CASE SCHOOL OF ENGINEERING
CASE WESTERN RESERVE UNIVERSITY

Students must take the equivalent of the following courses at their liberal arts college before entering CWRU

General Requirements for Dual Degree Program		
Course	**Course Title**	**Semester Credit Hours**
MATH		
MATH 121	Calculus for Science & Engineering I	4
MATH 122	Calculus for Science & Engineering II	4
MATH 223	Calculus for Science & Engineering III	3
MATH 224	Elementary Differential Equations	3
CHEMISTRY		
CHEM 105	Principles of Chemistry I	3
CHEM 106	Principles of Chemistry II	3
CHEM 113	Principles of Chemistry Laboratory	2
PHYSICS		
PHYS 121	General Physics I-Mechanics	4
PHYS 122	General Physics II-Electricity and Magnetism	4
COMPUTER PROGRAMMING		
Students must take **one** of the following: **EECS 132** should be taken by Computer Engineering majors and computer tracks of BME (Biomedical Computing and Analysis) All other majors should take **ENGR 131**		
ENGR 131	Elementary Computer Programming (MATLAB)	3
EECS 132	Introduction to Programming in Java	3

Sample Course Sequence for Biomedical Engineering
Track: Biomaterials

Summer before entering CWRU

Course	Course Title	Semester Credit Hours
***ENGR 131**	Elementary Computer Programming	3
ENGR 210	Intro to Circuits and Instrumentation	4

Year 1 Fall

Course	Course Title	Semester Credit Hours
EBME 201	Physiology-Biophysics I	3
EBME 306	Introduction to Biomedical Materials	3
EBME 308	Biomedical Signals and Systems	3
EBME 358	Biomedical Signals and Systems Laboratory	1
EMAC 270	Introduction to Polymer Science and Engineering	3
EMAC 351	Physical Chemistry for Engineering	3
		16

Year 1 Spring

Course	Course Title	Semester Credit Hours
CHEM 223	Introductory Organic Chemistry I	3
EBME 202	Physiology-Biophysics II	3
EBME 310	Principles of Biomedical Instrumentation	3
EBME 360	Biomedical Instrumentation Laboratory	1
EMAC 352	Polymer Physics and Engineering	3
ENGR 200	Statics and Strength of Materials	3
		16

Year 2 Fall

Course	Course Title	Semester Credit Hours
EBME 356	Biomaterials Lab.	1
EBME 370	Principles of Biomedical Engineering Design	3
ENGR 398	Professional Communication for Engineers	1

ENGL 398	Professional Communication for Engineers	2
STAT 312	Basic Statistics for Engineering and Science	3
	Approved Technical Elective or Con-joiner Course**	3
	Approved Technical Elective**	3
		16

Year 2 Spring

Course	Course Title	Semester Credit Hours
EBME 309	Modeling of Biomedical Systems	3
EBME 359	Biomedical Computer Simulation Laboratory	1
EBME 380	Biomedical Engineering Design Experience	3
	Approved Technical Elective**	3
	Approved Technical Elective**	3
	Approved Technical Elective or Con-joiner Course**	3
		16

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.*

*Students must have sufficient knowledge of the MATLAB coding language before entering CWRU, whether that's through independent study or a summer class before their first fall semester.

**Biomaterials students must take one con-joiner course and three technical electives. The preferred options are listed below, although others may be approved:
Con-joiner Courses:
EBME 305 (Materials for Prosthetics and Orthotics); EBME 316 (Biomaterials for Drug Delivery); EBME 325 (Introduction to Tissue Engineering)

Approved Technical Electives: EBME 350 (Quantitative Molecular, Cellular, and Tissue Bioengineering); EMAC 276 (Polymer Properties and Design); EBME 303 (Structure of Biological Materials); EMSE 276 (Materials Properties and Design)

Sample Course Sequence for Biomedical Engineering
Track: Biomechanics

Summer before entering CWRU

Course	Course Title	Semester Credit Hours
***ENGR 131**	Elementary Computer Programming	3
ENGR 210	Intro to Circuits and Instrumentation	4

Year 1 Fall

Course	Course Title	Semester Credit Hours
EBME 201	Physiology-Biophysics I	3
EBME 306	Introduction to Biomedical Materials	3
EBME 308	Biomedical Signals and Systems	3
EBME 358	Biomedical Signals and Systems Laboratory	1
EMAE 160	Mechanical Manufacturing	3
ENGR 200	Statics and Strength of Materials	3
		16

Year 1 Spring

Course	Course Title	Semester Credit Hours
EBME 202	Physiology-Biophysics II	3
EBME 309	Modeling of Biomedical Systems	3
EBME 310	Principles of Biomedical Instrumentation	3
EBME 359	Biomedical Computer Simulation Laboratory	1
EBME 360	Biomedical Instrumentation Laboratory	1
EMAE 181	Dynamics	3
EMAE 260	Design and Manufacturing I	3
		17

Year 2 Fall

Course	Course Title	Semester Credit Hours
EBME 370	Principles of Biomedical Engineering Design	3
ECIV 310	Strength of Materials	3
EMAE 251	Thermodynamics	3
ENGL 398	Professional Communication for Engineers	2
ENGR 398	Professional Communication for Engineers	1
STAT 312	Basic Statistics for Engineering and Science	3
	Approved Technical Elective**	3
		18

Year 2 Spring

Course	Course Title	Semester Credit Hours
EBME 305	Materials for Prosthetics and Orthotics	3
EBME 307	Biomechanical Prosthetic Systems	3
EBME 380	Biomedical Engineering Design Experience	3
	Approved Technical Elective**	3
	Approved Technical Elective**	3
		15

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.*

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**Biomechanics students must take 3 of the following approved technical electives.
EMAE 370 (Biomechanical Prosthetic Systems); EECS 304 (Control Engineering I with Lab); EMAE 415 (Intro to Musculo-Skeletal Biomechanics); EBME 326 (Tissue Biomechanics); EMAE 360 (Design and Manufacturing II)

Sample Course Sequence for Biomedical Engineering
Track: Biomedical Computing and Analysis

Summer before entering CWRU

Course	Course Title	Semester Credit Hours
EECS 132	Introduction to Programming in Java	3
ENGR 210	Intro to Circuits and Instrumentation	4
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Year 1 Fall

Course	Course Title	Semester Credit Hours
EECS 233	Introduction to Data Structures	3
EECS 302	Discrete Mathematics	3
ENGR 398	Professional Communication for Engineers	1
ENGL 398	Professional Communication for Engineers	2
EBME 308	Biomedical Signals and Systems	3
EBME 358	Biomedical Signals and Systems Laboratory	1
EBME 201	Physiology-Biophysics I	3
		16

Year 1 Spring

Course	Course Title	Semester Credit Hours
EBME 310	Principles of Biomedical Instrumentation	3
EBME 360	Biomedical Instrumentation Laboratory	1
EBME 309	Modeling of Biomedical Systems	3
EBME 359	Biomedical Computer Simulation Laboratory	4
EECS 324	Modeling and Simulation of Continuous Dynamical Systems	3
EBME 202	Physiology-Biophysics II	3
		17

Year 2 Fall

Course	Course Title	Semester Credit Hours
EBME 306	Introduction to Biomedical Materials	3
EBME 356	Introduction to Biomaterials Engineering Laboratory	1
ENGR 200	Statics and Strength of Materials	3
STAT 312	Basic Statistics for Engineers and Scientists	3
EBME 370	Principles of Biomedical Engineering Design	3
	Approved Technical Elective**	3-4
		16-17

Year 2 Spring

Course	Course Title	Semester Credit Hours
	Con-joiner Course**	3
EBME 380	Biomedical Engineering Design Experience	3
MATH 201	Introduction to Linear Algebra for Applications	3
	Approved Technical Elective**	3-4
	Approved Technical Elective**	3-4
		15-17

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.*

Computing & Analysis students must take 3 technical electives and 1 con-joiner course. Options are listed below.

Technical Electives:

EECS 281 (Logic Design and Computer Organization, 4 cr.); EECS 391 (Introduction to Artificial Intelligence, 3 cr.); EECS 338 (Intro to Operating Systems and Concurrent Programming, 4 cr.); EECS 293 (Software Craftsmanship, 4 cr.); EECS 341 (Introduction to Database Systems, 3 cr.); EECS 340 (Algorithms, 3 cr.)

Con-joiner Courses:

EBME 307 (Biomechanical Prosthetic Systems); EBME 327 (Bioelectric Engineering); EBME 350 (Quantitative Molecular, Cellular, and Tissue Engineering); EBME 361 (Biomedical Image Processing and Analysis)

Sample Course Sequence for Biomedical Engineering
Track: Biomedical Devices and Instrumentation

Summer before entering CWRU

Course	Course Title	Semester Credit Hours
***ENGR 131**	Elementary Computer Programming	3
ENGR 210	Intro to Circuits and Instrumentation	4

Year 1 Fall

Course	Course Title	Semester Credit Hours
EBME 308	Biomedical Signals and Systems	3
EBME 358	Biomedical Signals and Systems Laboratory	1
EECS 281	Logic Design and Computer Organization	4
ENGR 200	Statics and Strength of Materials	3
EBME 201	Physiology-Biophysics I	3
ENGR 398	Professional Communication for Engineers	1
ENGL 398	Professional Communication for Engineers	2
		17

Year 1 Spring

Course	Course Title	Semester Credit Hours
EBME 202	Physiology-Biophysics II	3
EBME 310	Principles of Biomedical Instrumentation	3
EBME 360	Biomedical Instrumentation Laboratory	1
EBME 309	Modeling of Biomedical Systems	3
EBME 359	Biomedical Computer Simulation Laboratory	1
EECS 309	Electromagnetic Fields I	3
EECS 245	Electronic Circuits	4
		18

Year 2 Fall

Course	Course Title	Semester Credit Hours
STAT 312	Basic Statistics for Engineering and Science	3
EBME 370	Principles of Biomedical Engineering Design	3
	Con-joiner Course or Approved Technical Elective	3
EBME 306	Introduction to Biomedical Materials	3
EBME 356	Introduction to Biomaterials Engineering Laboratory	1
	Technical Elective	3-4
		16-17

Year 2 Spring

Course	Course Title	Semester Credit Hours
EBME 380	Biomedical Engineering Design Experience	3
EECS 344	Electronic Analysis and Design	3
	Con-joiner Course or Approved Technical Elective	3
	Technical Elective	3-4
	Technical Elective	3-4
		15-17

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.*

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Technical Electives:
EECS 322 (Integrated Circuits and Electronic Devices); EECS 315 (Digital Systems Design, 4 cr.); EECS 275 (Fundamentals of Robotics, 4 cr.)

Con-joiner Courses:
EBME 320 (Medical Imaging Fundamentals); EBME 327 (Bioelectric Engineering)