:54 am
Alice Griffin
(agriffin): Approved
for Director of
Program
Assessment and
Review
7. 07/26/18 1:59 pm
Lisa Kulczak
(lkulcza): Rollback to
Director of Program
Assessment and
Review for Registrar
Initial
8. 07/27/18 10:14 am
Alice Griffin
(agriffin): Approved
for Director of

- Program
Assessment and
Review
9. 07/27/18 2:47 pm
Lisa Kulczak
(lkulcza): Approved
for Registrar Initial
 10. 07/27/18 3:41 pm
Gary Gunderman
(ggunderm):
Approved for
Institutional
Research
 11. 08/08/18 8:36 am
Lalit Verma
(lverma): Approved
for BAEG Chair
 12. 08/23/18 7:53 am
Manuel Rossetti
(rossetti): Approved
for ENGR
Curriculum
Committee
 13. 08/28/18 1:21 pm
Norman Dennis
(ndennis): Approved
for ENGR Faculty
 14. 10/12/18 3:13 pm
Lona Robertson
(ljrobert): Approved
for AFLS Dean
 15. 10/17/18 1:38 pm
Jeannine Durdik
(jdurdik): Approved
for ARSC Dean
 16. 10/17/18 6:42 pm
Norman Dennis
(ndennis): Approved
for ENGR Dean

- 17. 10/18/18 8:38 am
Miran Kang (kang):
Approved for Global
Campus
- 18. 10/18/18 9:29 am
Terry Martin
(tmartin): Approved
for Provost Review
- 19. 10/29/18 10:12 am
Alice Griffin
(agriffin): Approved
for University
Course and Program
Committee

History

- 1. Aug 15, 2014 by
Leepfrog
Administrator
(clhelp)
- 2. Aug 15, 2014 by
Charlie Alison
(calison)
- 3. Apr 19, 2016 by
Linda Pate (lpate)
- 4. Mar 27, 2018 by
Linda Pate (lpate)

Action	Code	Title
Add new	ENVR	Environmental
Add new	BENG	Biological

Are you adding a track? No

Are you adding a focused study? No

Effective Catalog Year Fall 2019

College/School Code College of Engineering(ENGR)

Department Code Department of Biological and Agricultural Engineering(BAEG)

Program Code BENGBS

Degree Bachelor of Science in Biological Engineering

CIP Code

14.4501 - Biological/Biosystems Engineering.

Program Title

Biological Engineering, Bachelor of Science in Biological Engineering

Program Delivery

Method

On Campus

Is this program interdisciplinary?

No ~~Yes~~

Does this proposal impact any courses from another College/School?

Yes

College(s)/School(s)

College/School Name
Bumpers College of Agricultural, Food, and Life Sciences(AFLS)
Fulbright College of Arts and Sciences(ARSC)

What are the total
hours needed to
complete the
program? 128

Program Requirements and Description

Requirements

The undergraduate program in biological engineering, leading to a Bachelor of Science degree in Biological Engineering, is accredited by the Engineering Accreditation Commission of [ABET](#). The B.S. in Biological Engineering degree is conferred by the College of Engineering and is granted after the successful completion of 128 hours of approved course work.

Diverse applications of biological engineering can be pursued through elective coursework. Each student is required to complete 12 semester hours of biological/engineering/technical electives that are relevant to their career goals. At least 3 hours must be selected from a list of acceptable biological electives. At least 3 hours must be engineering courses within BENG or other engineering programs. The remaining hours can be selected from engineering, math, biology, agriculture, sustainability, and other science/technical areas. A list of suggested electives is maintained by the department. Students may petition their adviser to seek approval of other

electives that are not on this list. Courses must provide engineering or technical content that is value-added (i.e. not duplicating or remedial) and meets the career goals of the student.

Environmental Concentration. Through proper selection of 12 hours of elective courses, biological engineering students may complete an Environmental Concentration. To complete the concentration, students must complete:

CVEG 3243 Environmental Engineering

CVEG 4243 Environmental Engineering Design

plus 3 hours of biological electives and 3 hours of technical electives from Environmental Concentration electives lists maintained by the department.

8-Semester Plan

Biological Engineering B.S.B.E. Eight-Semester Degree Program

The Bachelor of Science in Biological Engineering program is eligible for students who want to participate in an Eight Semester Degree Program. See the [Eight-Semester Degree Policy](#) for more details. The plan below lists a semester-by-semester sequence of courses to finish the degree in eight semesters. University core courses for engineering are listed at the bottom of this page. Students may submit a maximum of four (4) hours of "D" in BENG Courses for their degree.

Some courses are not offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course pre-requisites.

First Year	Units
	FallSpring
<u>GNEG 1111 Introduction to Engineering I</u>	1
<u>ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013)</u>	3
<u>CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)</u>	3
<u>MATH 2554 Calculus I (ACTS Equivalency = MATH 2405)</u>	4
<u>PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034)</u>	4
<u>GNEG 1121 Introduction to Engineering II</u>	1
<u>ENGL 1033 Technical Composition II</u>	3
or <u>ENGL 1023 Composition II (ACTS Equivalency = ENGL 1023)</u>	
Freshman Engineering Science Elective1	4
<u>MATH 2564 Calculus II (ACTS Equivalency = MATH 2505)</u>	4
<u>HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)</u>	3
or <u>HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)</u>	
or <u>PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003)</u>	
Year Total:	15 15
Second Year	Units

	Fall	Spring
<u>BENG 2632</u> Biological Engineering Design Studio		2
<u>MATH 2574</u> Calculus III (ACTS Equivalency = MATH 2603)		4
Sophomore Science Elective2		4
<u>BIOL 1543</u> Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)		3
<u>BIOL 1541L</u> Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)		1
<u>MEEG 2003</u> Statics		3
<u>BENG 2643</u> Biological Engineering Methods I		3
<u>MATH 2584</u> Elementary Differential Equations		4
<u>BIOL 2013</u> General Microbiology (ACTS Equivalency = BIOL 2004 Lecture)		3
<u>BIOL 2011L</u> General Microbiology Laboratory (ACTS Equivalency = BIOL 2004 Lab)		1
<u>MEEG 2403</u> Thermodynamics		3
or <u>CHEG 2313</u> Thermodynamics of Single-Component Systems		
Social Science Elective (from University Core list)		3
Year Total:		17 17
 Third Year		 Units
	Fall	Spring
<u>BENG 3653</u> Global Bio-Energy Engineering		3
<u>BENG 3733</u> Transport Phenomena in Biological Systems		3
<u>BENG 3663</u> Biological Engineering Methods II		3
Choose one:		4
<u>CHEM 3603</u> Organic Chemistry I		
& <u>CHEM 3601L</u> Organic Chemistry I Laboratory		
<u>CHEM 2613</u> Organic Physiological Chemistry (ACTS Equivalency = CHEM 1224 Lecture)		
& <u>CHEM 2611L</u> Organic Physiological Chemistry Laboratory (ACTS Equivalency = CHEM 1224 Lab)		
<u>CVEG 3213</u> Hydraulics		3
or <u>MEEG 3503</u> Mechanics of Fluids		
or <u>CHEG 2133</u> Fluid Mechanics		
<u>BENG 3723</u> Unit Operations in Biological Engineering		3
<u>BENG 3113</u> Measurement and Control for Biological Systems		3
<u>CVEG 3223</u> Hydrology		3
Biological Elective		3
Technical Elective		3
Year Total:		16 15
 Fourth Year		 Units
	Fall	Spring
<u>BENG 4812</u> Senior Biological Engineering Design I		2
<u>BENG 4831</u> Biological Engineering Professionalism		1

BENG 4743 Food and Bio-Product Systems Engineering	3
BENG 4933 Sustainable Watershed Engineering	3
Humanities Elective (from University Core list)	3
Social Science Elective (from University Core list)	3
BENG 4823 Senior Biological Engineering Design II	3
BENG 4663 Sustainable Biosystems Designs	3
Technical Elective (Engineering)	3
Fine Arts Elective (from University Core list)	3
Social Science Elective (from University Core list)	3
Technical Elective	3
Year Total:	15 18

Total Units in Sequence: 128

1 The Freshman Engineering Science Elective must be chosen from either [CHEM 1123/CHEM 1121L](#) or [PHYS 2074](#).

2 The Sophomore Science Elective must be: [PHYS 2074](#) if [CHEM 1123/CHEM 1121L](#) was chosen as the Freshman Engineering Science Elective; or [CHEM 1123/CHEM 1121L](#) if [PHYS 2074](#) was chosen as the Freshman Engineering Science Elective. That is, both courses are required for the degree.

Biological Engineering B.S.B.E. with Environmental Concentration Eight-Semester Degree Program

The Bachelor of Science in Biological Engineering program is eligible for students who want to participate in an Eight Semester Degree Program. See the [Eight-Semester Degree Policy](#) for more details. The plan below lists a semester-by-semester sequence of courses to finish the degree in eight semesters. University core courses for engineering are listed at the bottom of this page. Students may submit a maximum of four (4) hours of "D" in BENG Courses for their degree.

Some courses are not offered every semester, so students who deviate from the suggested sequence must pay careful attention to course scheduling and course pre-requisites.

First Year	Units
	FallSpring
GNEG 1111 Introduction to Engineering I	1
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013)	3
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)	3
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405)	4
PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034)	4
GNEG 1121 Introduction to Engineering II	1
ENGL 1033 Technical Composition II	3
or ENGL 1023 Composition II (ACTS Equivalency = ENGL 1023)	
Freshman Engineering Science Elective 1	4

<u>MATH 2564</u> Calculus II (ACTS Equivalency = MATH 2505)	4
<u>HIST 2003</u> History of the American People to 1877 (ACTS Equivalency = HIST 2113)	3
or <u>HIST 2013</u> History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)	
or <u>PLSC 2003</u> American National Government (ACTS Equivalency = PLSC 2003)	
Year Total:	15 15
Second Year	Units
	FallSpring
<u>BENG 2632</u> Biological Engineering Design Studio	2
<u>MATH 2574</u> Calculus III (ACTS Equivalency = MATH 2603)	4
Sophomore Science Elective2	4
<u>BIOL 1543</u> Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)	3
<u>BIOL 1541L</u> Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	1
<u>MEEG 2003</u> Statics	3
<u>BENG 2643</u> Biological Engineering Methods I	3
<u>MATH 2584</u> Elementary Differential Equations	4
<u>BIOL 2013</u> General Microbiology (ACTS Equivalency = BIOL 2004 Lecture)	3
<u>BIOL 2011L</u> General Microbiology Laboratory (ACTS Equivalency = BIOL 2004 Lab)	1
<u>MEEG 2403</u> Thermodynamics	3
or <u>CHEG 2313</u> Thermodynamics of Single-Component Systems	
Social Science Elective (from University Core list)	3
Year Total:	17 17
Third Year	Units
	FallSpring
<u>BENG 3653</u> Global Bio-Energy Engineering	3
<u>BENG 3733</u> Transport Phenomena in Biological Systems	3
<u>BENG 3663</u> Biological Engineering Methods II	3
Choose one:	4
<u>CHEM 3603</u> Organic Chemistry I	
& <u>CHEM 3601L</u> Organic Chemistry I Laboratory	
<u>CHEM 2613</u> Organic Physiological Chemistry (ACTS Equivalency = CHEM 1224 Lecture)	
& <u>CHEM 2611L</u> Organic Physiological Chemistry Laboratory (ACTS Equivalency = CHEM 1224 Lab)	
<u>CVEG 3213</u> Hydraulics	3
or <u>MEEG 3503</u> Mechanics of Fluids	
or <u>CHEG 2133</u> Fluid Mechanics	
<u>BENG 3723</u> Unit Operations in Biological Engineering	3
<u>BENG 3113</u> Measurement and Control for Biological Systems	3
<u>CVEG 3223</u> Hydrology	3
Biological ElectiveStudents who choose the Environmental Concentration should select from a biological elective list for the Environmental Concentration that is maintained by the department.	3

Technical Elective Students who choose the Environmental Concentration should select CVEG 3243 for this technical elective.	3
Year Total:	16 15
Fourth Year	
	Units
	FallSpring
BENG 4812 Senior Biological Engineering Design I	2
BENG 4831 Biological Engineering Professionalism	1
BENG 4743 Food and Bio-Product Systems Engineering	3
BENG 4933 Sustainable Watershed Engineering	3
Humanities Elective (from University Core list)	3 -
Social Science Elective (from University Core list)	3
Technical Elective (Engineering)Students who choose the Environmental Concentration should select CVEG 4243 for this elective	3
BENG 4823 Senior Biological Engineering Design II	3
BENG 4663 Sustainable Biosystems Designs	3
Fine Arts Elective (from University Core list)	3
Humanities Elective (from University Core list)	3
Social Science Elective (from University Core list)	3
Technical Elective Students who choose the Environmental Concentration should select from a technical elective list for the Environmental Concentration that is maintained by the department.	3
Year Total:	15 18

Total Units in Sequence: 128

1 The Freshman Engineering Science Elective must be chosen from either [CHEM 1123](#)/[CHEM 1121L](#) or [PHYS 2074](#).

2 The Sophomore Science Elective must be: [PHYS 2074](#) if [CHEM 1123](#)/[CHEM 1121L](#) was chosen as the Freshman Engineering Science Elective; or [CHEM 1123](#)/[CHEM 1121L](#) if [PHYS 2074](#) was chosen as the Freshman Engineering Science Elective. That is, both courses are required for the degree.

Are Similar Programs available in the area?

No

Estimated Student Demand for Program 20 ~~100~~

Scheduled Program 2020

Review Date

Program Goals and Objectives

Program Goals and Objectives

Program Goals and Objectives

The educational objectives of the Biological Engineering program at the University of Arkansas are to produce graduates to:

- 1) Successfully practice engineering involving the design and management of sustainable food, water, energy and related biological systems,
- 2) Make valuable and sustained contributions that benefit employers, communities, Arkansas and the world, and
- 3) Succeed in continuing professional development or graduate studies, as needed for professional growth.

The objective of the Environmental Concentration is to meet the previously listed objectives of the Biological Engineering program, with specific applications in the environmental area.

Learning Outcomes

Learning Outcomes

In order to prepare graduates to attain our Educational Objectives, the following student outcomes were defined:

- a) An ability to apply knowledge of mathematics, science, and engineering.
- b) An ability to design and conduct experiments, as well as analyze and interpret data.
- c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) An ability to function on multidisciplinary teams.
- e) An ability to identify, formulate, and solve engineering problem.
- f) An understanding of professional and ethical responsibility.
- g) An ability to communicate effectively.
- h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- i) A recognition of the need for, and an ability to engage in life-long learning.
- j) A knowledge of contemporary issues.
- k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The learning outcomes for the Environmental Concentration are the same as the previously listed outcomes for the Biological Engineering program, with specific applications in the environmental area.

Description and justification of the request

Description of specific change	Justification for this change
<p>We are adding an Environmental Concentration to the B.S. degree in Biological Engineering. Students who choose to pursue the concentration must follow constraints on the selection of courses for 12 hours of electives in the program. Here is a list of the elective categories and the constraints for the concentration:</p> <p>Biological Elective (3h): choose from restricted list for the Environmental Concentration, as maintained by the department.</p> <p>Technical Elective (3h): CVEG 3213, Environmental Engineering</p> <p>Technical Elective (Engineering, 3 h): CVEG 4243, Environmental Engineering Design</p> <p>Technical elective (3 h): choose from restricted list for the Environmental Concentration, as maintained by the department.</p> <p>To facilitate review, the restricted biological elective list, to be maintained by the</p>	<p>The proposed Environmental Concentration within the BS in Biological Engineering would provide undergraduates with the option to complete a focused set of elective choices in environmental engineering and other select environmental based courses, and to be recognized for this educational concentration on their transcripts, as well as resumes distributed to potential employers.</p> <ul style="list-style-type: none"> o This concentration and its designation would benefit students by directing their studies and providing evidence that they have completed the focused program. o Prospective employers will benefit from their ability to selectively recruit graduates who have completed the concentration. <p>As evidence of student interest for an environmental concentration, many BENG students have chosen to focus their elective courses in the environmental area and have then been successful after graduation in gaining employment with environmental consulting firms. They have also been successful in working toward professional registration in environmental engineering. A recent survey of juniors currently in the program indicated that at least 10 intend to take both of the CVEG courses (that are required as part of the proposed concentration) in the coming academic year. With the approval of the concentration, we estimate that the number of students in the concentration could rise to approximately 20 students per year.</p> <p>Our recent correspondence with several consulting firms have confirmed the priority given to courses selected for the concentration. Firms indicated that they would value the concentration and would recruit graduates who complete the BSBE with the proposed environmental concentration.</p> <p>There is a clear need for engineers and scientists that are specialists in the environment. We believe that graduates from this program will have fulfilling careers that will benefit communities in Arkansas and beyond.</p>

Description of specific change	Justification for this change
<p>department. will initially be populated by:</p> <p>BIOL 3863 Ecology CSES 2203 Soil Science ENSC 4023 Water Quality</p> <p>To facilitate review, the restricted technical elective list, to be maintained by the department, will initially be populated by:</p> <p>BIOL 3863 Ecology (if not chosen for the biological elective) BENG 4963 Modeling Environmental Biophysics BENG 4973 Practice in Water Quality Monitoring and Analysis CSES 2203 Soil Science (if not chosen for the biological elective) CHEM 3613 Organic Chemistry II CVEG 4203 Environmental Permits and Regulations CVEG 4223 Groundwater Hydrology CVEG 4263 Air Pollution Control CVEG 4273 Open Channel Flow ENSC 4023 Water Quality (if not chosen for the biological elective) ENSC 4034 Analysis of Environmental Contaminants GEOL 1113 General Geology</p>	

Description of specific change	Justification for this change
INEG 2313 Engineering Statistics INEG 2413 Engineering Economics	

Upload attachments

[BENGBS - New Option - Ltr of Notification.docx](#)

Reviewer Comments

Alice Griffin (agriffin) (05/04/18 2:19 pm): Hyper-linked courses in program requirements.

Alice Griffin (agriffin) (05/04/18 2:37 pm): Rollback: Please upload a Word version (rather than PDF) of the LON. Approval dates will need to be entered. Thank you.

Charlie Alison (calison) (06/08/18 9:20 am): Corrected listing for CHEM lab to go with CHEM 2613 lecture course.

Alice Griffin (agriffin) (07/07/18 7:53 am): Updated LON to include ADHE revisions. Inserted anticipated approval dates.

Lisa Kulczak (lkulcza) (07/26/18 1:59 pm): Rollback: Some additional updates need to be made to proposal.

Alice Griffin (agriffin) (07/26/18 3:27 pm): Created an individual 8 SDCP for Environmental Concentration.

Alice Griffin (agriffin) (07/26/18 3:28 pm): Edited 8 SDCP.

Alice Griffin (agriffin) (07/26/18 5:01 pm): Additional edits to 8 SDCP.

Alice Griffin (agriffin) (07/27/18 8:12 am): Added footnotes to the 8 SDCP.

Alice Griffin (agriffin) (07/27/18 9:51 am): Last edit to 8 semester plan.

Alice Griffin (agriffin) (07/27/18 10:11 am): Hyper-linked courses in footnotes.

Lisa Kulczak (lkulcza) (07/27/18 2:40 pm): Added general "BENG" concentration for students not wishing to pursue the Environmental concentration option.

Alice Griffin (agriffin) (10/18/18 11:23 am): Changed effective date in LON from fall 2018 to fall 2019. Revised approval dates.

Key: 471