

Date Submitted: 03/22/20 3:24 pm

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

Last approved: 05/21/19 12:02 pm

Last edit: 02/03/21 3:07 pm

Changes proposed by: tac

Catalog Pages Using
this Program

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

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

Submitter: 575-2351 User ID: crsleaf1 Phone:

Program Status Active

Academic Level Undergraduate

Type of proposal Major/Field of Study

Select a reason for this modification

Making Minor Changes to an Existing Degree (e.g. changing 15 or fewer hours, changing admission/graduation requirements, adding/changing Focused Study or Track)

Are you adding a concentration?

No **Yes**

Are you adding or modifying a track?

No

Are you adding or modifying a focused study?

No

Effective Catalog Year Fall 2021

College/School Code

College of Engineering (ENGR)

In Workflow

1. ENGR Dean Initial
2. Director of Program Assessment and Review
3. Registrar Initial
4. Institutional Research
5. BAEG Chair
6. ENGR Curriculum Committee
7. ENGR Faculty
8. AFLS Dean
9. ARSC Dean
10. ENGR Dean
11. Global Campus
12. Provost Review
13. University Course and Program Committee
14. Faculty Senate
15. Provost Final
16. Provost's Office-- Notification of Approval
17. Registrar Final
18. Catalog Editor Final

Approval Path

1. 03/18/20 8:54 am
Norman Dennis (ndennis): Rollback to Initiator
2. 03/22/20 4:51 pm
Norman Dennis (ndennis): Approved

Department Code

Department of Biological and Agricultural Engineering (BAEG)

Program Code

BENGBS

Degree

Bachelor of Science in Biological Engineering

CIP Code

for ENGR Dean

Initial

3. 05/08/20 1:51 pm

Alice Griffin

(agriffin): Approved

for Director of

Program

Assessment and

Review

4. 07/22/20 12:34 pm

Lisa Kulczak

(lkulcza): Approved

for Registrar Initial

5. 07/22/20 1:03 pm

Gary Gunderman

(ggunderm):

Approved for

Institutional

Research

6. 01/07/21 2:18 pm

Lalit Verma

(lverma): Approved

for BAEG Chair

7. 01/12/21 4:34 pm

Manuel Rossetti

(rossetti): Rollback

to BAEG Chair for

ENGR Curriculum

Committee

8. 02/04/21 11:33 am

Linda Pate (lpate):

Approved for BAEG

Chair

9. 02/18/21 9:37 am

Manuel Rossetti

(rossetti): Approved

for ENGR

Curriculum

Committee

10. 02/18/21 9:44 am
Norman Dennis
(ndennis): Approved
for ENGR Faculty
11. 02/18/21 9:53 am
Lona Robertson
(ljrobert): Approved
for AFLS Dean
12. 02/18/21 7:48 pm
Jeannie Hulen
(jhulen): Approved
for ARSC Dean
13. 02/18/21 7:50 pm
Norman Dennis
(ndennis): Approved
for ENGR Dean
14. 02/19/21 8:35 am
Suzanne Kenner
(skenner): Approved
for Global Campus
15. 02/19/21 9:30 am
Terry Martin
(tmartin): Approved
for Provost Review
16. 02/26/21 4:21 pm
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)
5. May 21, 2019 by
Thomas Costello
(tac)

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

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**, www.abet.org 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**. **Students who choose electives meeting the Environmental Concentration requirements, can earn the concentration, see the 8-Semester Plan for the B.S. student: in Biological Engineering with an Environmental Concentration.** **Students are required to complete 40 hours of upper division courses (3000-4000 level). It is recommended that students consult with their academic adviser when making course selections.**

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
GNEG 1111 Introduction to Engineering I	1
ENGL 1013 Composition I (ACTS Equivalency = ENGL 1013) (Satisfies General Education Outcome 1.1)	3
CHEM 1103 University Chemistry I (ACTS Equivalency = CHEM 1414 Lecture)	3
MATH 2554 Calculus I (ACTS Equivalency = MATH 2405) (Satisfies General Education Outcome 2.1)	4
PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034)	4 -
U.S. History or Government Elective - Choose one course from the following (Satisfies General Education Outcomes 3.3 & 4.2):	
HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113)	3
or HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123)	
or PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003)	
GNEG 1121 Introduction to Engineering II	1
ENGL 1033 Technical Composition II (ACTS Equivalency = ENGL 1023) (Satisfies General Education Outcome 1.2)	3
Freshman Engineering Science Elective	4

<u>CHEM 1123</u> University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & <u>CHEM 1121L</u> University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab) or <u>BIOL 1543</u> and <u>BIOL 1541L</u>	
<u>MATH 2564</u> Calculus II (ACTS Equivalency = MATH 2505)	4
HIST 2003 History of the American People to 1877 (ACTS Equivalency = HIST 2113) or HIST 2013 History of the American People, 1877 to Present (ACTS Equivalency = HIST 2123) or PLSC 2003 American National Government (ACTS Equivalency = PLSC 2003)	- 3
PHYS 2054 University Physics I (ACTS Equivalency = PHYS 2034)	4
Year Total:	14 16
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 Elective (whichever has not been taken)	4
<u>CHEM 1123</u> University Chemistry II (ACTS Equivalency = CHEM 1424 Lecture) & <u>CHEM 1121L</u> University Chemistry II Laboratory (ACTS Equivalency = CHEM 1424 Lab) or <u>BIOL 1543</u> and <u>BIOL 1541L</u>	
BIOL 1543 Principles of Biology (ACTS Equivalency = BIOL 1014 Lecture)	3 -
BIOL 1541L Principles of Biology Laboratory (ACTS Equivalency = BIOL 1014 Lab)	1 -
<u>MEEG 2003</u> Statics	3
PHYS 2074 University Physics II (ACTS Equivalency = PHYS 2044 Lecture)	4
<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) & <u>BIOL 2011L</u> General Microbiology Laboratory (ACTS Equivalency = BIOL 2004 Lab)	4
BIOL 2011L 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-University Core	- 3
Social Science Elective - Choose one course from the list below (Satisfies General Education Outcome 4.1)1	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	

& CHEM 3601L Organic Chemistry I Laboratory		
CHEM 2613 Organic Physiological Chemistry (ACTS Equivalency = CHEM 1224 Lecture)		
& CHEM 2611L Organic Physiological Chemistry Laboratory (ACTS Equivalency = CHEM 1224 Lab)		
CVEG 3213 Hydraulics		3
or MEEG 3503 Mechanics of Fluids		
or CHEG 2133 Fluid Mechanics		
BENG 3723 Unit Operations in Biological Engineering		3
BENG 3113 Measurement and Control for Biological Systems		3
CVEG 3223 Hydrology		3
Biological Elective		3
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 - Choose one course from the list below (Satisfies General Education Outcomes 3.2 and 5.1)2		3
Social Science Elective-choose any course listed on the State Minimum Core.		3
Social Science Elective-University Core		3 -
BENG 4823 Senior Biological Engineering Design II (Satisfies General Education Outcome 6.1)		3
BENG 4663 Sustainable Biosystems Designs		3
Technical Elective (Engineering)		3
Fine Arts Elective - Choose one course from the list below (Satisfies General Education Outcome 3.1)3		3
Social Science Elective - choose any course listed on the State Minimum Core.		3
Social Science Elective-University Core		- 3
Technical Elective		3
Year Total:		15 18
Total Units in Sequence:		128
1 This Social Science Elective should be selected from the following courses in order to meet State Minimum Core and the General Education Outcome 4.1: ANTH 1023, COMM 1023, GEOS 2003, GEOS 2003H, HDFS 1403, HDFS 2413, HDFS 2603, HIST 1113, HIST 1113H, HIST 1123, HIST 1123H, HIST 2093, HUMN 1114H, HUMN 2114H, PLSC 2013, or RESM 2853.		
2 The Humanities Elective should be selected from the following courses in order to meet State Minimum Core and the General Education Outcomes 3.2 and 5.1: CLST 1003, CLST 1013, PHIL 2003, PHIL 2003H, PHIL 2003C, PHIL 2103, or PHIL 2103C.		

~~FILE 2003C, FILE 2103, or FILE 2103C.~~

3The Fine Arts Elective should be selected from the following courses in order to meet State Minimum Core and the General Education Outcome 3.1: ARHS 1003, COMM 1003, DANC 1003, MLIT 1003, MLIT 1003H, MLIT 1013, MLIT 1013H, MLIT 1333, THTR 1003, or THTR 1013.

Are Similar Programs available in the area?

No

Estimated Student Demand for Program **150** ~~20~~

Demand for Program

Scheduled Program 2020

Review Date

Program Goals and

Objectives

Program Goals and Objectives

The ~~faculty educational objectives~~ of the Biological Engineering program ~~seeks at the University of Arkansas are~~ to **provide a challenging technical education in a safe, secure and inclusive learning environment that promotes a desire for service and prepares** ~~produce~~ graduates to:

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

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

Learning Outcomes

Learning Outcomes

Completion of degree requirements provides graduates with the following learning outcomes: ~~In order to prepare graduates to attain our Educational Objectives, the following student outcomes were defined:~~

- 1) ~~a)~~ An ability to **identify, formulate, apply knowledge of mathematics, science,** and **solve complex engineering problems by applying principles of engineering, science, and mathematics.** ~~engineering.~~
- 2) ~~b)~~ An ability to **apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare,** ~~conduct experiments~~; as well as **global, cultural, social, environmental, analyze** and **economic factors.** ~~interpret data.~~

Learning Outcomes

3) An ability to communicate effectively with a range of audiences. ~~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.~~

4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. ~~d) An ability to function on multidisciplinary teams.~~

5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. ~~e) An ability to identify, formulate, and solve engineering problem.~~

6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. ~~f) An understanding of professional and ethical responsibility.~~

7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. ~~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
Eliminate ENGL 1023 as an alternate to ENGL 1033.	ENGL 1023 is not listed as meeting General Education Learning Outcome 1.2 at this time.

Description of specific change	Justification for this change
<p>Limit the choices for one of the Social Science Electives (University Core) to:</p> <p>ANTH 1023 COMM 1023 GEOS 2003 GEOS 2003H HDFS 1403 HDFS 2413 HDFS 2603 HIST 1113 HIST 1113H HIST 1123 HIST 1123H HIST 2093 HUMN 1114H HUMN 2114H PLSC 2013 RESM 2853.</p>	<p>These courses will meet General Education Learning Outcome 4.1.</p>
<p>Limit the choices for the Fine Arts Elective (University Core) to:</p> <p>ARHS 1003 COMM 1003 DANC 1003 MLIT 1003 MLIT 1003H MLIT 1013 MLIT 1013H MLIT 1333 THTR 1003 THTR 1013</p>	<p>These courses will meet General Education Learning Outcome 3.1.</p>

Description of specific change	Justification for this change
Limit the choices for the Humanities Elective (University Core) to: CLST 1003 CLST 1013 PHIL 2003 PHIL 2003C PHIL 2003H PHIL 2103 PHIL 2103C	These courses will meet General Education Learning Outcomes 3.2 and 5.1.
Notes were added to indicate which courses satisfied the General Education Learning Outcomes: 1.1., 1.2, 2.1, 3.1, 3.2, 3.3, 3.4, 4.1, 4.2, 5.1 and 6.1, respectively.	This will help the student to see how their program meets the General Education requirements.
Additional narrative changes (e.g., educational objectives and student outcomes) were added to make this consistent with narrative in the existing catalog, and to better describe the availability of the Environmental Concentration.	To make sure the student has consistent and clear information about the program.

Upload attachments

Reviewer Comments

Norman Dennis (ndennis) (03/18/20 8:54 am): Rollback: Can you add a comment in each of the courses or selection of courses that indicates which outcome(s) in the gen ed program the course or selection from a list of courses meets. I have not done a complete analysis but it seems your lists of course may to too generous and would allow a student not to satisfy all outcomes.

Alice Griffin (agriffin) (05/06/20 1:20 pm): Revised formatting of the eight semester plan to provide consistency with the General Education curriculum language. Removed course titles in footnotes and hyper-linked courses for access to details.

Alice Griffin (agriffin) (05/08/20 1:44 pm): Added statement in program requirements regarding the 40 hour rule with permission from the college dean's office.

Lisa Kulczak (lkulcza) (10/27/20 12:19 pm): Per email from Norm Dennis, updated ABET info/link in program requirements.

Manuel Rossetti (rossetti) (01/12/21 4:34 pm): Rollback: Rollback to allow change with FEP science elective and Physics 1 to be addressed.