CASE SCHOOL OF ENGINEERING
CASE WESTERN RESERVE UNIVERSITY

BIOMEDICAL ENGINEERING

Dual Degree Program Course Requirements

Engineering Requirements for all majors/departments		
Course Code	**Course Title**	**Semester Credit Hours**
CHEM 105	Principles of Chemistry I	3
CHEM 106	Principles of Chemistry II	3
CHEM 113	Principles of Chemistry Lab	2
ENGR 131	Elementary Computer Programming (JAVA)	3
MATH 121	Calculus for Science and Engineering I	4
MATH 122	Calculus for Science and Engineering II	4
MATH 223	Calculus for Science and Engineering III	3
MATH 224	Elementary Differential Equations	3
PHYS 121	General Physics I	4
PHYS 122	General Physics II	4
	Humanities and Social Science (including college level writing proficiency)	22
	Physical Education (2 semesters)	0
		55

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The Biomedical Engineering Department recommends that the following courses be taken prior to beginning the Dual Degree Program at Case Western Reserve University. If the courses cannot be fulfilled, they will be integrated into the curriculum, which may possibly extend the program timeline.

Recommended Engineering Courses for Biomedical Engineering			
Course Code	**Course Title**	**Semester Credit Hours**	**Description**
STAT 312	Statistics for Engineering & Science	3	For advanced undergraduate students in engineering, physical sciences, life sciences. Comprehensive introduction to probability models and statistical methods of analyzing data with the object of formulating statistical models and choosing appropriate methods for inference from experimental and observational data and for testing the model's validity. Balanced approach with equal emphasis on probability, fundamental concepts of statistics, point and interval estimation, hypothesis testing, analysis of variance, design of experiments, and regression modeling. Note: Credit given for only one (1) of STAT 312, 313, 333, 433. Prereq: MATH 122 or equivalent.
CHEM 223	Introduction to Organic Chemistry	3	Introductory course for science majors and engineering students. Develops themes of structure and bonding along with elementary reaction mechanisms. Includes treatment of hydrocarbons, alkyl halides, alcohols, and ethers as well as an introduction to spectroscopy. Prereq: CHEM 106 or CHEM 111.

Binary Biomedical Engineering students may choose from four specialty sequences, including:

Please Note: The course sequence serves as an example of the classes necessary to complete the Dual Degree Program. Courses and the semesters taken will be based on the student's transfer credit and discussion with the Case Western Reserve University faculty advisor.

Sample Course Sequence for Bioelectricity

Fall Year 1

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	201	Physiology – Biophysics I	3	0	3
EBME	308	Biomedical Signals & Systems	3	3	4
EBME	313	Biomedical Engineering Lab I	1	3	2
ENGR	200	Statics & Strength of Materials	3	0	3
ENGR	210	Introduction to Circuits & Instrumentation	3	3	4
			13	9	16

Spring Year 1

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	202	Physiology – Biophysics II	3	0	3
EBME	310	Principles of Biomedical	3	0	3
EBME	360	Biomedical Instrumentation Lab	0	3	1
EECS	245	Electronic Circuits	4	0	4
EECS	321	Semiconductor Electronic Devices	4	0	4
EECS	346	Engineering Optimization	3	0	3
			17	3	18

Fall Year 2

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	306	Introduction to Biomaterials	3	0	3
EBME	317	Excitable Cells: Molecular Mechanisms	3	0	3
EBME	380	Design for Biomedical Engineering	1	6	3
EECS	281	Logic Design & Computer Organization	3	2	4
ENGR	225	Thermo, Fluids Dynamics, Heat & Mass Transfer	4	0	4
			14	8	17

Spring Year 2

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	309	Modeling Of Biomedical Systems	3	0	3
EBME	314	Biomedical Engineering Lab II	1	3	2
EBME	327	Fundamentals of Bioelectric Engineering	3	0	3
EBME	344	Electronic Analysis and Design	3	0	3
EBME	359	Biomed Computer Simulation Lab	0	3	1
EECS	309	Electromagnetic Fields I	3	0	3
ENGL	398N	Professional Communication for	3	0	3
			16	6	18

Sample Course Sequence for Orthopedic Biomaterials

Fall Year 1

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	201	Physiology – Biophysics I	3	0	3
EBME	308	Biomedical Signals & Systems	3	3	4
EMSE	201	Introduction to Materials Science & Eng.	3	0	3
CHEM	301	Introduction to Physical Chemistry I	3	0	3
ENGR	210	Introduction to Circuits & Instrumentation	3	3	4
			15	6	17

Spring Year 1

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	202	Physiology – Biophysics II	3	0	3
EBME	310	Principles of Biomedical Instrumentation	3	0	3
EBME	360	Biomedical Instrumentation Lab	0	3	1
EBME	313	Biomedical Engineering Lab I	1	3	2
EMSE	303	Mechanical Behavior of Materials	3	0	3
EMSE	202	Phase Diagrams & Transformations	3	0	3
			13	6	15

Fall Year 2

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	306	Introduction to Biomaterials	3	0	3
EBME	314	Biomedical Engineering Lab II	1	3	2
EBME	380	Design for Biomedical Engineering	1	6	3
EMAC	270	Introduction to Polymer Science	3	0	3
EMSE	203	Applied Thermodynamics	3	0	3
ENGR	200	Statics & Strength Materials	3	0	3
			14	9	17

Spring Year 2

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	309	Modeling Of Biomedical Systems	3	0	3
EBME	359	Biomed Computer Simulation Lab	0	3	1
EBME	307	Biomechanical Prosthetic Systems	3	0	3
		(or) ***EMSE 307 Foundry Metallurgy***	***3***	***0***	***3***
ECIV	310	Strength of Materials	3	0	3
ENGR	225	Thermo, Fluids, Heat & Mass Transfer	4	0	4
ENGL	398N	Professional Communication for	3	0	3
			16	3	17

Sample Course Sequence for Polymer Biomaterials

Fall Year 1

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	201	Physiology – Biophysics I	3	0	3
EBME	313	Biomedical Engineering Lab I	1	3	2
ENGR	200	Statics & Strength Materials	3	0	3
ENGR	225	Thermo, Fluids, Heat & Mass Transfer	4	0	4
EMAC	270	Introduction to Polymer Science	3	0	3
			14	3	15

Spring Year 1

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	202	Physiology – Biophysics II	3	0	3
EBME	310	Principles of Biomedical Instrumentation	3	0	3
EBME	360	Biomedical Instrumentation Lab	0	3	1
EBME	350	Quantitative Molecular Bioengineering	3	0	3
EBME	303	Structure of Biological Materials	3	0	3
ENGR	210	Introduction to Circuits & Instrumentation	3	3	4
			15	6	17

Fall Year 2

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	306	Introduction to Biomaterials	3	0	3
EBME	308	Biomedical Signals & Systems	3	3	4
EBME	380	Design for Biomedical Engineering	1	6	3
EMAC	351	Physical Chemistry for Engineers I	3	0	3
EMAC	370	Polymer Chemistry and Industry	3	0	3
			13	9	16

Spring Year 2

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	309	Modeling Of Biomedical Systems	3	0	3
EBME	359	Biomed Computer Simulation Lab	0	3	1
ECHE	340	Biochemical Engineering	3	0	3
EBME	314	Biomedical Engineering Lab II	1	3	2
EMAC	376	Polymer Engineering	3	0	3
EMAC	355	Polymer Analysis Laboratory	2	3	3
			12	9	15

Sample Course Sequence for Tissue Engineering

Fall Year 1

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	201	Physiology – Biophysics I	3	0	3
ENGR	210	Introduction to Circuits & Instrumentation	3	3	4
ENGR	200	Statics & Strength Materials	3	0	3
EBME	308	Biomedical Signals & Systems	3	3	4
EBME	313	Biomedical Engineering Lab I	1	3	2
			13	9	16

Spring Year 1

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	202	Physiology – Biophysics II	3	0	3
EBME	310	Principles of Biomedical	3	0	3
EBME	360	Biomedical Instrumentation Lab	0	3	1
EBME	314	Biomedical Engineering Lab II	1	3	2
ENGL	398N	Professional Communication for	3	0	3
ENGR	225	Thermo, Fluid Dynamics, Heat & Mass	4	0	4
			14	6	16

Fall Year 2

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	306	Introduction to Biomaterials	3	0	3
BIOL	362	Principles of Developmental Biology	3	0	3
EBME	380	Design for Biomedical Engineering	1	6	3
ECHE	360	Transport Phenomenon Chemical	4	0	3
EMAC	270	Introduction to Polymer Science &	3	0	3
			14	6	15

Spring Year 2

Subject Code	Course Number	Course Title	Hours per Week		Semester Credit Hours
			Class	Lab	
EBME	309	Modeling Of Biomedical Systems	3	0	3
EBME	359	Biomed Computer Simulation	0	3	1
ECHE	340	Biochemical Engineering	3	0	3
ECHE	364	Chemical Reaction Processes	3	0	3
EBME	350	Quantitative Molecular	3	0	3
EBME	303	Structure of Biological Materials	3	0	3
			15	3	16