BIOENGINEERING, BSE

Bioengineering is a multidisciplinary area where the engineering sciences interface biology, biomedical sciences, and medicine, to advance human health. Bioengineering brings together the creation of new knowledge and understanding of biological systems through engineering analysis and experimentation, with the application of engineering design and practice principles for the development of devices, processes, methods and biotechnologies to improve medical practice and health care delivery.

For more information: https://www.seas.upenn.edu/prospective-students/undergrad/majors/bioengineering/

Bioengineering (BE) Major Requirements

40.5 course units are required. Read more about the Undergraduate Student Handbook (http://www.seas.upenn.edu/undergraduate/handbook).

Code	Title	Course Units
Engineering		
BE 100	Introduction to Bioengineering	0.5
BE 101	Introduction to Bioengineering II	0.5
ENGR 105	Introduction to Scientific Computing	1
BE 200	Introduction to Biomechanics	1
BE 220	Biomaterials	1
BE 301	Bioengineering Signals and Systems	1
BE 305	Engineering Principles of Human Physiology	1
BE 306	Molecular Physiology and Cellular Engineering from Atoms to Disease	1
BE 309	Bioengineering Modeling, Analysis and Design Laboratory I	1
BE 310	Bioengineeirng Modeling, Analysis and Design Laboratory II	1
BE 324	Chemical Basis of Bioengineering II	1
BE 350	Introduction to Biotransport Processes	1
BE 495	Senior Design Project	1
BE 496	Senior Design Project	1
BE Elective (400 or 500 level)		2
Engineering Elective		1
Math		
MATH 104	Calculus, Part I	1
MATH 114	Calculus, Part II	1
MATH 240	Calculus, Part III	1
or ENM 240	Differential Equations and Linear Algebra	
MATH 241	Calculus, Part IV	1
Select one of the following: [1]		1
ENM 375	Biological Data Science I - Fundamentals of Biostatistics	
ENM 321	Engineering Statistics	
ESE 302	Engineering Applications of Statistics	
STAT 431	Statistical Inference	
Natural Science		7.5
PHYS 140	Principles of Physics I (without laboratory)	
or PHYS 150	Principles of Physics I: Mechanics and Wave Motion	
or PHYS 170	Honors Physics I: Mechanics and Wave Motion	
PHYS 141	Principles of Physics II (without laboratory)	
or PHYS 151	Principles of Physics II: Electromagnetism and Radiation	
or PHYS 171	Honors Physics II: Electromagnetism and Radiation	
EAS 091	Chemistry Advanced Placement/ International Baccalaureate Credit (Engineering Students Only)	
or CHEM 101	General Chemistry I	
or CHEM 115	Honors Chemistry I	
CHEM 102	General Chemistry II	
or CHEM 116	Honors Chemistry II	
CHEM 054	General Chemistry Laboratory II	
BIOL 121	Introduction to Biology - The Molecular Biology of Life	
BIOL 123	Introductory Molecular Biology Laboratory	
BIOL 204	Biochemistry	
or BIOL 205	Cell Biology	
or BIOL 221	Molecular Biology and Genetics	
Technical Electives		
Select two Engineering, Math, Science Electives [2]		2
Social Sciences and Humanities [3]		
Select 2 Social Science courses		2
Select 2 Humanities courses		2
Select 1 Social Science or Humanities course		1
Select 2 Social Science, Humanities or Technology in Business & Society courses		2
Ethics Requirement		
Select one from the following:		
EAS 203	Engineering Ethics	
SOCI 101/ PHIL 072/PPE 072	Bioethics	
HSOC 102	Bioethics	
HSOC 140	History of Bioethics	
LGST 220	International Business Ethics	
NURS 330	Theoretical Foundations of Health Care Ethics	
NURS 525	Ethical Aspects of Health and Technology	
PHIL 472	Survey of Ethical Theory	
SOCI 118	Sociology of Bioethics	
Free Elective		
Select 3 free elective courses		3
Total Course Units		40.5

1. ENM 375 Biological Data Science I - Fundamentals of Biostatistics is recommended.
2. If PHYS 150 Principles of Physics I: Mechanics and Wave Motion or PHYS 170 Honors Physics I: Mechanics and Wave Motion & PHYS 151 Principles of Physics II: Electromagnetism and Radiation or PHYS 171 Honors Physics II: Electromagnetism and Radiation taken then only 1 course unit technical elective required.

[3] The Social Science & Humanities Depth, Writing & Ethics Requirements can be satisfied with the 7 total course units.

Concentrations

Students may select one of eight concentrations (http://www.be.seas.upenn.edu/current-students/undergraduates/concentrations.php):

- Biomedical Data Science and Computational Medicine
- Biomedical Devices
- Cellular/Tissue Engineering and Biomaterials
- Biomedical Imaging and Radiation Physics
- Systems and Synthetic Biology
- Neuroengineering
- Multiscale Biomechanics
- Therapeutics, Drug Delivery & Nanomedicine

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2018 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.
