

# BIOENGINEERING UNDERGRADUATE MAJOR (BA, BS, HBA, HBS)

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. Upper-level course work 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 course work in biomedical materials engineering, biomedical engineering principles, and selected course work in cell engineering, surface analysis and bioconjugation. 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.

Alumni of the bioengineering program will be work-ready engineers, problem solvers, responsible professionals, and interdisciplinary collaborators. Program educational objectives can be found here.

## Major Code: 298

- Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Ability to 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.
- Ability to communicate effectively with a range of audiences.
- 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.
- 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.
- Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

First Year		Credits
CBEE 101	CHEMICAL, BIOLOGICAL, AND ENVIRONMENTAL ENGR ORIENTATION	3
CBEE 102	ENGINEERING PROBLEM SOLVING AND COMPUTATIONS	3
CH 231 & CH 261	GENERAL CHEMISTRY and *LABORATORY FOR CHEMISTRY 231	5
CH 232 & CH 262	GENERAL CHEMISTRY and *LABORATORY FOR CHEMISTRY 232	5
CH 233 & CH 263	GENERAL CHEMISTRY and *LABORATORY FOR CHEMISTRY 233	5
COMM 111 or COMM 114	*PUBLIC SPEAKING or *ARGUMENT AND CRITICAL DISCOURSE	3
HHS 231	*LIFETIME FITNESS FOR HEALTH	2
HHS 241	*LIFETIME FITNESS (or any PAC course)	1-2
MTH 251	*DIFFERENTIAL CALCULUS	4
MTH 252	INTEGRAL CALCULUS	4
MTH 254	VECTOR CALCULUS I	4
PH 211	*GENERAL PHYSICS WITH CALCULUS	4
WR 121	*ENGLISH COMPOSITION	3
	Credits	46-47
Second Year		
BI 231	INTRODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY	3
BI 233	INTRODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY	3
CBEE 211	MATERIAL BALANCES AND STOICHIOMETRY	3
CBEE 212	ENERGY BALANCES	3
CBEE 213	PROCESS DATA ANALYSIS	4
CH 331	ORGANIC CHEMISTRY	4
CH 332	ORGANIC CHEMISTRY	4
ENGR 201	ELECTRICAL FUNDAMENTALS I	3
ENGR 211	STATICS	3
MTH 256	APPLIED DIFFERENTIAL EQUATIONS	4
MTH 306 or MTH 264 and MTH 265	MATRIX AND POWER SERIES METHODS or INTRODUCTION TO MATRIX ALGEBRA and INTRODUCTION TO SERIES	4
PH 212	*GENERAL PHYSICS WITH CALCULUS	4
PH 213	*GENERAL PHYSICS WITH CALCULUS	4
Biology selection <sup>1</sup>		2-4
Perspectives		3
	Credits	51-53
Third Year		
BB 450 & BB 451	GENERAL BIOCHEMISTRY and GENERAL BIOCHEMISTRY	7
BIOE 340	BIOMEDICAL ENGINEERING PRINCIPLES	3
BIOE 351	BIOMATERIALS AND BIOINTERFACES	3
BIOE 420	SOCIAL JUSTICE, ETHICS, AND ENGINEERING	3
CBEE 320	PROFESSIONALISM AND ENGINEERING ETHICS	3
CHE 311	THERMODYNAMICS	3
CHE 331	TRANSPORT PHENOMENA I	4
CHE 332	TRANSPORT PHENOMENA II	3
CHE 333	TRANSPORT PHENOMENA III	3
WR 327	*TECHNICAL WRITING	3
	*Difference, Power, and Discrimination <sup>5</sup>	3
	Bioengineering electives <sup>3</sup>	3
	*Perspectives	6
	Credits	47
Fourth Year		
BB 493	BIOCHEMISTRY LABORATORY MOLECULAR TECHNIQUES 1	3
BIOE 415	BIOENGINEERING LABORATORY	3
BIOE 457	BIOREACTORS	3
BIOE 462	BIOSEPARATIONS	3
BIOE 490	BIOENGINEERING PROCESS DESIGN	4
BIOE 491	BIOENGINEERING PRODUCT DESIGN	4

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BIOE 492	BIOENGINEERING CAPSTONE DESIGN	4
CBEE 414	*PROCESS ENGINEERING LABORATORY	3
Bioengineering elective <sup>5</sup>		3
Bioscience or Bioengineering elective <sup>3,4</sup>		3
Engineering electives <sup>2</sup>		6
*Perspectives		3
*Synthesis		6
Credits		48
Total Credits		192-195

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Baccalaureate Core Course (BCC)

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Writing Intensive Course (WIC)

- 1 Approved bioscience course from BIOE program list
- 2 Approved engineering elective from BIOE program list
- 3 Approved bioengineering elective from BIOE program list
- 4 Approved bioscience elective from BIOE program list
- 5 Approved DPD elective from BIOE program list

**Major Code: 298**

**First Year**

		Credits
<b>Fall</b>		
CBEE 101	CHEMICAL, BIOLOGICAL, AND ENVIRONMENTAL ENGR ORIENTATION	3
CH 231 & CH 261	GENERAL CHEMISTRY and *LABORATORY FOR CHEMISTRY 231	5
HHS 231	*LIFETIME FITNESS FOR HEALTH	2
HHS 241	*LIFETIME FITNESS (or any PAC course)	1
MTH 251	*DIFFERENTIAL CALCULUS	4
Credits		15

<b>Winter</b>		
CBEE 102	ENGINEERING PROBLEM SOLVING AND COMPUTATIONS	3
CH 232 & CH 262	GENERAL CHEMISTRY and *LABORATORY FOR CHEMISTRY 232	5
MTH 252	INTEGRAL CALCULUS	4
WR 121	*ENGLISH COMPOSITION	3
Credits		15

<b>Spring</b>		
CH 233 & CH 263	GENERAL CHEMISTRY and *LABORATORY FOR CHEMISTRY 233	5
COMM 111 or COMM 114	*PUBLIC SPEAKING or *ARGUMENT AND CRITICAL DISCOURSE	3
MTH 254	VECTOR CALCULUS I	4
PH 211	*GENERAL PHYSICS WITH CALCULUS	4
Credits		16

**Second Year**

<b>Fall</b>		
BI 231	INTRODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY	3
CBEE 211	MATERIAL BALANCES AND STOICHIOMETRY	3
CH 331	ORGANIC CHEMISTRY	4
PH 212	*GENERAL PHYSICS WITH CALCULUS	4
*Bacc Core Course, Cultural Diversity		3
Credits		17

<b>Winter</b>		
CBEE 212	ENERGY BALANCES	3
CH 332	ORGANIC CHEMISTRY	4
MTH 256	APPLIED DIFFERENTIAL EQUATIONS	4
PH 213	*GENERAL PHYSICS WITH CALCULUS	4
*Bacc Core Course, Biology		2-4
Credits		17-19

<b>Spring</b>		
BI 233	INTRODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY	3
CBEE 213	PROCESS DATA ANALYSIS	4
ENGR 201	ELECTRICAL FUNDAMENTALS I	3
ENGR 211	STATICS	3
MTH 306 or MTH 264 and MTH 265	MATRIX AND POWER SERIES METHODS or INTRODUCTION TO MATRIX ALGEBRA and INTRODUCTION TO SERIES	4
Credits		17

**Third Year**

<b>Fall</b>		
BB 450	GENERAL BIOCHEMISTRY	4
CBEE 320	PROFESSIONALISM AND ENGINEERING ETHICS	3
CHE 311	THERMODYNAMICS	3
CHE 331	TRANSPORT PHENOMENA I	4
*Bacc Core Course, Literature and the Arts		3
Credits		17

<b>Winter</b>		
BB 451	GENERAL BIOCHEMISTRY	3
BIOE 420	SOCIAL JUSTICE, ETHICS, AND ENGINEERING	3
CHE 332	TRANSPORT PHENOMENA II	3
WR 327	*TECHNICAL WRITING	3
*Bacc Core Course, Western Culture		3
Credits		15

<b>Spring</b>		
BIOE 340	BIOMEDICAL ENGINEERING PRINCIPLES	3
BIOE 351	BIOMATERIALS AND BIOINTERFACES	3
Bioengineering elective		3
CHE 333	TRANSPORT PHENOMENA III	3
*Bacc Core Course, Difference, Power, and Discrimination		3
Credits		15

**Fourth Year**

<b>Fall</b>		
BB 493	BIOCHEMISTRY LABORATORY MOLECULAR TECHNIQUES 1	3
BIOE 457	BIOREACTORS	3
BIOE 491	BIOENGINEERING PRODUCT DESIGN	4
CBEE 414	*PROCESS ENGINEERING LABORATORY	3
Engineering elective		3
Credits		16

<b>Winter</b>		
BIOE 415	BIOENGINEERING LABORATORY	3
BIOE 462	BIOSEPARATIONS	3
BIOE 492	BIOENGINEERING CAPSTONE DESIGN	4
Bioengineering elective		3
*Bacc Core Course, Social Processes and Institutions		3
Credits		16

<b>Spring</b>		
BIOE 490	BIOENGINEERING PROCESS DESIGN	4
Bioscience or Bioengineering elective		3
Engineering elective		3
*Bacc Core Course, Science, Technology, and Society		3

*Bacc Core Course, Contemporary Global Issues	3
Credits	16
Total Credits	192-194