BIOENGINEERING UNDERGRADUATE MAJOR (BS, HBS)

This program is available at the following location:

- **Corvallis**

The Bachelor of Science and Honors Bachelor of Science degrees in Bioengineering are accredited by the Engineering Accreditation Commission of ABET, http://www.ABET.org.

Bioengineering is an interdisciplinary field that applies engineering principles and quantitative methods to the development of new and novel biologicals, materials, devices, and processes. In practice, bioengineers address issues surrounding the broad areas of bioprocess, biomedical, and bioenvironmental technology.

The bioengineering undergraduate program provides a solid background in biology, chemistry, physics and math, in addition to the engineering sciences. It is organized around three themes: 1. Bioprocessing; 2. Tissue Engineering; and 3. Signals of Life. Upper-level coursework in bioengineering includes the analysis and design of processes involving immobilized or suspended microbial cultures and the recovery of therapeutic products from bioreactors, as well as coursework in biomedical materials engineering, biomedical engineering principles, biomedical imaging processing, and selected coursework in cell engineering, surface analysis, among other topics. All students complete a capstone-design experience that integrates drug and medical device regulation.

Bioengineering graduates are prepared to contribute to the rapidly growing sector of bioscience-based industries, and to have the ability to formulate and solve problems pertaining to enzyme and microbial process technologies, mammalian cell culture, and downstream processing in biotechnology. They also generate solutions to problems with medical relevance, including the design of devices and systems to replace lost organ function, deliver therapeutic agents, and otherwise improve human health.

Program Educational Objectives (PEOs)

The PEOs represent the objectives for alumni of the Bioengineering program about three years after graduation, and are as follows.

Alumni of the Bioengineering program will be work-ready engineers, problem solvers, responsible professionals, and interdisciplinary collaborators. Specifically, within a few years after graduation, they will have:

1. Obtained employment in the biotechnology, biomedical, or bioprocessing industries or entered graduate studies in bioengineering or a related field and/or gained admission to professional schools including health-professional programs.
2. Created value through solving problems at the interface of engineering and biology using modern engineering tools, whether in a manufacturing, research, or clinical environment.
3. Pursued professional development in order to fulfill their professional and ethical responsibilities through lifelong learning, and proactively sought skills to remain on the cutting edge of technology that can aid in answering questions at the interface of biosciences, technology, and society.
4. Demonstrated good communication skills and worked effectively in cross-functional team environments comprised of a diverse set of members with varying organizational backgrounds, positions, and geographic locations.

Major Code: 298

Upon successful completion of the program, students will meet the following learning outcomes:

- Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
- Communicate effectively with a range of audiences.
- 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.
- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- Acquire and apply new knowledge as needed, using appropriate learning strategies.

Code	Title	Credits
ENGR 110 & ENGR 115 or ENGR 310	+TRANSITIONS and THE OREGON STATE ENGINEERING STUDENT [1] +TRANSITIONS	3
ENGR 102	+DESIGN ENGINEERING AND PROBLEM SOLVING	3
ENGR 103	ENGINEERING COMPUTATION AND ALGORITHMIC THINKING	3
ENGR 201	ELECTRICAL FUNDAMENTALS I	3
ENGR 211	STATICS	3
ENGR 330	+INCLUSIVE AND EQUITABLE ENGINEERING	3
MTH 251Z	+*DIFFERENTIAL CALCULUS	4
MTH 252Z	INTEGRAL CALCULUS	4
MTH 254	VECTOR CALCULUS I	4
MTH 256	APPLIED DIFFERENTIAL EQUATIONS	4
MTH 264 & MTH 265	INTRODUCTION TO MATRIX ALGEBRA and INTRODUCTION TO SERIES	4
COMM 111Z or COMM 114	+*PUBLIC SPEAKING +*ARGUMENT AND CRITICAL DISCOURSE	3-4
WR 121Z	+*COMPOSITION I	4
WR 227Z	+*TECHNICAL WRITING	4
CH 201 & CH 204	GENERAL CHEMISTRY FOR ENGINEERING APPLICATIONS and +CHEMISTRY FOR ENGINEERING APPLICATIONS LABORATORY I	4
CH 202 & CH 205	CHEMISTRY FOR ENGINEERING MAJORS and LABORATORY FOR CH 202	4
CH 203	GENERAL CHEMISTRY FOR ENGINEERING APPLICATIONS	3
CH 331	ORGANIC CHEMISTRY	4
CH 332	ORGANIC CHEMISTRY	4
PH 211	+*GENERAL PHYSICS WITH CALCULUS	4
PH 212	*GENERAL PHYSICS WITH CALCULUS	4
PH 213	*GENERAL PHYSICS WITH CALCULUS	4

BI 231Z	HUMAN ANATOMY AND PHYSIOLOGY I	4
BI 232Z	HUMAN ANATOMY AND PHYSIOLOGY II	4
BB 450 & BB 451	GENERAL BIOCHEMISTRY and GENERAL BIOCHEMISTRY	7
CBEE 211	MATERIAL BALANCES AND STOICHIOMETRY	3
CBEE 212	ENERGY BALANCES	3
CBEE 213	PROCESS DATA ANALYSIS	4
CBEE 320	PROFESSIONALISM AND ENGINEERING ETHICS	3
BIOE 240	A PRACTICAL INTRODUCTION TO BIOMEDICAL SIGNALS AND SENSORS	3
BIOE 311	BIOENGINEERING THERMODYNAMICS	3
BIOE 331	BIOTRANSPORT I	3
BIOE 332	BIOTRANSPORT II	3
BIOE 340	BIOMEDICAL ENGINEERING PRINCIPLES	3
BIOE 350	MATHEMATICAL AND NUMERICAL METHODS FOR BIOENGINEERS	3
BIOE 351	BIOMATERIALS AND BIOINTERFACES	3
BIOE 420	SOCIAL JUSTICE, ETHICS, AND ENGINEERING	3
BIOE 453	BIOENGINEERING LABORATORY TECHNIQUES	3
BIOE 457	BIOREACTORS	3
BIOE 462	BIOSEPARATIONS	3
BIOE 465	BIOMEDICAL IMAGE PROCESSING	3
BIOE 495	^BIOENGINEERING PRODUCT DESIGN	4
BIOE 496	BIOENGINEERING CAPSTONE DESIGN	4
BIOE 497	+BIOENGINEERING PROCESS DESIGN	4
Engineering Electives		
Select 8 credits from the following courses:		8
BEE 320	BIOSYSTEMS ANALYSIS AND MODELING	
BEE 468	BIOREMEDIATION ENGINEERING	
BIOE 440	BIOCONJUGATION	
BIOE 445	SURFACE ANALYSIS	
BIOE 459	CELL ENGINEERING	
CHE 334	TRANSPORT PHENOMENA LABORATORY	
CHE 361	CHEMICAL PROCESS DYNAMICS AND SIMULATION	
CHE 445	POLYMER ENGINEERING AND SCIENCE	
CHE 446	POLYMER SYNTHESIS AND PROCESSING	
CHE 450	CONVENTIONAL AND ALTERNATIVE ENERGY SYSTEMS	
CHE 451	SOLAR ENERGY TECHNOLOGIES	
CHE 461	PROCESS CONTROL	
CS 446/BDS 446	NETWORKS IN COMPUTATIONAL BIOLOGY	
ENGR 212	DYNAMICS	
ENGR 213	STRENGTH OF MATERIALS	
ENGR 248	ENGINEERING GRAPHICS AND 3-D MODELING	
ENVE 321	ENVIRONMENTAL ENGINEERING FUNDAMENTALS	
ENVE 322	FUNDAMENTALS OF ENVIRONMENTAL ENGINEERING	
ENVE 421	DRINKING WATER TREATMENT PROCESSES	
ENVE 422	WASTEWATER TREATMENT PROCESSES	
ENVE 425	AIR POLLUTION CONTROL	
ENVE 431	FATE AND TRANSPORT OF CHEMICALS IN ENVIRONMENTAL SYSTEMS	
+Core Ed: Arts & Humanities		7
+Core Ed: Social Science		3
+Core Ed: Difference, Power & Oppression Foundations		3
+Core Ed: Seeking Solutions		3
Total Credits		**180**

* Baccalaureate Core course. Applies to general education requirements for undergraduate students in a catalog year up to 2024-2025

\+ Core Education course. Applies to general education requirements for undergraduate students in catalog year 2025-2026 and beyond

^ Writing Intensive Curriculum (WIC) course

[1] Students who complete CORE 100 or CORE 300 or a non-ENGR Transitions course will use an Engineering elective course to substitute for ENGR 115

Major Code: 298

Degree plans are subject to change and the following is only an example of how students may complete their degree in four years. Students should consult their advisor to determine the best degree plan for them. Contact details for advisors can be found on the Academic Advising *(https://catalog.oregonstate.edu/advising/) page.*

First Year		
Fall		**Credits**
CH 201 & CH 204	GENERAL CHEMISTRY FOR ENGINEERING APPLICATIONS and +CHEMISTRY FOR ENGINEERING APPLICATIONS LABORATORY I	4
ENGR 110 & ENGR 115 or ENGR 310	+TRANSITIONS or +TRANSITIONS	3
MTH 251Z	+*DIFFERENTIAL CALCULUS	4
WR 121Z	+*COMPOSITION I	4
	Credits	**15**
Winter		
CH 202 & CH 205	CHEMISTRY FOR ENGINEERING MAJORS and LABORATORY FOR CH 202	4
COMM 111Z or COMM 114	+*PUBLIC SPEAKING or +*ARGUMENT AND CRITICAL DISCOURSE	3-4
ENGR 102	+DESIGN ENGINEERING AND PROBLEM SOLVING	3
MTH 252Z	INTEGRAL CALCULUS	4
	Credits	**14**
Spring		
CH 203	GENERAL CHEMISTRY FOR ENGINEERING APPLICATIONS	3
ENGR 103	ENGINEERING COMPUTATION AND ALGORITHMIC THINKING	3
MTH 254	VECTOR CALCULUS I	4
PH 211	+*GENERAL PHYSICS WITH CALCULUS	4
Core Ed: Difference, Power & Oppression Foundations		3
	Credits	**17**
Second Year		
Fall		
BI 231Z	HUMAN ANATOMY AND PHYSIOLOGY I	4
CBEE 211	MATERIAL BALANCES AND STOICHIOMETRY	3
CH 331	ORGANIC CHEMISTRY	4
PH 212	*GENERAL PHYSICS WITH CALCULUS	4
	Credits	**15**
Winter		
BI 232Z	HUMAN ANATOMY AND PHYSIOLOGY II	4
CBEE 212	ENERGY BALANCES	3
CH 332	ORGANIC CHEMISTRY	4
PH 213	*GENERAL PHYSICS WITH CALCULUS	4
	Credits	**15**
Spring		
BIOE 240	A PRACTICAL INTRODUCTION TO BIOMEDICAL SIGNALS AND SENSORS	3
CBEE 213	PROCESS DATA ANALYSIS	4
ENGR 201	ELECTRICAL FUNDAMENTALS I	3
MTH 264	INTRODUCTION TO MATRIX ALGEBRA	2
MTH 265	INTRODUCTION TO SERIES	2
	Credits	**14**

Third Year		
Fall		
BB 450	GENERAL BIOCHEMISTRY	4
BIOE 311	BIOENGINEERING THERMODYNAMICS	3
BIOE 331	BIOTRANSPORT I	3
CBEE 320	PROFESSIONALISM AND ENGINEERING ETHICS	3
	Credits	**13**
Winter		
BB 451	GENERAL BIOCHEMISTRY	3
BIOE 332	BIOTRANSPORT II	3
BIOE 350	MATHEMATICAL AND NUMERICAL METHODS FOR BIOENGINEERS	3
BIOE 420	SOCIAL JUSTICE, ETHICS, AND ENGINEERING	3
MTH 256	APPLIED DIFFERENTIAL EQUATIONS	4
	Credits	**16**
Spring		
BIOE 340	BIOMEDICAL ENGINEERING PRINCIPLES	3
BIOE 351	BIOMATERIALS AND BIOINTERFACES	3
ENGR 211	STATICS	3
WR 227Z	+*TECHNICAL WRITING	4
Core Ed: Arts and Humanities Global		3
	Credits	**16**
Fourth Year		
Fall		
BIOE 453	BIOENGINEERING LABORATORY TECHNIQUES	3
BIOE 457	BIOREACTORS	3
BIOE 495	^BIOENGINEERING PRODUCT DESIGN	4
Engineering Elective		4
	Credits	**14**
Winter		
BIOE 462	BIOSEPARATIONS	3
BIOE 496	BIOENGINEERING CAPSTONE DESIGN	4
Engineering Elective		4
Core Ed: Arts & Humanities General		4
	Credits	**15**
Spring		
BIOE 465	BIOMEDICAL IMAGE PROCESSING	3
BIOE 497	+BIOENGINEERING PROCESS DESIGN	4
ENGR 330	+INCLUSIVE AND EQUITABLE ENGINEERING	3
Core Ed: Seeking Solutions		3
Core Ed: Social Science		3
	Credits	**16**
	Total Credits	**180**

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