Biomedical Engineering, B.S.Bm.E.

Degree Offered

- Bachelor of Science in Biomedical Engineering (B.S.Bm.E.)

Nature of the Program

The biomedical engineering discipline is among the fastest growing engineering disciplines due to the rapid advancement of medical technologies and treatment and diagnosis strategies; in fact, many are claiming this century as the one that will revolutionize the biological sciences. These advancements will provide immense benefits for society globally. The biomedical engineering curriculum is designed to give graduates a broad background in the areas of biomedical engineering, including biomaterials, biomechanics and biomedical imaging. Students have the ability to design a set of technical electives based on interest and career aspirations. The goal for these electives is to enhance a student's knowledge in one or more of the focus areas so they can be prepared for graduate school, any professional school, or a job in a specific industry. The Bachelor of Science degree in Biomedical Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org, under the General Criteria and the Program Criteria for Bioengineering and Biomedical Engineering.

Program Educational Objectives

- Graduates will be engaged in their professional careers and/or post graduate training as demonstrated by their abilities to identify and solve important biomedical engineering problems, develop and implement new and valuable ideas with potential applications to healthcare, and to engage in lifelong learning opportunities.
- Graduates will be able to work competitively in diverse professional environments as demonstrated by their abilities to work on teams and independently, to provide leadership, and to communicate effectively to a variety of audiences.
- Graduates will behave professionally and ethically, be committed to responsible safety practices, and articulate the societal impact of their work.

Click here to view the Suggested Plan of Study (p. 5)

Curriculum in Biomedical Engineering

General Education Foundations

Please use this link to view a list of courses that meet each GEF requirement. **(**http://registrar.wvu.edu/gef/**)**

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

Code	Title	Hours
General Education Foundations		
F1 - Composition & Rhetoric		3-6
ENGL 101 & ENGL 102	Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research	
or ENGL 103	Accelerated Academic Writing	
F2A/F2B - Science & Technology		4-6
F3 - Math & Quantitative Reasoning		3-4
F4 - Society & Connections		3
F5 - Human Inquiry & the Past		3
F6 - The Arts & Creativity		3
F7 - Global Studies & Diversity		3
F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree)		9
Total Hours		31-37

Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

Degree Requirements

Students must meet the following criteria to qualify for a Bachelor of Science in Biomedical Engineering degree:

- Complete a minimum of 127 credit hours
- Satisfy WVU's undergraduate degree requirements

- Satisfy Statler College's undergraduate degree requirements (http://catalog.wvu.edu/undergraduate/collegeofengineeringandmineralresources/#policiestext)
- Complete all courses listed in the curriculum requirements with the required minimum grades
- Attain an overall grade point average of 2.00 or better
- Attain a WVU grade point average of 2.00 or better
- Attain a Statler grade point average of 2.00 or better
- A maximum of one math or science courses with a grade of D+, D, or D- may apply towards a Statler College degree
- Complete a survey regarding their academic and professional experiences at WVU, as well as post-graduation job placement or continuing education plans.

The Statler GPA is computed based on all work taken at WVU with a subject code within Statler College (BIOM, BMEG, CE, CHE, CPE, CS, CSEE, CYBE, EE, ENGR, ENVE, ETEC, IENG, IH&S, MAE, MINE, PDA, PNGE, SAFM, SENG) excluding ENGR 140, ENGR 150, and CS 101. The WVU GPA is computed based on all work taken at WVU. The Overall GPA is computed based on all work taken at WVU and transfer work.

Curriculum Requirements

Code	Title	Hours
University Requirements		19
Fundamentals of Engineering Requirements		5
Math and Science Requirements		46
Biomedical Engineering Program Requirements		57
Total Hours		127

University Requirements

Code	Title	Hours
General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)		
Outstanding GEF Requirements 1, 4, 5, 6, and 7		18
ENGR 191	First-Year Seminar	1
Total Hours		19

Fundamentals of Engineering Requirements

Code	Title	Hours
A minimum grade of C- is required in all Fundamentals of Engineering courses.		
ENGR 101	Engineering Problem Solving 1	2
Engineering Problem Solving (Select one of the following):		3
CHE 102	Introduction to Chemical Engineering	
ENGR 102	Engineering Problem Solving 2	
ENGR 103	Introduction to Nanotechnology Design	
MAE 102	Introduction to Mechanical and Aerospace Engineering Design	
Total Hours		5

Math and Science Requirements

Code	Title	Hours
A minimum grade of C- is required in all Math and Science courses.		
Choose one of the following:		4
BIOL 115 & 115L	Principles of Biology and Principles of Biology Laboratory (GEF 8)	
BIOL 101 & 101L & BIOL 102 & BIOL 102L	General Biology 1 and General Biology 1 Laboratory and General Biology 2 and General Biology 2 Laboratory	
BIOL 235	Human Physiology	3
or BIOL 117 & 117L	Introductory Physiology and Introductory Physiology Laboratory	

CHEM 115 & 115L & CHEM 116 & CHEM 116L	Fundamentals of Chemistry 1 and Fundamentals of Chemistry 1 Laboratory and Fundamentals of Chemistry 2 and Fundamentals of Chemistry 2 Laboratory	8
CHEM 233	Organic Chemistry 1	3
CHEM 233L	Organic Chemistry 1 Laboratory	1
Calculus I (GEF 3):		4
MATH 153 & MATH 154	Calculus 1a with Precalculus and Calculus 1b with Precalculus	
MATH 155	Calculus 1	
MATH 156	Calculus 2 (GEF 8)	4
MATH 251	Multivariable Calculus	4
MATH 261	Elementary Differential Equations	4
PHYS 111 & 111L	General Physics 1 and General Physics 1 Laboratory (GEF 8)	4
PHYS 112 & 112L	General Physics 2 and General Physics 2 Laboratory	4
STAT 215	Introduction to Probability and Statistics **	3
or IENG 213	Engineering Statistics	
Total Hours		46

Biomedical Engineering Program Requirements

Code	Title	Hours
BMEG 201	Introduction to Biomedical Engineering	4
BMEG 310	Biomedical Imaging	3
BMEG 230	Numerical Methods in Biomedical Engineering	3
BMEG 311	Biomaterials	3
BMEG 315	Transport Phenomena in Biological Systems	4
BMEG 340	Biomechanics	4
BMEG 321	Thermodynamics and Kinetics for Biomedical Engineering	3
BMEG 420 & 420L	Biomedical Instrumentation and Biomedical Instrumentation Laboratory	4
BMEG 455/455S	Biomedical Senior Design 1 (Fulfills Writing and Communication Skills Requirement)	4
BMEG 456S	Biomedical Senior Design 2	3
EE 221	Introduction to Electrical Engineering	3
EE 221L	Introduction to Electrical Engineering Laboratory	1
Technical Electives (18 Credit Hours)		
Science Electives: Choose at least 6 credit hours from the following:		6
AGBI 410	Introductory Biochemistry	
AGBI 410L	Introduction to Biochemistry Laboratory	
BIOL 107	Biotechnology and Society	
BIOL 219 & 219L	Cellular and Molecular Biology and Cellular & Molecular Biology Laboratory	
BIOL 302	Biometry	
BIOL 324	Molecular Genetics	
BIOL 324L	Molecular Genetics Laboratory	
BIOL 348	Neuroscience 1	
BIOL 349	Neuroscience 2	
BMM 339	Introduction to Human Biochemistry	
CHEM 215 & 215L	Introductory Analytical Chemistry and Introductory Analytical Chemistry Laboratory	
CHEM 234	Organic Chemistry 2	
CHEM 234L	Organic Chemistry 2 Laboratory	

CHEM 310 & 310L	Instrumental Analysis and Instrumental Analysis Laboratory	
CHEM 335 & 335L	Methods of Structure Determination and Methods of Structure Determination Laboratory	
CHEM 341 & 341L	Physical Chemistry: Brief Course and Physical Chemistry: Brief Course Laboratory	
CHEM 462	Biochemistry 2	
CHEM 462L	Biochemistry 2 Laboratory	
CHPR 332	Safety Education Principles and Content	
FIS 314 & 314L	Introduction to Microscopy and Introduction to Microscopy Laboratory	
PALM 205	Introduction to Human Anatomy	
PHIL 331	Health Care Ethics	
PHYS 211	Introduction to Mathematical Physics	
PHYS 314	Introductory Modern Physics	
PHYS 321	Optics	
Engineering Electives: Choose at least 9 credit hours from the following:		9
BMEG 480	Cellular Machinery	
BMEG 481	Applied Bio-Molecular Modeling	
BMEG 482	Introduction to Tissue Engineering	
BMEG 497	Research	
BMEG 498	Honors Research	
CHE 366	Materials Science	
CHE 461	Polymer Science and Engineering	
CHE 462	Polymer Processing	
CHE 531	Mathematical Methods in Chemical Engineering	
CPE 271	Introduction to Digital Logic Design	
CS 111 & 111L	Introduction to Data Structures and Introduction to Data Structures Laboratory	
EE 223	Electrical Circuits	
EE 251	Digital Electronics	
EE 327	Signals and Systems 1	
EE 329 & 329L	Signals and Systems 2 and Signals and Systems Laboratory	
EE 455	Introduction to Microfabrication	
EE 465	Introduction to Digital Image Processing	
EE 528	Biomedial Microdevices	
IENG 213	Engineering Statistics **	
IENG 360	Human Factors Engineering	
MAE 211 & 211L	Mechatronics and Mechatronics Laboratory	
MAE 241	Statics	
MAE 242	Dynamics	
MAE 243	Mechanics of Materials	
MAE 343	Intermediate Mechanics of Materials	
Other Elective: Choose at least 3 credit hours from the Science or Engineering Electives		3
Total Hours		57

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IENG 213 cannot fulfill both the statistics requirement and a technical elective.

Suggested Plan of Study

It is important for students to take courses in the order specified in the Plan of Study as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.Bm.E degree program that completes degree requirements in four years is as follows.

First Year

Fall	Hours	Spring	Hours
BIOL 115 & 115L (GEF 8)	4	CHEM 116 & 116L	4
CHEM 115 & 115L (GEF 2B)	4	ENGL 101 (GEF 1)	3
ENGR 101	2	ENGR 102	3
ENGR 191	1	MATH 156 (GEF 8)	4
MATH 155 (GEF 3)	4	PHYS 111 & 111L (GEF 8)	4
	15		18

Second Year

Fall	Hours	Spring	Hours
BMEG 201	4	BIOL 235	3
EE 221	3	BMEG 230	3
EE 221L	1	CHEM 233	3
ENGL 102 (GEF 1)	3	CHEM 233L	1
PHYS 112 & 112L	4	MATH 261	4
MATH 251	4	STAT 215	3
	19		17

Third Year

Fall	Hours	Spring	Hours
BMEG 311	3	BMEG 310	3
BMEG 321	3	BMEG 315	4
BMEG 420 & 420L	4	BMEG 340	4
GEF Course 4	3	GEF Course 5	3
		GEF Course 6	3
	13		17

Fourth Year

Fall	Hours	Spring	Hours
BMEG 455 & 455S	4	BMEG 456S	3
Science Technical Elective	3	Science Technical Elective	3
Engineering Technical Elective	3	Technical Elective	3
GEF Course 7	3	Two Engineering Technical Electives	6
	13		15

Total credit hours: 127

Major Learning Outcomes

BIOMEDICAL ENGINEERING

Upon graduation, all Bachelors of Science students in Biomedical Engineering will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An 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
3. An ability to communicate effectively with a range of audiences

4. An 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
5. An 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
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

These outcomes are achieved via rigorous individual courses in all basic areas of biomedical engineering, the natural and life sciences, mathematics, humanities, and social sciences. A flexible electives program allows specialization in areas such as biochemistry, biomechanics, biomaterials, and bioelectronics.

The Chemical and Biomedical Engineering Department uses an outcomes-assessment plan for continuous program improvement. Course work and design projects, in conjunction with yearly interviews provide the measures of learning outcomes. These outcomes-assessment results provide feedback to the faculty to improve teaching and learning processes.