PURDUE UNIVERSITY | College of Engineering

Engineering Faculty Document
No.: EFD 50-24
November 29, 2023

TO: The Engineering Faculty

FROM: The Faculty of the Department of Agricultural & Biological Engineering

RE: Curriculum and Course Changes – Biological Engineering Plan of Study

The faculty of the Department of Agricultural & Biological Engineering has approved the following changes to the curriculum for Biological Engineering. The requested changes to the course titles, sequencing, concentrations offered, and plan of study aim to increase cohesion in the Biological and to add flexibility to student schedules. The effort was made possible through the *Agile Reform of Curriculum* grant from the College of Engineering.

Summary of Changes:

1. Remove MA 303 from the plan of study.
2. Update ABE 227 to ABE 327
3. Update titles for 13 courses in the curriculum.
4. Shift from five separate plans of study – each with a regimented concentration – to single plan of study with more flexible optional concentrations.
5. A more succinct and structured plan for providing Biological Engineering students with a sufficient background in biology has been added.
6. Add a 1 credit course on biochemical laboratory techniques for biological engineers.
7. The overall plan of study will be modified to accommodate the changes in points 1 through 6.

Rationale:

1. MA 30300 was added to the BE plan in Fall 2014 to provide students training in partial differential equations (PDE). However, this addition has not resulted in student mastery of PDE's as needed for our courses. To increase flexibility and reduce credit hours, we will adjust content in both ABE 30100 and ABE 30700 to include PDE at the depth needed for our students.
2. ABE 22700 is currently listed as a sophomore level course, but it is much better suited to students in their junior year as reflected in the plan of study and when students actually enroll in the course. ABE 22700 will now be ABE 32700. Appropriate prerequisites for ABE 32700 are listed in the supporting documents. See Supporting Documentation for additional information.

3. To improve cohesion, consistency, and to better match content, 13 courses will have altered titles. Biological Engineering courses are currently varied in title with some courses as "Biological Engineering" and others as "Biological Systems" or "Bioprocess Engineering", a consistency shift in course title will increase cohesion to the plan of study. Table 1 in the **Supporting Documentation** shows both the current and proposed course titles.
4. Currently, the Biological Engineering concentrations are directly tied to separate plans of study. The current plans of study are: Biological Engineering – No concentration, BioEnvironmental Engineering, Cellular and Biomolecular Engineering, Pharmaceutical Process Engineering, and Food and Biological Process Engineering. Going forward, a single plan of study with 9 credit hours reserved within the plan to accommodate the optional concentrations will be shared by all BE students. All Biological Engineering students will be advised under a single plan and will be able to select courses to best fit their interests within a departmentally administered optional concentration list. Students will now have three common semesters in the Biological Engineering curriculum before they choose to differentiate into their preferred concentration. This will allow students additional time in the program to determine their specific interests before they affiliate themselves with a more specialized course path. The optional concentrations will enable students to study an area more in-depth to better prepare them for their individual career goals. The list of courses to be considered within the optional concentrations is included in the **Supporting Documentation**.
5. Our biological engineering students have a need for a stronger background in biology and biochemistry. Our current plans of study provide students options for biological science selectives. While this practice can be useful for students, we have determined that not all students have been provided with sufficient background in biological principles. We want to shift from the selectives model to a more prescribed set of biology courses. This shift will provide our students with more biology earlier in their curriculum so that they will be more successful in downstream BE courses. ***We would now require ABE 22600, BIOL 22100, 23000, and BCHM 30700***. The implementation is shown in the supplemental documentation.
6. BE students need more hands-on experiences and proper training in laboratory techniques for continued success in the fast-paced biotech space that awaits many of them post-graduation. The prescribed biology/biochemistry course set would have included BCHM 30900 – the laboratory course associated with BCHM 30700. However, this course is already beyond capacity and cannot accommodate our students if made a requirement.

The Biological Engineering faculty would instead prefer to create a laboratory course that will better fit the educational needs of a BE student. This new course will combine biological and biochemical lab techniques and instrumentation geared towards Biological Engineers. The new 1-credit course – ***ABE 30200: Biochemical Laboratory Techniques for Biological Engineers*** – will provide BE students with additional practical hands-on experiences. We will be able to layer in laboratory modeling and design that BCHM 30900 would not be able to offer our students. ABE 30200 will be taught by Dr. Abby Engelberth in the fall semester. All BE students would be required to take ABE 30200 and it will be included in the BE foundational course set. See the supplemental documentation for syllabus.

7. Bullets 1 through 6 culminate in overall plan of study changes to the BE curriculum. In addition to these changes we will also implement the following changes:
    a. ABE 30100 will be moved from semester 6 to semester 5; a spring to fall course change. This will introduce students to some of the PDE math concepts sooner since MA 30300 will be removed from the plan of study in semester 5.
    b. ABE 37000 will be moved from semester 5 to semester 6; fall to spring course offering change. This will enable students to more effectively use the math concepts learned in ABE 30100 and 30700.
    c. The plan of study now has a set of biological engineering foundational courses that have been identified. These are common to all BE students and will be used to set the stage for the BE capstone experience. These courses are shown in Green in the flowchart in the Supporting Documentation
    d. Pre-requisites have been updated to reflect content changes or to ensure that all courses have the correct pre-requisites listed. The updated pre-requisites match what is shown in the flowchart presented the supporting documentation.

    The new plan of study is shown in the **Supporting Documentation**. Included is the plan in both tabular form as well as a flowchart.

Head/Director of the Department of Agricultural & Biological Engineering

Link to Curriculog entry:

Curriculum updates will require multiple Curriculug Proposal (one for each updated course) and Submission of Plans of Study Changes through the Registrar's Curriculum Update Process.

Supporting Documentation

Point 2

Department of Agricultural & Biological Engineering

Proposed Course Expiration or Modification
(College of Engineering Undergraduate)

Department: Agricultural & Biological Engineering

Contact: Abigail S Engelberth

A. Expiration of a course

Prefix Course#- Click here to enter text.

Course Title Click here to enter text.

Justification: [short phrase will suffice] Click here to enter text.

Expected Impact to other Programs: Click here to enter text.

B. Modifications of a course

Prefix Course#- ABE 22700

Course Title Biotechnology Laboratory II

Proposed Change: ABE 32700

Justification: [short phrase will suffice] ABE 22700 is currently listed as a sophomore level course, but it is much better suited to students in their junior year as reflected in the plan of study and when students actually enroll in the course. Prerequisite courses will now include ABE 22600 and BIOL 22100 with BCHM 30700 as a co-requisite.

Expected Impact to other Programs: No expected impact to other programs

Point 3. Course titles to be changed

ABE COURSE #	CURRENT NAME	PROPOSED NAME
201	Thermodynamics in Biological Systems I	Material and Energy Balances in Biological Engineering
202	Thermodynamics in Biological Systems II	Thermodynamics in Biological Engineering
301	Numerical and Computational Modeling in Biological Engineering	Modeling and Computational Tools in Biological Engineering
303	Applications of Physical Chemistry to Biological Processes	Physical Chemistry in Biological Engineering
304	Bioprocess Engineering Laboratory	Biological Engineering Laboratory
307	Momentum transfer in food and biological systems	Momentum Transfer in Biological Engineering
370	Biological and Microbial Kinetics and Reaction Engineering	Reaction Kinetics in Biological Engineering
440	Cell and Molecular Design Principles	Cell and Molecular Modeling in Biological Engineering
457	Transport Processes in Biological Engineering	Unit Operations in Biological Engineering
557	Transport Operations in Food and Biological Systems II	Biological Engineering Process Design I
558	Process Design for Food and Biological Systems	Biological Engineering Process Design II
580	Process Engineering of Renewable Resources	Advanced Processes in Biological Engineering

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Point 4: Optional Concentrations and corresponding course selections

Prerequisites are listed in *italics*.

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Biological Engineering Selectives List

Γ, Π	(2)	ABE 32700 Biotechnology Laboratory II	(ABE 22600, BIOL 22100, BCHM 307 co-req)
Π	**(3)**	**ABE 51100 Drug Development**	**(ABE 22600 and 22700)**
β	(3)	AGRY 25500 Soil Science	
Γ	**(3)**	**AGRY 32000 Genetics**	
Γ	(3)	BIOL 24100 Biology IV: Genetics and Molecular Biology	(BIOL 23000 & CHM 11600)
β	**(3)**	**BIOL 48300 Great Issues: Environmental and Conservation Biology**	**(BIOL 11000 or BIOL 11100 or BIOL 12100 or BIOL 28600 or BIOL 58500 or BIOL 24100)**
β	(3)	EEE 35500 Engineering Environmental Sustainability	
Φ	**(1)**	**FS 36100 Food Plant Sanitation**	**8 Credits in BIOL**
Φ	(3)	FS 36200 Food Microbiology	(BCHM 30700 and BIOL 22100)
Φ	**(2)**	**FS 36300 Food Microbiology Laboratory**	**(FS 36200 co-req)**
Φ	(3)	FS 45300 Food Chemistry	(BCHM 30700)
Π	**(4)**	**IPPH 56200 Introduction to Pharmaceutical Manufacturing Processes**	**(CHE 34800, ABE 37000)**
Φ	(4)	NUTR 20500 Food Science I	(CHM 11600)
Φ	**(3)**	**NUTR 31500 Fundamentals of Nutrition**	**(BIOL 13100 or CHM 11600)**
Π	(3)	PHRM 42800 Dosage Forms I	
Π	**(2)**	**PHRM 42900 Dosage Forms II**	**(PHRM 428)**
β	(3)	POL 22300 Introduction to Environmental Policy	
β, Φ, Π	**(3)ε**	**ABE 31400 Design of Electronic Systems**	**(MA26200)**
β	(4)ε	ABE 32500 Soil and Water Resource Engineering	(AGRY 25500 co-req and MA 26200)
β	**(3)ε**	**ABE 42500 Water Quality Engineering**	**(ABE 32500)**
β	(3)ε	ABE 42600 Ecological Restoration Engineering	(ABE 32500)
Γ	**(3)ε**	**ABE 44000 Cell and Molecular Modeling**	**(MA 26200, BIOL 23000)**
Γ, Φ, Π	(3)ε	ABE 58000 Advanced Processes in Biological Engineering	(ABE 37000 or CHE 34800)
Φ, Π	**(3)ε**	**ABE 59100 Principles of Sustainable Biomanufacturing**	
Γ	(3)ε	BME 47000 Biomolecular Engineering	(BIOL 23000)
Γ	**(3)ε**	**BME 55100 Tissue Engineering**	**(BIOL 23000 or MA26600)**
β	(3)ε	CE 35000/EEE 35000 Environmental Engineering	(MA 16200, PHYS 17200, CHM 11600)
Φ	**(3)ε**	**CHE 30600 Design Of Staged Separation Processes**	
Γ, Φ, Π	(3)ε	CHE 52500* Biochemical Engineering	(CHE 34800)
Π	**(3)ε**	**CHE 55300 Pharmaceutical Process Development and Design**	

Key for courses associated with optional concentrations

- **β** Bioenvironmental
- **Γ** Cellular and Biomolecular Engineering
- **Φ** Food and Biological Process Engineering
- **Π** Pharmaceutical Process Engineering

At least 6 credits must be ENGR as denoted by ε

***Students cannot earn credit in both CHE 52500 and ABE 58000**

Students may not receive more than one concentration unless they take an additional 9 credits to independently fulfill each concentration.

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Point 6: New 1-credit laboratory course – ***ABE 30200: Biochemical Laboratory Techniques for Biological Engineers***

Department of Agricultural and Biological Engineering (ABE)
Proposed Course and Curricular Changes
College of Engineering Undergraduate

A. **COURSES TO BE ADDED**
Prefix and Course Number: ABE 30200
Long Title: Biochemical Laboratory Techniques for Biological Engineers

Note: *See below for tentative syllabus*

B. **CURRICULAR CHANGES**
Proposed Changes:
Justification/Rationale:

Expected Impact to other Programs:

Note: Plans of study should be marked in green for additions and red for deletions. If appropriate, this should be included with the submission.

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Supporting Documentation for ABE 30200

A. **Short Title**: BE Biochem Lab

B. **Semester Offered**: Fall

C. **Schedule Type and Hours:** 1 credit lab – LAB/110/1/16

D. **Credits**: 1 credit lab

E. **Justification for the course:** BE students need more hands-on experiences and proper training in laboratory techniques for continued success in the fast-paced biotech space that awaits many of them post-graduation. BCHM 30900 – the laboratory course associated with BCHM 30700 – could have served as a potential source for the much needed additional hands-on experience. However, BCHM 30900 course is already beyond capacity and cannot accommodate our students if made a requirement. T

   The Biological Engineering faculty will instead create a laboratory course that will better fit the educational needs of our BE students. This new course will combine biological and biochemical lab techniques and instrumentation geared towards Biological Engineers. The new 1-credit course – ***ABE 30200: Biochemical Laboratory Techniques for Biological Engineers*** – will provide BE students with additional practical hands-on experiences. We will be able to layer in laboratory modeling and design that BCHM 30900 would not be able to offer our students. ABE 30200 will provide an avenue for BE students to master basic laboratory techniques while allowing for greater depth in experimental design than BCHM 30900 could have offered.

F. **Expected impact to other programs**: Open additional slots in BCHM 30900 for students not in Biological Engineering. BCHM 30900 is a service course – currently with a waitlist – that is taken by many students in the College of Agriculture. Creation of ABE 30200 will allow students from other majors access to BCHM 30900 in a more timely manner.

G. **Course description for University Catalog**:

H. **Requisites (Pre-Reqs/Co-Reqs/concurrent pre-req):** Pre-Req: ABE 22600, Co-Req: BCHM 30700

I. **Restrictions:** The course is intended for undergraduate biological engineering students.

J. **Learning Outcomes:** Upon completion of the course, the student will be able to:

1. Perform statistical analysis on collected data to produce results to be interpreted and disseminated both written and orally.
2. Demonstrate proficiency in the following lab skills:
   - Read and understand both digital and analog outputs
   - Liquid handling and dilutions
   - Protein purification and determination assays
   - Column chromatography
   - Spectrophotometric assays
   - Enzyme activity assays
3. Understand and apply scientific methods of experimental design and analysis.

K. Instructor Information: Abigail Engelberth, ABE 2041B; aengelbe@purdue.edu

Course Title: ***Biochemical Laboratory Techniques for Biological Engineers***

Laboratory Meeting Days and Times: M or W 9:30-11:20 or 11:30-1:20 in ABE B073

Meeting time will depend on enrollment and laboratory availability

Proposed Schedule:

Week	Experiment/Topic
1	Lab Introduction: Lab Technique Boot camp
2	Lab Introduction: Acids, bases and buffers
3	Lab Introduction: Spectrophotometry
4	Lab Introduction: Instrumentation, Valves, and Meters
5	Lactate Dehydrogenase Purification I: Salt precipitation week 1.
6	Lactate Dehydrogenase Purification I: Salt precipitation week 2.
7	Lactate Dehydrogenase Purification II: Gel Filtration Chromatography.
8	Lactate Dehydrogenase Purification III: Ion Exchange Chromatography.
9	Midterm Practical Exam
10	Experimental Design
11	Cellobiase purification I: Salt precipitation
12	Cellobiase purification II: Gel Filtration Chromatography
13	Cellobiase purification III: Ion exchange Chromatography
14	Design Project Introduction
15	Design Project in Practice
16	Final Report

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Point 7a-c: Proposed curriculum views

- List of required courses
- Eight Semester Plan
- Selective List
- Eight Semester Plan - flow chart view

Departmental/Program Major Courses (51 credits)

Required Major courses (44 credits)

_____ (4) ABE 20100 Material and Energy Balances in Biological Engineering
_____ (3) ABE 20200 Thermodynamics in Biological Engineering
_____ (2) ABE 22600 Biotechnology Laboratory I **(satisfies College of Agriculture: Biological Science Selective)**
_____ (1) ABE 29000 Sophomore Seminar ***(satisfies UCC Science, Technology & Society requirement)***
_____ (3) ABE 30100 Modeling and Computational Tools in Biological Engineering
_____ (1) ABE 30200 Biochemical Laboratory Techniques for Biological Engineers
_____ (3) ABE 30300 Physical Chemistry in Biological Engineering
_____ (3) ABE 30400 Biological Engineering Laboratory
_____ (3) ABE 30700 Momentum Transfer in Biological Engineering
_____ (3) ABE 30800 Heat and Mass Transfer in Food and Biological Systems
_____ (3) ABE 37000 Reaction Kinetics in Biological Engineering
_____ (3) ABE 45700 Unit Operations in Biological Engineering
_____ (3) ABE 46000 Sensors and Process Control
_____ (1) ABE 49000 Professional Practice in Agricultural and Biological Engineering
_____ (3) ABE 55700 Biological Engineering Process Design I
_____ (3) ABE 55800 Biological Engineering Process Design II

Biological Engineering Major Selectives (9 credits)

_____ (9) ABE Engineering Selectives (three or more courses)

Other Department/Program Course Requirements (77-79 credits)

_____ (2) ENGR 13100 Transforming Ideas to Innovation I ***(satisfies UCC Information Literacy requirement)***
_____ (2) ENGR 13200 Transforming Ideas to Innovation II
_____ (4) BIOL 22100 Introduction to Microbiology (satisfies College of Agriculture: Biological Science Selective)
_____ (3) BIOL 23000 (satisfies College of Agriculture: Biological Science Selective)
_____ (3) BCHM 30700 Biochemistry
_____ (3) CHE 32000 Statistical Modeling and Quality Enhancement
_____ (4) CHM 11500 General Chemistry I ***(satisfies a UCC Science requirement)***
_____ (4) CHM 11600 General Chemistry II **(Recommended FYE selective)** ***(satisfies a UCC Science requirement)***
_____ (4) CHM 25700 Organic Chemistry *(or (3) CHM 25500 Organic Chem + (1) CHM 25501 Organic Chem I Lab)*
_____ (4) CS 177 Programming with Multiple Options
_____ (4) MA 16500 Analytic Geometry & Calculus I (or (5) MA 16100) **(satisfies UCC *Quantitative Reasoning requirement*)**
_____ (4) MA 16600 Analytic Geometry & Calculus II (or (5) MA 16200)
_____ (4) MA 26100 Multivariate Calculus
_____ (4) MA 26200 Linear Algebra and Differential Equations
_____ (4) PHYS 17200 Modern Mechanics
_____ (3) Economics Selective ***(satisfies UCC Human Cultures: Behavioral/Social Sciences requirement)***
_____ (3) Human Cultures: Humanities Selective ***(satisfies UCC Human Cultures: Humanities requirement)***
_____ (6) Humanities or Social Science Selective
_____ (3) Humanities or Social Science Selective (30000+ level)
_____ (3) Oral Communication Selective ***(satisfies UCC Oral Communication requirement)***
_____ (3) Written Communication Selective ***Written Communication requirement)***
_____ (3) Written or Oral Communication Selective (20000+ level)
_____ International Understanding (6 credits - may be met with UCC or COA Core Requirements)
_____ Multicultural Awareness (3 credits - may be met with UCC or COA Core Requirement)

Electives (0-1 credits)

_____ (0-1) _____

129 semester credits required for degree completion. 2.0 Graduation GPA required for Bachelor of Science degree. The student is ultimately responsible for knowing and completing all degree requirements. The myPurduePlan powered by Degree Works is the knowledge source for specific requirements and completion.

PURDUE UNIVERSITY

Biological Engineering, BSBE
Department of Agricultural and Biological Engineering

Fall 2023

Catalog Term: 202410

Program: BE-BSE

Major: BIEN

Suggested Arrangement of Courses
Note that course placement is dependent upon both pre-requisite requirements as well as limited offering terms
(ABE courses ONLY offered in Fall or Spring terms – not both)
Please see your academic advisor for other options creating your personalized plan of study

PRE-ABE/FYE Curriculum – must earn C- or higher in all Pre-ABE/FYE courses to transition to major					
Credits	Fall 1st Year	Prerequisite	Credits	Spring 1st Year	Prerequisite
4	**CHM 11500***	pre/co: MA 16100/16500	4	**CHM 11600*§**	CHM 11500
2	**ENGR 13100***		2	**ENGR 13200**	ENGR 13100
4-5	**MA 16500* or MA 16100**	min. ALEKS score=85	4-5	**MA 16600 or MA 16200**	MA 16100/16500 (≥ C-)
3	Economics Selective		4	**PHYS 17200***	pre/co: MA 16100/16500
3	Written Communication Selective*		3	Oral Communication Selective*	
16-17			**17-18**		

Credits	Fall 2nd Year	Prerequisite	Credits	Spring 2nd Year	Prerequisite
4	**ABE 20100†**	CHM 11600, MA 16200/16600	3	**ABE 20200‡**	ABE 20100, MA 26100 (≥ C-)
2	**ABE 22600**		4	**BIOL 22100**	
1	**ABE 29000†**		3	**CHE 32000‡**	ABE 20100, CHM 25700, pre/co: MA 26100 (≥ C-)
3	**BIOL 23000**		4	**CS 17700**	
4	**MA 26100**	MA 16200/16600 (≥ C-)	4	**MA 26200**	MA 26100 (≥ C-)
4	**CHM 25700 or CHM 25500+25501**	CHM 11600			
18			**18**		

Credits	Fall 3rd Year	Prerequisite	Credits	Spring 3rd Year	Prerequisite
3	**ABE 30100†**	CS 17700, pre/co: ABE 30700	3	**ABE 30400‡**	co: ABE 30800
1	**ABE 30200†**		3	**ABE 30800‡**	ABE 30700
3	**ABE 30300†**	ABE 20200, CHM 25700, or CHM 25500/CHM 25501 pre/co: ABE 30700	3	**ABE 37000‡**	CHM 25700, MA 30300, (≥ C-) BIOL 22100 or 23000 or 23100
3	**ABE 30700†**	ABE 20200, pre/co: MA 26200	3	**ABE 45700‡**	co: ABE 30800
3	**BCHM 30700**		3	Biological Engineering Selective	
3	Written or Oral Communication Selective (20000+)				
16			**15**		

Credits	Fall 4th Year	Prerequisite	Credits	Spring 4th Year	Prerequisite
3	**ABE 46000‡**	MA 26200 (≥ C-)	3	**ABE 55800‡**	ABE 55700
1	**ABE 49000†**	ABE 29000	3	Biological Engineering Selective	
3	**ABE 55700†**	ABE 45700	3	Human Cultures: Humanities Selective	
3	Biological Engineering Selective		3	Humanities or Social Science Selective	
3	Humanities or Social Science Selective		3	Humanities or Social Science Selective (30000+)	
1	Elective				
14			**15**		

* Fulfills University Undergraduate Core Curriculum Requirement.
§ Fulfills FYE selective for Biological Engineering
† Indicates Fall only course
‡ Indicates Spring only course
International Understanding **(6 credits) and** Multicultural Awareness **(3 credits) may be met with UCC or COA Core Requirements).**
129 semester credits required for degree completion. 2.0 Graduation GPA required for Bachelor of Science degree. The student is ultimately responsible for knowing and completing all degree requirements

Biological Engineering Selectives (9 Credits)

Biological Engineering Selectives (6-9 credits)

- ABE 31400 Design of Electronic Systems
- ABE 32500 Soil and Water Resource Engineering
- ABE 42500 Water Quality Engineering
- ABE 42600 Ecological Restoration Engineering
- ABE 44000 Cell and Molecular Modeling
- ABE 58000 Advanced Processes in Biological Engineering
- ABE 59100 Principles of Sustainable Biomanufacturing
- BME 47000 Biomolecular Engineering
- BME 55100 Tissue Engineering
- CE 35000/EEE 35000 Environmental Engineering
- CHE 30600 Design Of Staged Separation Processes
- CHE 52500* Biochemical Engineering
- CHE 55300 Pharmaceutical Process Development and Design

Biological Science and Technical Selectives (0-3 credits)

- ABE 32700 Biotechnology Laboratory II
- ABE 51100 Drug Development
- AGRY 25500 Soil Science
- AGRY 32000 Genetics
- BIOL 24100 Biology IV: Genetics and Molecular Biology
- BIOL 48300 Great Issues: Environmental and Conservation Biology
- EEE 35500 Engineering Environmental Sustainability
- FS 36100 Food Plant Sanitation
- FS 36200 Food Microbiology
- FS 36300 Food Microbiology Laboratory
- FS 45300 Food Chemistry
- IPPH 56200 Introduction to Pharmaceutical Manufacturing Processes
- NUTR 20500 Food Science I
- NUTR 31500 Fundamentals of Nutrition
- PHRM 42800 Dosage Forms I
- PHRM 42900 Dosage Forms II
- POL 22300 Introduction to Environmental Policy

Biological Engineering Concentrations

Bioenvironmental Engineering Concentration (9 credits)

Bioenvironmental Engineering Selective (6-9 credits)

- ABE 31400 Design of Electronic Systems
- ABE 32500 Soil and Water Resource Engineering
- ABE 42500 Water Quality Engineering
- ABE 42600 Ecological Restoration Engineering
- CE 35000/EEE 35000 Environmental Engineering

Bioenvironmental Selective (0-3 credits)

- AGRY 25500 Soil Science
- EEE 35500 Engineering Environmental Sustainability
- POL 22300 Introduction to Environmental Policy
- BIOL 48300 Great Issues: Environmental and Conservation Biology

Cellular and Biomolecular Engineering Concentration (9 credits)

Cellular and Biomolecular Engineering Selective (6-9 credits)

- ABE 44000 Cell and Molecular Modeling
- ABE 58000 Advanced Processes in Biological Engineering
- BME 47000 Biomolecular Engineering
- CHE 52500 Biochemical Engineering
- BME 55100 Tissue Engineering

Cellular and Biomolecular Selective (0-3 credits)

- ABE 32700 Biotechnology Laboratory II
- AGRY 32000 Genetics
- BIOL 24100 Biology IV: Genetics and Molecular Biology

Food and Biological Process Engineering Concentration (9 credits)

Food and Biological Process Engineering Selective (6-9 credits)

- ABE 31400 Design of Electronic Systems
- ABE 58000 Advanced Processes in Biological Engineering
- CHE 30600 Design Of Staged Separation Processes
- CHE 52500 Biochemical Engineering

- ABE 59100 Principles of Sustainable Biomanufacturing

Food and Biological Process Selective (0-3 credits)

- NUTR 20500 Food Science I
- NUTR 31500 Fundamentals of Nutrition
- FS 36200 Food Microbiology
- FS 36300 Food Microbiology Laboratory
- FS 36100 Food Plant Sanitation
- FS 45300 Food Chemistry

Pharmaceutical Process Engineering Concentration (9 credits)

Pharmaceutical Process Engineering Selective (6-9 credits)

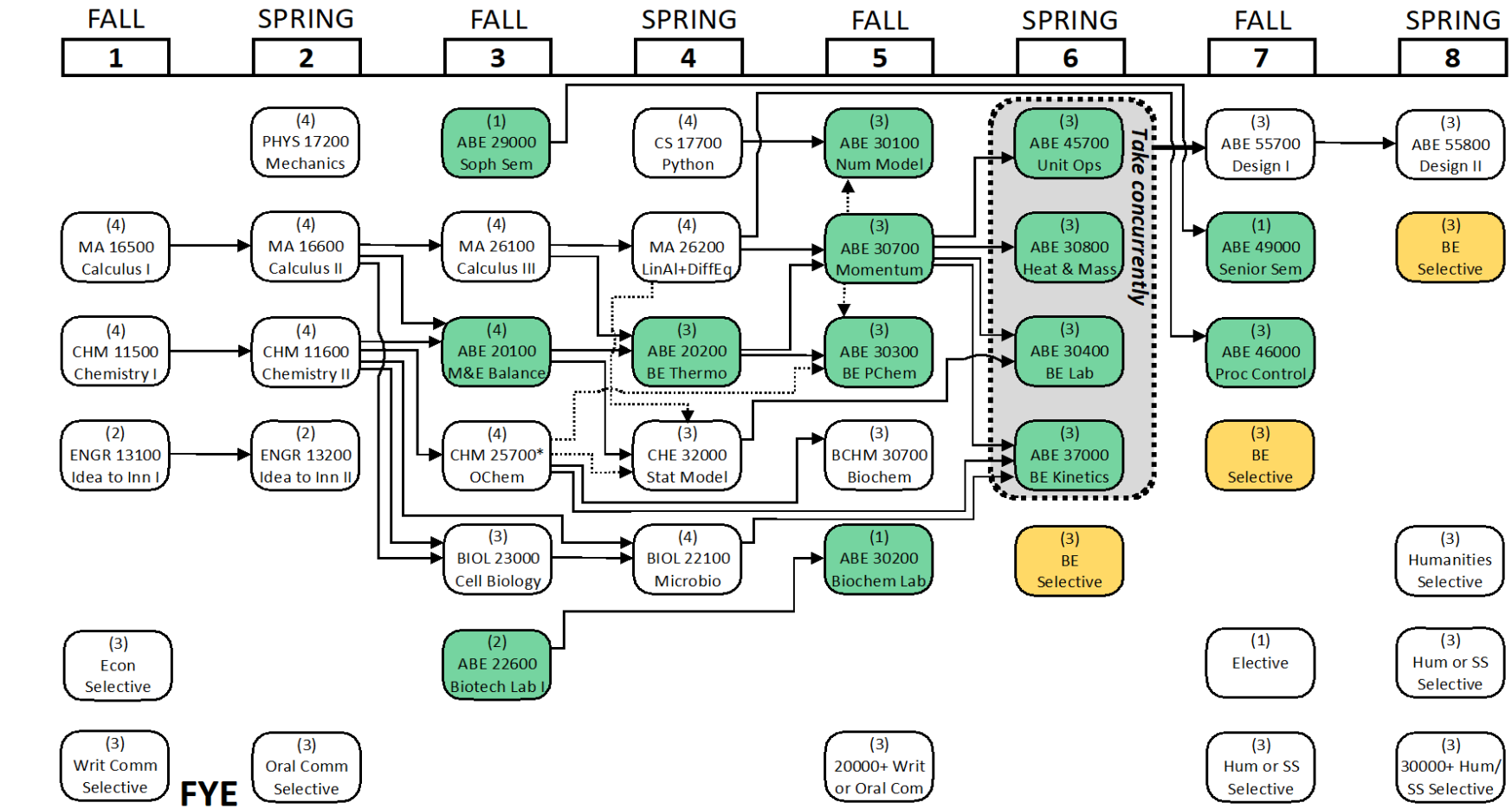
- ABE 31400 Design of Electronic Systems
- ABE 58000 Advanced Processes in Biological Engineering
- CHE 52500 Biochemical Engineering
- CHE 55300 Pharmaceutical Process Development and Design
- ABE 59100 Principles of Sustainable Biomanufacturing

Pharmaceutical Process Selective (0-3 credits)

- ABE 32700 Biotechnology Laboratory II
- ABE 51100 Drug Development
- IPPH 56200 Introduction to Pharmaceutical Manufacturing Processes
- PHRM 42800 Dosage Forms I
- PHRM 42900 Dosage Forms II

2024-2025

BIOLOGICAL ENGINEERING



CREDITS: 16 17 18 18 16 15 14 15 = 129

Pre-requisite

Co-requisite

B / A — Lines A and B do not interact

: ABE foundational course

: BE Selective option

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engineering.purdue.edu/ABE

purdue.edu/registrar

Taking courses in the listed semesters is recommended. See the course catalog or an ABE academic advisor for complete degree requirement information. Selective information.

*: May be replaced with CHEM 25500 + 25501

Point 7d: Updated ABE Course Prerequisites

ABE Course Number	Current Pre-requisites	Updated Pre-requisites
ABE 20100	CHM 11600	CHM 11600, MA16600
ABE 20200	MA 26100, ABE 20100	No change
ABE 22600	None	No change
ABE 30100	ABE 37000, CS 15900 or CS 17700, MA 30300,	CS 17700, pre/co ABE 30700
ABE 30300	ABE 20200, CHM 25700, co: ABE 30700	No change
ABE 30400	Pre/co ABE 30800	ABE 30700, CHE 32000, pre/co: ABE 30800, 37000, 45700
ABE 30700	ABE 20200, MA 26200	ABE 20200, MA 26200, pre/co ABE 30100 and ABE 30300
ABE 30800	ABE 30700	ABE 30700, pre/co: ABE 30400, 37000, 45700
ABE 32700	ABE 22600	ABE 22600, BIOL 22100, co: BCHM 30700
ABE 37000	CHM 25700, MA 26200, (≥ C-) BIOL 22100 or 23000 or 23100	ABE 30700, BIOL 22100, CHM 25700, pre/co: ABE 30400, 30800, 45700
ABE 45700	co: ABE 30800	ABE 30700, pre/co: ABE 30400, 30800, 37000
ABE 46000	MA 26200	No change
ABE 55700	ABE 45700	ABE 30400, 30800, 37000, 45700
ABE 55800	ABE 55700	No change

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