

Bioengineering BS BIOE with Cellular Engineering Concentration

Overview

The **Bachelor of Science in Bioengineering** is offered by the Department of Bioengineering.

The Bioengineering program integrates engineering science, rigorous mathematical tools and a quantitative approach to the life sciences and applies this spectrum of knowledge in an interdisciplinary fashion to provide solutions to basic and applied biological and medical problems. This goal will be accomplished by offering to the students an integrated set of courses aimed at providing a thorough introduction to the complex and interdisciplinary field of Bioengineering:

- Teach engineering science, analysis, and design in the context of quantitative approaches to solving life science and medicine-related problems.
- Integrate interdisciplinary aspects of biology, physiology, and engineering within courses and design projects.
- Emphasize the interdisciplinary nature of Bioengineering, in terms of problem solving, design, within the framework of interdisciplinary teams focusing on the dialogue between "biology-inspired engineering" and "biology as a specific arm of applied engineering principles."
- Immerse students in key life science and medical principles, while focusing on understanding cell/molecular-level events through quantitative analysis and modeling.
- Provide an exceptional learning environment with significant instruction by Bioengineering faculty and researchers in collaboration with experts from other fields, especially the Health Science Campus.

In this curriculum, incoming students will first and foremost be trained as solid Temple engineers, focusing on applying engineering science, design, and analysis to real life problems specifically in the areas of biology and medicine. Hands-on engineering experience will be gained through intense laboratory coursework and by solving real-life biomedical problems.

Bioengineering study leads to careers in several fields.

Students **must select** from one of three **concentrations** in:

- Cellular Engineering,
- Engineering Devices, or
- Pre-Health.

Cellular Engineering Concentration

A **concentration in Cellular Engineering** provides students with the skills to apply quantitative approaches to problem solving in cellular and molecular engineering, particularly as they relate to human health. A range of courses include design, development and uses of biomaterials; building functional tissues using cells and scaffolds; and repairing diseased tissues and organs at the cellular and molecular level. It also explores the host-biomaterial interface and interactions.

Campus Location: Main

Program Code: EN-BIOE-BSBE

Accreditation

The Bioengineering (BS) program is accredited by the Engineering Accreditation Commission of ABET, <https://www.abet.org>, under the General Criteria and Program Criteria for Bioengineering and Biomedical and Similarly Named Engineering Programs. ABET is a non-profit and non-governmental accrediting agency for academic programs in the disciplines of applied science, computing, engineering, and engineering technology recognized by the Council for Higher Education Accreditation (CHEA).

+1 Bachelor to Master's Accelerated Degree Program

High-achieving undergraduates can earn both a bachelor's degree and a master's degree within five years. Students apply for this program in sophomore year, and four graduate-level courses are taken in place of undergraduate requirements during junior and senior years. After the bachelor's degree is earned, one graduate-level course is taken in the summer followed by full-time study in the subsequent Fall and Spring semesters to complete the master's degree study. The following accelerated program is available:

- Bachelor of Science in Bioengineering and Master of Science in Bioengineering

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Learn more about the Bachelor of Science in Bioengineering.

These requirements are for students who matriculated in academic year 2023-2024. Students who matriculated prior to fall 2023 should refer to the Archives to view the requirements for their Bulletin year.

Summary of Requirements

University Requirements

All new students are required to complete the university's General Education (GenEd) curriculum.

All Temple students must take a minimum of two writing-intensive courses for a total of at least six credits. The writing-intensive course credits are counted as part of the major; they are not General Education (GenEd) or elective credits. The writing-intensive courses must be completed at Temple University and students may not transfer in credits to satisfy this requirement. The specific writing-intensive courses required for this major are:

Code	Title	Credit Hours
ENGR 2196 or ENGR 2996	Technical Communication Honors Technical Communication	3
ENGR 4296 or ENGR 4996	Capstone Senior Design Project Honors Capstone Senior Design Project	3

Department and Major Requirements

Code	Title	Credit Hours
Required Math & Basic Science Courses		
MATH 1041 or MATH 1941	Calculus I Honors Calculus I	4
MATH 1042 or MATH 1942	Calculus II Honors Calculus II	4
MATH 2043 or MATH 2943	Calculus III Honors Calculus III	4
Select one of the following:		3
MATH 2041 or MATH 2941	Differential Equations I Honors Differential Equations I	
MATH 3041 or MATH 3941	Differential Equations I Honors Differential Equations I	
Select one of the following:		4
BIOL 2112 or BIOL 2912	Introduction to Cellular and Molecular Biology Honors Introduction to Cellular and Molecular Biology	
BIOL 1112	Introduction to Biomolecules, Cells and Genomes	
CHEM 1031 or CHEM 1951	General Chemistry I Honors General Chemical Science I	3
CHEM 1033 or CHEM 1953	General Chemistry Laboratory I Honors Chemical Science Laboratory I	1
Select one of the following:		4
PHYS 1061 or PHYS 1961	Elementary Classical Physics I Honors Elementary Classical Physics I	
PHYS 2021	General Physics I	

or PHYS 2921	Honors General Physics I	
Select one of the following:		4
PHYS 1062	Elementary Classical Physics II	
or PHYS 1962	Honors Elementary Classical Physics II	
PHYS 2022	General Physics II	
or PHYS 2922	Honors General Physics II	

Required General Education Courses

Select one of the following:		4
ENG 0802	Analytical Reading and Writing	
ENG 0812	Analytical Reading and Writing: ESL	
ENG 0902	Honors Writing About Literature	
IH 0851	Intellectual Heritage I: The Good Life	3
or IH 0951	Honors Intellectual Heritage I: The Good Life	
IH 0852	Intellectual Heritage II: The Common Good	3
or IH 0952	Honors Intellectual Heritage II: The Common Good	
GenEd 08xx or 09xx (Human Behavior)		3
GenEd 08xx or 09xx (Race and Diversity)		3
GenEd 08xx or 09xx (Global/World Society)		3
GenEd 08xx or 09xx (U.S. Society)		3
GenEd 08xx or 09xx (Arts)		3

Required Bioengineering & Engineering Courses (Common for all Pathways)

BIOE 2001	Frontiers in Bioengineering	2
BIOE 2101	Engineering Principles of Physiological Systems	3
BIOE 3001	Research Design and Methods in Bioengineering	2
BIOE 3101	Bioelectrical Engineering Lab	3
BIOE 3102	Biomaterials Lab	3
BIOE 3201	Biomedical Instrumentation	2
BIOE 4101	Biomechanics Lab	3
BIOE 4311	The Entrepreneurial Bioengineer	3
ENGR 1101	Introduction to Engineering & Engineering Technology	3
or ENGR 1901	Honors Introduction to Engineering	
ENGR 1102	Introduction to Engineering Problem Solving	3
ENGR 2196	Technical Communication (WI)	3
or ENGR 2996	Honors Technical Communication	
ENGR 3571	Classical and Statistical Thermodynamics	3
Bioengineering Design Course - select one of the following:		3
BIOE 3402	Design Elective: Biodesign	
BIOE 3512		
BIOE 4279		
ENGR 4296	Capstone Senior Design Project (WI)	3
or ENGR 4996	Honors Capstone Senior Design Project	

Required Bioengineering Electives (minimum of 9 credits)

BIOE 2201	Modeling Fundamentals in Bioengineering	1.5
BIOE 2202	Programming Fundamentals in Bioengineering	1.5
BIOE 3303	Biotransport Phenomena	3
Select from the following list:		3
BIOE 2312	Mechanics for Bioengineering I	
BIOE 2401	Biodesign - Needs and Ideation	
BIOE 3302	Drug Delivery	
BIOE 3331	Principles of Macromolecular Science	
BIOE 3401	Biodesign - Testing and Validation	
BIOE 3511	Interactions of Biomaterials with Living Tissues	

BIOE 3725	Cell Biology for Engineers	
BIOE 4278	Cardiac Devices	
BIOE 3301	Biomedical Signals and Systems (with additional prerequisites)	
Required Technical Electives		
CHEM 1032	General Chemistry II	3
or CHEM 1952	Honors General Chemical Science II	
CHEM 1034	General Chemistry Laboratory II	1
or CHEM 1954	Honors Chemical Science Laboratory II	
CHEM 2201	Organic Chemistry I	3
or CHEM 2921	Organic Chemistry for Honors I	
CHEM 2203	Organic Chemistry Laboratory I	1
or CHEM 2923	Organic Honors Laboratory I	
CHEM 2202	Organic Chemistry II	3
or CHEM 2922	Organic Chemistry for Honors II	
CHEM 2204	Organic Chemistry Laboratory II	1
or CHEM 2924	Organic Honors Laboratory II	
CHEM 3401	Applications of Biochemistry	3
Bioengineering Capstone Course		
Select one of the following:		3
BIOE 4333	Capstone Elective: Applied Biospectroscopy	
BIOE 4411	Capstone Elective: Biomaterials	
BIOE 4431	Capstone Elective: Neuroengineering	
BIOE 4461	Capstone Elective: Principles of Tissue Engineering	
BIOE 4501	Capstone Elective: Regenerative Engineering	
BIOE 4555	Capstone Elective - Biophotonics: Seeing is Believing	
Free Electives		
Free Elective #1		3
Free Elective #2		3
Total Credit Hours		128

Suggested Academic Plan

Please note that this is a **suggested** academic plan. Depending on your situation, your academic plan may look different.

Bachelor of Science in Bioengineering with Concentration in Cellular Engineering

Suggested Plan for New Students Starting in the 2023-2024 Academic Year

Year 1		Credit Hours
Fall		
MATH 1041	Calculus I	4
or MATH 1941	or Honors Calculus I	
CHEM 1031	General Chemistry I	3
or CHEM 1951	or Honors General Chemical Science I	
CHEM 1033	General Chemistry Laboratory I	1
or CHEM 1953	or Honors Chemical Science Laboratory I	
ENGR 1101	Introduction to Engineering & Engineering Technology	3
or ENGR 1901	or Honors Introduction to Engineering	
ENG 0802	Analytical Reading and Writing	4
or ENG 0812	or Analytical Reading and Writing: ESL	
or ENG 0902	or Honors Writing About Literature	
Credit Hours		15
Spring		
MATH 1042	Calculus II	4
or MATH 1942	or Honors Calculus II	
Select one of the following:		4

PHYS 1061 or PHYS 1961	Elementary Classical Physics I or Honors Elementary Classical Physics I	
PHYS 2021 or PHYS 2921	General Physics I or Honors General Physics I	
BIOE 2001	Frontiers in Bioengineering	2
ENGR 1102	Introduction to Engineering Problem Solving	3
CHEM 1032 or CHEM 1952	General Chemistry II or Honors General Chemical Science II	3
CHEM 1034 or CHEM 1954	General Chemistry Laboratory II or Honors Chemical Science Laboratory II	1
Credit Hours		17
Year 2		
Fall		
MATH 2043 or MATH 2943	Calculus III or Honors Calculus III	4
Select one of the following:		4
PHYS 1062 or PHYS 1962	Elementary Classical Physics II or Honors Elementary Classical Physics II	
PHYS 2022 or PHYS 2922	General Physics II or Honors General Physics II	
CHEM 2201 or CHEM 2921	Organic Chemistry I or Organic Chemistry for Honors I	3
CHEM 2203 or CHEM 2923	Organic Chemistry Laboratory I or Organic Honors Laboratory I	1
BIOE 3001	Research Design and Methods in Bioengineering	2
Select one of the following:		4
BIOL 2112 or BIOL 2912	Introduction to Cellular and Molecular Biology or Honors Introduction to Cellular and Molecular Biology	
BIOL 1112	Introduction to Biomolecules, Cells and Genomes	
Credit Hours		18
Spring		
BIOE 3201	Biomedical Instrumentation	2
BIOE 2101	Engineering Principles of Physiological Systems	3
BIOE 3102	Biomaterials Lab	3
CHEM 2202 or CHEM 2922	Organic Chemistry II or Organic Chemistry for Honors II	3
CHEM 2204 or CHEM 2924	Organic Chemistry Laboratory II or Organic Honors Laboratory II	1
ENGR 3571	Classical and Statistical Thermodynamics	3
BIOE 2201	Modeling Fundamentals in Bioengineering	1.5
BIOE 2202	Programming Fundamentals in Bioengineering	1.5
Credit Hours		18
Year 3		
Fall		
BIOE 3101	Bioelectrical Engineering Lab	3
BIOE 3303	Biotransport Phenomena	3
IH 0851 or IH 0951	Intellectual Heritage I: The Good Life or Honors Intellectual Heritage I: The Good Life	3
ENGR 2196 or ENGR 2996	Technical Communication or Honors Technical Communication	3
Select one of the following:		3
MATH 2041 or MATH 2941	Differential Equations I or Honors Differential Equations I	

MATH 3041 or MATH 3941	Differential Equations I or Honors Differential Equations I	
Credit Hours		15
Spring		
CHEM 3401	Applications of Biochemistry	3
BIOE 4101	Biomechanics Lab	3
IH 0852 or IH 0952	Intellectual Heritage II: The Common Good or Honors Intellectual Heritage II: The Common Good	3
GenEd Breadth Course		3
Free Elective #1		3
Credit Hours		15
Year 4		
Fall		
Bioengineering Capstone - select one of the following:		3
BIOE 4333	Capstone Elective: Applied Biospectroscopy	
BIOE 4411	Capstone Elective: Biomaterials	
BIOE 4431	Capstone Elective: Neuroengineering	
BIOE 4461	Capstone Elective: Principles of Tissue Engineering	
BIOE 4501	Capstone Elective: Regenerative Engineering	
BIOE 4555	Capstone Elective - Biophotonics: Seeing is Believing	
Bioengineering Design Course - select one of the following:		3
BIOE 3402	Design Elective: Biodesign	
BIOE 3512		
BIOE 4279		
BIOE Elective		3
GenEd Breadth Course		3
GenEd Breadth Course		3
Credit Hours		15
Spring		
ENGR 4296 or ENGR 4996	Capstone Senior Design Project or Honors Capstone Senior Design Project	3
BIOE 4311	The Entrepreneurial Bioengineer	3
GenEd Breadth Course		3
GenEd Breadth Course		3
Free Elective #2		3
Credit Hours		15
Total Credit Hours		128
Code	Title	Credit Hours
Other Approved Technical Electives (check for prerequisites)		
BIOL 3096	Cell Structure and Function	4
BIOL 3352	Systems Neuroscience	3
CIS 1057	Computer Programming in C	4
ECE 2332 & ECE 2333	Principles of Electric Circuits and Principles of Electric Circuits Lab	5
ECE 3412 & ECE 3413	Classical Control Systems and Classical Control Laboratory	4
ECE 3512 or ECE 3912	Signals: Continuous and Discrete Honors Signals: Continuous and Discrete	4
ENGR 2011 or MATH 2101 or MEE 2011	Engineering Analysis & Applications Linear Algebra Linear Systems	3

ENGR 3117	Computer-Aided Design (CAD)	3
ENGR 3201	Material Science for Engineers	3
ENGR 3553	Mechanics of Fluids	3
or ENGR 3953	Honors Mechanics of Fluids	