

**UNDERGRADUATE PROGRAM
IN
BIOMEDICAL ENGINEERING**

**BIOMATERIALS AND TISSUE
ENGINEERING TRACK**

BACHELOR OF SCIENCE OF BIOMEDICAL ENGINEERING

The Bachelor of Science in Biomedical Engineering was designed to provide an in-depth understanding of the fundamentals of engineering and therefore, the program in Biomedical Engineering focuses first on core engineering course work, followed by advanced applications specific to the field of Biomedical Engineering. To provide a core background in engineering fundamentals, the program is divided into three tracks: (1) Biomechanics, (2) Instrumentation, Signals and Imaging and (3) Biomaterials and Tissue Engineering. The Biomechanics track is designed for those students who would pursue a Mechanical Engineering background with specialization in the areas of cardiovascular, orthopaedic, rehabilitation engineering and system simulations. The Instrumentation, Signals and Imaging track is designed for those students who wish to pursue an Electrical Engineering background with specialization in biomedical instrumentation, signal and image processing, imaging devices and detectors and system simulations. The Biomaterials and Tissue Engineering track provides students with a core background in Mechanics, Chemistry and Engineering with specialization in Biomaterials and Tissue Engineering applications.

It is anticipated that the majority of the students will choose to participate in the Cooperative education program in the College of Engineering at The University of Akron. Currently, 80% of eligible undergraduates in the College of Engineering participate in the Co-Op program.

Students in the Department of Biomedical Engineering will receive individual advising in their areas of interest. Graduates of the program will be prepared to apply their knowledge of engineering and medicine to design, test and evaluate systems or system components to be used in the health care industry, to design and develop research projects, including the analysis and interpretation of data and the dissemination of results, and to participate in other biomedical engineering problem solving activities. Graduates will also be well prepared to enter Graduate School, Medical School or even Law School.

FOR MORE INFORMATION, CONTACT THE CHAIR OF THE DEPARTMENT OF BIOMEDICAL ENGINEERING AT THE UNIVERSITY OF AKRON (972-6650) OR (info@biomed.uakron.edu).

Program Educational Objectives

Educational objectives for the Biomedical Engineering program have been adopted by the program faculty, and are published in the University Undergraduate Bulletin, on the Department Web Pages and on all materials distributed to potential students as part of the description of the program. These objectives are those qualities or attributes that graduates of the Bachelor of Science Program in Biomedical Engineering will possess in the first few years following graduation.

The educational objectives of the Biomedical Engineering program are to educate biomedical engineers who:

- 1. Are viewed as technically competent at the interface between engineering and medicine as evidenced by:**
 - a. creative and innovative problem solving**
 - b. performance as a contributing team member**
 - c. ethical and professional actions**
 - d. an ability to interface with diverse constituencies**
 - e. a knowledge of intellectual property and federal regulations**
 - f. professional licensure.**
- 2. Possess an ability to communicate effectively with written, oral and visual means in both technical and non-technical settings.**
- 3. Exhibit continual professional development as evidenced by:**
 - a. attendance at conferences, workshops or other training courses**
 - b. enrollment in graduate, medical or other professional schools**
 - c. active participation in professional societies**
 - d. professional licensure.**
- 4. Exhibit continual professional service as evidenced by:**
 - a. active participation in professional societies**
 - b. service as a mentor.**
- 5. Are advancing on their chosen career path.**

BACHELOR OF SCIENCE IN BIOMEDICAL ENGINEERING
Biomaterials and Tissue Engineering OPTION / With Co-Op

	FALL	SPRING	SUMMER
YEAR 1 (31)	Tools for BME 3 English Comp. I 4 Prin Chemistry I 3 Prin Chemistry Lab 1 Calculus I 4 <u>4</u> 15	Prin. Chemistry II 3 Qualitative Analysis 2 Physics I 4 Calculus II 4 Intro to BME Design 3 <u>3</u> 16	Vacation or School
YEAR 2 (32)	Physics II 4 Calculus III 4 Statics 3 BME Sophomore Sem 1 Anat & Phys I & Lab 4 <u>4</u> 16	English Comp. II 3 Differential Equations 3 Dynamics 3 Mechanics of Solids 3 Anat & Phys II & Lab 4 <u>4</u> 16	Vacation or Optional Co-Op or School
YEAR 3 (28)	Thermo I 3 Organic Chemistry I 3 Organic Chem. I Lab 2 Biofluid Mechanics 3 Mechanics of Biological Tissues 3 Speech or Oral Comp 3 <u>3</u> 17	CO-OP	Social Sci Elective 3 Applied Statistics I 4 Hum West Trad 4 <u>4</u> 11
YEAR 4 (16)	CO-OP	Transport Phenomena 3 Basic EE 4 Biocomputing 3 BME Elective 3 Biomaterials 3 <u>3</u> 16	CO-OP
YEAR 5 (32) (139)	Advanced Biomaterials 3 BME Elective 3 BME Design I 2 Intro to Biophysical Measurements 4 Intro to Ethics (Hum) 3 Area Studies 2 <u>2</u> 17	Intro Econ Anal 3 Humanities Elective 3 Phys Ed 1 BME Elective 3 BME Design II 2 Exp Tech in Biomaterials and Tissue Engineering 3 <u>3</u> 15	

BME Electives must include a minimum of 3 credits from Biomedical Engineering (4800). All other electives may be chosen from a list of Approved Electives.

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BIOMATERIALS AND TISSUE ENGINEERING OPTION/ WITH CO-OP

YEAR 1

FALL	Tools for Biomedical Engineering	4800:101	3 cr
	English Composition I	3300:111	4 cr
	Principles of Chemistry I	3150:151	3 cr
	Principles of Chemistry Laboratory	3150:152	1 cr
	Analytic Geometry - Calculus I	3450:221	4 cr

SPRING	Qualitative Analysis	3150:154	2 cr
	Principles of Chemistry II	3150:153	3 cr
	Analytic Geometry - Calculus II	3450:222	4 cr
	Elementary Classical Physics I & Lab	3650:291	4 cr
	Intro to BME Design	4800:111	3 cr

YEAR II

FALL	Analytic Geometry -Calculus III	3450:223	4 cr
	Elementary Classical Physics II & Lab	3650:292	4 cr
	Statics	4300:201	3 cr
	BME Sophomore Seminar	4800:201	1 cr
	Human Anatomy and Physiology I	3100:200	3 cr
	Human Anatomy and Physiology I Lab	3100:201	1 cr

SPRING	English Composition II	3300:112	3 cr
	Differential Equations	3450:235	3 cr
	Dynamics	4600:203	3 cr
	Introduction to Mechanics of Solids	4300:202	3 cr
	Human Anatomy and Physiology II	3100:202	3 cr
	Human Anatomy and Physiology II Lab	3100:203	1 cr

YEAR III

FALL	Introduction to Public Speaking	7600:105	3 cr
	OR		
	Effective Oral Communication	7600:106	3 cr
	Thermodynamics I	4600:300	3 cr
	Organic Chemistry Lecture I	3150:263	3 cr
	Organic Chemistry Lab I	3150:265	1 cr
	Biofluid Mechanics	4800:360	3 cr
	Mechanics of Biological Tissues	4800:365	3 cr

SPRING	Co-Op		
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SUMMER	Humanities in the Western Tradition I	3400:210	4 cr
	Applied Statistics I	3470:461	4 cr
	Social Science Elective		3 cr

YEAR IV**FALL**

Co-Op

SPRING

Transport Phenomena	4200:321	3 cr
Basic Electrical Engineering	4400:320	4 cr
Biocomputing	4800:220	3 cr
BME Elective		3 cr
Biomaterials	4800:400	3 cr

SUMMER

Co-Op

YEAR V**FALL**

Advanced Biomaterials	4800:440	3 cr
BME Elective		3 cr
BME Design I	4800:491	2 cr
Introduction to Biophysical Measurements	4800:305	4 cr
Intro to Ethics	3600:120	3 cr
Area Studies	3400:	2 cr

SPRING

Intro to Economic Analysis	3250:244	3 cr
Humanities Elective		3 cr
Physical Education	5540:120-83	1 cr
Intro to the FEM	4600:420	3 cr
BME Elective		3 cr
BME Design II	4800:492	2 cr
Experimental Techniques in Biomaterials	4800:445	3 cr

BME Electives must include a minimum of 3 credits from Biomedical Engineering (4800). All other electives may be chosen from a list of Approved Electives.

BME APPROVED ELECTIVES

A minimum of 3 credits must be from Biomedical Engineering 4800

Students in the Biomechanics track may take courses from the Instrumentation, Signals and Imaging track, from the Biomaterials and Tissue Engineering track or from the list below.

Students in the Instrumentation, Signals and Imaging track may take courses from the Biomechanics track, from the Biomaterials and Tissue Engineering track or from the list below.

Biomechanics of Human Movement	4800:370	3 cr
Physiological Control Systems	4800:422/522	3 cr

Other courses which can be used as electives :

3450: Mathematics

Fundamentals of Advanced Mathematics	3450:307	3 cr
Linear Algebra	3450:312	3 cr
Theory of Numbers	3450:413	3 cr
Vector Analysis	3450:414	3 cr
Combinatorics and Graph Theory	3450:415	3 cr
Complex Variables	3450:425	3 cr
Introduction of Numerical Analysis	3450:427	3 cr
Numerical Linear Algebra	3450:428	3 cr
Special Functions and Operational Calculus	3450:431	3 cr
Partial Differential Equations	3450:432	4 cr
Mathematical Models	3450:436	3 cr
Advanced Engineering Mathematics I, II	3450:438,9	3 cr
Concepts in Geometry	3450:441	4 cr
Projective Geometry	3450:442	3 cr

3650: Physics

Optics	3650:320	3 cr
Computational Physics	3650:350	3 cr
NMR Spectroscopy I	471/571	2 cr
Methods of Mathematical Physics I	481/581	3 cr

9841 : Polymer Engineering

Polymer Fluid Mechanics	9841:321	3 cr
Engineering Properties of Polymers	9841:450	3 cr

4400: Electrical Engineering

Discrete-Time Systems	4400:333	3 cr
Active Circuits	4400:334	3 cr
Electromagnetics I	4400:353	4 cr
Electromagnetics II	4400:354	3 cr
Physical Electronics	4400:360	3 cr
Microprocessor System	4400:365	3 cr
Control Systems I	4400:371	4 cr
Energy Conversion	4400:381	3 cr
Analog Communication	4400:445	3 cr
Random Signals	4400:447	3 cr
Digital Communication	4400:449/549	3 cr
Pulse Electronics	4400:464	4 cr
Control Systems II	4400:472/572	4 cr
Modern Power Systems	4400:481	3 cr

4600: Mechanical Engineering

Thermodynamics II	4600:301	3 cr
Compressible Fluid Mechanics	4600:411/511	3 cr
Energy Conversion	4600:415/515	3 cr
Machine Dynamics	4600:430/530	3 cr
Fundamentals of Mechanical Vibrations	4600:431/531	3 cr
Control Systems Design	4600:441/541	3 cr
Optimization Methods in Mechanical Eng.	4600:443/543	3 cr
Robot Design, Control and Application	4600:444/544	3 cr
Introduction to Computational Fluid Flow and Convection	4600:450/550	3 cr
Computer Aided Design and Manufacturing	4600:463/563	3 cr

3150: Chemistry

Organic Chemistry I	3150:263	3 cr
Organic Chemistry II	3150:264	3 cr