

Department of Biomedical Engineering

Program of Biomedical Engineering for International Students (2021)

I. Introduction

The department of biomedical engineering was established in June 2016. The department currently has 19 core faculty members. Research areas in the department include mechanomedicine, wearable devices and wireless health monitoring, de novo regenerative engineering, multiscale and multimodal biomedical imaging, computational medicine for big data and health informatics, biomedical MEMS.

The department of biomedical engineering receives strong support from the department of biomedical engineering at Columbia University and has formed its own undergraduate curricula based on the BME curricula of Columbia University. The major core courses and the capstone course 'biomedical engineering design' were introduced and adapted.

The SUSTech Biomedical Engineering programme train students in the field of engineering and applied sciences to address problems in biology, medicine and life sciences. This skill is crucial for the students to better understand the living systems and their behavior for the development of biomedical systems and devices. Through complex and sophisticated analysis, modern engineering adapts data acquisition and variable measurements to resolve questions that are currently unanswered. These analysis includes simulation and systems development within individual cells, organs, complex organisms and populative studies. The emphasis of the BME programme is to endow students with the understanding of basic engineering science and applied engineering (in both the physical and biological fields). The BME programme aspires to provide students with professional training in biomedical engineering, preparing them for employment or post-graduate studies in the relevant discipline.

II. Objectives and Learning Outcomes

The objectives of the undergraduate program in biomedical engineering are as follows:

- Professional employment in areas such as the medical device industry, engineering consulting, and biotechnology;
- Graduate studies in biomedical engineering or related fields;
- Attendance at medical, dental, or other professional schools.

Learning Outcomes: The undergraduate program in biomedical engineering will prepare graduates who will have:

- a) An ability to apply knowledge of mathematics, science, and engineering;
- b) An ability to design and conduct experiments, as well as to analyze and interpret data;
- c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;

- d) An ability to function on multidisciplinary teams;
- e) An ability to identify, formulate, and solve engineering problems;
- f) An understanding of professional and ethical responsibility;
- g) An ability to communicate effectively;
- h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
- i) A recognition of the need for, and an ability to engage in life-long learning;
- j) A knowledge of contemporary issue;
- k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
- l) An understanding of biology and physiology;
- m) The capability to apply advanced mathematics (including differential equations and statistics), science, and engineering, to solve the problems at the interface of engineering and biology;
- n) The ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and nonliving materials and systems.

III. Study Length and Graduation Requirements

Study length: 4 years

Degree conferred: Bachelor of Engineering

The minimum credit requirement for graduation: 139 credits (not including English courses);

Category	Module	Minimum Credit Requirement
General Education (GE) Required Courses (52 credits)	Science	32
	Physical Education	4
	Chinese Languages & Culture	16
General Education (GE) Elective Courses (10 credits)	Humanities	4
	Social Sciences	4
	Arts	2
	Science	0
Major Course (77 credits)	Major Foundational Courses	16
	Major Core Courses	23
	Major Elective Courses	26
	Internship and Undergraduate Thesis / Projects	12
Total (not including English courses)		139

Note: A minimum of 26 credits are required from Major Elective Courses (including a minimum of 6 lab credits).

IV. Discipline

Biomedical Engineering

V. Main Courses

Major Foundational Courses: Engineering Mechanics-Statics and Dynamics, Principles of Electric Circuits, Signals and Systems, Fundamentals of Biomedical Materials, Cell Biology.

Major Core Courses: Biomedical Optics, Quantitative Physiology I, Quantitative Physiology II,

Biomechanics, Principles of Medical Imaging Systems, Biomaterials and Tissue Engineering, Biomedical Engineering Lab I, Biomedical Engineering Lab II.

VI. Practice-Based Courses

Projects of Science and Technology Innovation, Professional Practice, Biomedical Engineering Design I (or Capstone Design I), Biomedical Engineering Design II (or Capstone Design II).

VII. Pre-requisites for Major Declaration

Major Declaration Time	Course Code	Course Name	Prerequisite
Declare major at the end of First Year	MA101B	Calculus I A	
	MA102B	Calculus II A	MA101B
	MA107A	Linear Algebra A	
	PHY103B	General Physics B (I)	
	PHY105B	General Physics B (II)	PHY103B
	CH101A	General Chemistry A	
	CS102B	Introduction to computer programming B	
	BIO103	Principles of Biology	
	PHY104B	Experiments of Fundamental Physics	
	BMEB111	Principles of Electric Circuits	
NOTES: Declare major at the end of First Year There are 10 courses in the list of Pre-requisites courses at the end of First Year and you are required to complete and pass at least 6 courses of them.			
Declare major at the end of Second Year	MA101B	Calculus I A	
	MA102B	Calculus II A	MA101B
	MA107A	Linear Algebra A	
	PHY103B	General Physics B (I)	
	PHY105B	General Physics B (II)	PHY103B
	CH101A	General Chemistry A	
	CS102B	Introduction to computer programming B	
	BIO103	Principles of Biology	
	PHY104B	Experiments of Fundamental Physics	
	MAE203B	Engineering Mechanics I – Statics and Dynamics	MA107A
	BMEB111	Principles of Electric Circuits	
	EE205	Signals and Systems	MA101B
	BMEB214	Fundamentals of Biomedical Materials	
BIO206-15	Cell Biology	BIO103	
NOTES: Declare major at the end of Second Year 1. You are required to complete the GE Required Courses. In addition, you are required to complete and pass at least 3 courses in the part of Major Foundational Courses. 2. If student doesn't meet the above requirement while GPA is not less than 3.0, they can apply for special approval.			

VIII. Requirements for GE Required Courses

(I) Science Module

Course Code	Course Name	Credit	Lab Credits	Hours/week	Term	Instruction Language	Prerequisite	Dept
MA101B	Calculus I A	4		4	Spr/Fall	1/Fall		Math
MA102B	Calculus II A	4		4	Spr/Fall	1/Spr	MA101B	
MA107A	Linear Algebra A	4		4	Spr/Fall	1/Fall		Math
PHY103B	General Physics B (I)	4		4	Spr/Fall	1/Fall		Physics
PHY105B	General Physics B (II)	4		4	Spr/Fall	1/Spr	PHY103B	
CH101A	General Chemistry A	4		4	Spr/Fall	1/Spr/Fall		Chemistry
CS102B	Introduction to Computer Programming B	3	1	4	Spr/Fall	1/Sp/rFall		Computers
BIO103	Principles of Biology	3		3	Spr/Fall	1/Spr/Fall		Biology
PHY104B	Experiments of Fundamental Physics	2	2	4	Spr/Fall	1/Spr/Fall		Physics
Total		32	3					

(II) Physical Education

Course Code	Course Name	Credits	Hours/week	Terms	Instruction language	Prerequisite	Dept.
GE131	Physical Education I	1	2	Fall	C	NA	PE Center
GE132	Physical Education III	1	2	Spr	C	NA	
GE231	Physical Education III	1	2	Fall	C	NA	
GE232	Physical Education IV	1	2	Spr	C	NA	
GE331	Physical Education V	0	2	Fall	C	NA	
GE332	Physical Education VI	0	2	Spr	C	NA	
Total		4	12				

GE131, GE132, GE231, GE232, GE331, GE332 are required PE courses offered by Center For Physical Education. Students are required to select a specific sport program each semester. Student who meets the exemption conditions stated in "SUSTech Physical Education Course Exemption Regulation" can apply for exemption from GE331 and GE332.

(III) Chinese Languages & Culture

Course Code	Course Name	Credit	Hours/week	Term	Language Instruction	Prerequisite	Dept.
CLE008	Elementary Chinese I	2	4	1/Fall	B	NA	CLE
CLE009	Elementary Chinese II	2	4	1/Spr	B	CLE008	
CLE027	Intermediate Chinese I	2	4	2/Fall	B	CLE009	
CLE028	Intermediate Chinese II	2	4	2/Spr	B	CLE027	
CLE031	Advanced Chinese I	2	4	3/Fall	B	CLE028	
CLE032	Advanced Chinese II	2	4	3/Spr	B	CLE031	
CLE033	Chinese Culture	2	2	Spr/Fall	B/E	NA	CLE/ HUM/ SSC
CLE034	Chinese History	2	2	Spr/Fall	B/E	NA	

(IV) English Language

Students will undertake the English Placement Test and be placed into three levels according to the result of the test and their performance in the National College Entrance Exam. Students at different levels are required to take the courses with a different credit value in total.

Level A: 8 credits; SUSTech English III, English for Academic Purposes and 2-credit CLE elective course

Level B: 12 credits; SUSTech English II, SUSTech English III, English for Academic Purposes, and 2-credit CLE elective course

Level C: 14 credits; SUSTech English I, SUSTech English II, SUSTech English III, and English for Academic Purposes.

List of English Language Courses

Course Code	Course Name	Credit	Hours/week	Language Instruction	Prerequisite	Dept	Notes
CLE021	SUSTech English I	4	4	E	NA	CLE	Required
CLE022	SUSTech English II	4	4	E	CLE021		
CLE023	SUSTech English III	4	4	E	CLE022		
CLE030	English for Academic Purposes	2	2	E	CLE023		
/	(at least one 2-credit CLE elective course)	2	2	E	CLE030		Level A & B Required

IX Requirements for GE Elective Courses

(I) Students are required to complete 4 credits for the Humanities Module and Social Sciences Module respectively, and 2 credits for the Music and Art Module. (Information about the available courses and the instruction language will be announced before the course selection session)

X. Major Course Arrangement

Table 1: Major Required Course (Foundational and Core Courses)

Course Category	Course Code	Course Name	Credit	Lab Credits	Hours/week	Term	Advised term to take the course	Instruction language	Prerequisite	Dept.
Major Foundational Courses	MAE203B	Engineering Mechanics I – Statics and Dynamics	3		3	Fall	2/Fall	E	MA107A	MAE
	BMEB111	Principles of Electric Circuits	3		3	Fall	2/Fall	E		BME
	EE205	Signals and Systems	3	1	4	Fall	2/Fall	E	MA101B	EE
	BMEB214	Fundamentals of Biomedical Materials	3		3	Fall	2/Fall	E		BME
	BIO206-15	Cell Biology	4		4	Spr	2/Spr	E	BIO103	BIO
	Total			16						
Major Core Courses	BMEB315	Biomedical Optics	2		2	Spr	2/Spr	B/E		BME
	BMEB311	Quantitative Physiology I	3		3	Fall	3/Fall	E		BME
	BMEB318	Biomechanics	3		3	Fall	3/Fall	E		BME
	BMEB317	Principles of Medical Imaging Systems	3		3	Fall	3/Fall	E	BMEB111	BME
	BMEB312	Quantitative Physiology II	3		3	Spr	3/Spr	E	BMEB311	BME
	BMEB319	Biomaterials and Tissue Engineering	3		3	Spr	3/Spr	E		BME
	BMEB321	Biomedical Engineering Lab I	3	3	6	Fall	3/Fall	E		BME
	BMEB322	Biomedical Engineering Lab II	3	3	6	Spr	3/Spr	E	BMEB321	BME
	Total			23						
Practice-based Courses	BMEB121*	Projects of Science and Technology Innovation	2	2	4	Start 1Spr		B/E		BME
	BMEB470	Professional Practice	2	2	16	Smr	3/ Smr	B		BME
	BMEB422	Biomedical Engineering Design I	4	4	8	Fall	4/ Fall	B/E		BME
	BMEB423	Biomedical Engineering Design II	4	4	8	Spr	4/ Spr	B/E	BMEB422	BME
	Total			12						
Total			51							

NOTE: Students who have completed Comprehensive Design I&II (COE491 & COE492) are not required to take the BMEB422 &BMEB423.

Table 2: Major Elective Courses

Course Code	Course Name	Credits	Lab Credits	Hours/week	Term	Advised term to take the course	Instruction language	Prerequisite	Dept.
BMEB131	Introduction to Biomedical Engineering	2		2	Spr	1/Spr	B		BME
BMEB324	Biomedical Optics Laboratory	2	2	4	Spr	3/Spr	E	BMEB315	BME
BMEB325	Medical Imaging Systems Laboratory	2	2	4	Spr	3/Spr	B	BMEB317	BME
BMEB211	Introduction to Nanobiomedicine	3		3	Spr	2/Spr	E		BME
BMEB213	Medical Materials and Devices	3		3	Fall	2/Fall	E		BME
BMEB316	Medical Image Processing	3	1	4	Fall	3/Fall	E		BME
BMEB215	Machine Learning and its Medical Engineering Applications	3		3	Spr	2/ Spr	E	MA102B,M A107A,MA2 12	BME
BMEB216	Anatomy and Physiology	3		3	Spr	2/ Spr	E		BME
BMEB319	Neural Engineering and Brain-computer Interface	3		3	Fall	3/ Fall	E	MA107A	BME
BMEB330	Medical Robotics	3		3	Spr	3/ Spr	E	MA107B	BME
BMEB331	Medical Big Data	3		3	Spr	3/ Spr	E	MA102B; MA107A; MA212; BMEB215	BME
BMEB332	Intelligent Sensing Technology	3		3	Spr	3/ Spr	E		BME
BMEB326	Clinical Perception for Biomedical Engineering I	2		2	Spr	2/ Spr	B/E		BME
BMEB327	Clinical Perception for Biomedical Engineering II	2	2	4	Smr	2/ Smr	B/E	BMEB326	BME
EE202-17	Digital Circuits	3		3	Spr	2/Spr	C	PHY105B	EE
EE202-17L	Digital Circuits Laboratory	1	1	2	Spr	2/Spr	C	EE202-17	EE
EE323	Digital Signal Processing	3	1	4	Fall	3/Fall	E	EE205	EE
EE303	Fundamentals of Optoelectronic Technology	3	1	4	Fall	3/Fall	B	PHY105B	EE
EE419	Biosensors	3	1	4	Fall	4/Fall	E		EE
EE431	BioMEMS and Lab-on-a-Chip	3		3	Fall	4/Fall	E		EE

EE306	Introduction to MEMS	3	1	4	Spr	3/Spr	B	PHY105B	EE
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	4	Spr	2/Spr	B	BIO201 ; BIO104 ;	BIO
BIO320	Molecular Biology	3		3	Fall	2/Fall	B	BIO103	BIO
BIO202	Biochemistry II (metabolism)	3		3	Spr	2/Spr	B	BIO201	BIO
BIO203	Microbiology	3		3	Spr	2/Spr	B		BIO
BIO201	Biochemistry (Macromolecules)	3		3	Fall	2/Fall	B	BIO103 ; CH101A	BIO
BIO208	Cell biology laboratory	2	2	4	Spr	2/Spr	B	BIO104	BIO
BIO332	Stem Cell and Regenerative Biology	2		2	Spr	3/Spr	B	BIO206-15	BIO
BIO306	Bioinformatics	4	2	6	Spr	3/Spr	B	BIO309	BIO
BIO304	Systems Biology	3		3	Fall	3/Fall	B	BIO102A or BIO103 ; MA212 ;	BIO
BIO310	Neurobiology	3		3	Fall	3/Fall	B	BIO201	BIO
BIO405	Immunology	3		3	Fall	4/Fall	B	BIO206-15	BIO
BIO104	General Biology Laboratory	2	2	4	Spr	1Spr	B	BIO102Bor BIO103	BIO
MED306	Histology and Embryology	3	1	4	Fall	3/Fall		BIO320 ; BIO206-15	MED
CS301	Embedded System and Microcomputer Principle	3	1	4	Fall	3/Fall	B	EE202-17 or CS207	CS
CS202	Computer Organization	3	1	4	Spr	2/Spr	B	EE202-17	CS
CS203B	Data Structures and Algorithm Analysis B	3	1	4	Fall	2/Fall	B	CS102A or GE105	CS
MA305	Numerical Analysis	3		3	Fall	3/Fall	C	MA203a or MA213	MA
MA212	Probability and Statistics	3		3	SprFall	2/Spr	B	MA102a or MA102B	MA
ME102	CAD and Engineering Drawing	3		3	Fall	1/Fall	B		ME
CH216	Analytical Chemistry I	3		3	Fall	2/Fall	B	CH101A	CH
Total		113							

NOTE: A minimum of 26 credits are required from Major Elective Courses (including a minimum of 6 lab credits).

Table 3: Overview of Practice-Based Courses

Course Code	Course Name	Credits	Lab Credits	Hours/week	Term	Advised term to take the course	Instruction language	Prerequisite	Dept.
BMEB321	Biomedical Engineering Lab I	3	3	6	Fall	3Fall	B		BME
BMEB322	Biomedical Engineering Lab II	3	3	6	Spr	3Spr	B	BMEB321	BME
BMEB316	Medical image processing	3	1	4	Fall	3/Fall	E		BME
BMEB327	Clinical Perception for Biomedical Engineering II	2	2	4	Smr	2/ Smr	B/E	BMEB326	BME
BIO104	Biology Laboratory	2	2	4	Spr	1Spr	B	BIO102B or BIO103	BIO
CS203B	Data Structure and Algorithm AnalysisB	3	1	4	Fall	2/Fall	C	CS102A or GE105	EE
BIO208	Cell Biology Laboratory	2	2	4	Fall	2/Fall	B	BIO206-15 ; BIO104	BIO
BIO204	Biochemistry Laboratory	2	2	4	Spr	2/Spr	B	BIO201; BIO104; BIO320	BIO
EE208	Engineering electromagnetics	3	1	4	Spr	2/Spr	B	MA101B ; MA103A ; EE104	EE
EE202-17L	Digital Circuit Laboratory	1	1	2	Spr	2/Spr	C	EE202-17	EE
CS202	Computer Organization	3	1	4	Spr	2/Spr	B	EE202-17	CS
EE303	Fundamental of Optoelectronic Technology	3	1	4	Fall	3/Fall	B	PHY105B	EE
EE323	Digital Signal Processing	3	1	4	Fall	3/Fall	E	EE205	EE
CS301	Embedded system and microcomputer principle	3	1	4	Fall	3/Fall	B	EE202-17 or CS207	EE
MED306	Histology and Embryology	3	1	4	Fall	3/Fall		BIO320 ; BIO206-15	MED
BMEB325	Medical Imaging Systems Laboratory	2	2	4	Spr	3/Spr	C	BMEB317 ; EE205	BME
BMEB324	Biomedical Optics Laboratory	2	2	4	Spr	3/Spr	B	BMEB315	BME
BIO306	Bioinformatics	4	2	6	Spr	3/Spr	B	BIO309	BIO
EE306	Introduction to MEMS	3	1	4	Spr	3/Spr	B	PHY105B	EE
EE419	Biosensors	3	1	4	Fall	4/Fall	E		EE
BMEB121	Projects of Science and Technology Innovation	2	2	4	Start1S pr		B		BME
BMEB470	Professional Practice	2	2	4	Sum	3/Sum			BME
BMEB422	Biomedical Engineering Design I	4	4	8	Fall	4/Fall	E		BME
BMEB423	Biomedical Engineering Design II	4	4	8	Spr	4/Spr	E	BMEB422	BME
Total		65							

Table 4: Overview of Course Hours and Credits

Course Category	Total Course Hours	Total Credits	Credit Requirements	Percentage of the Total*
General Education (GE) Required Courses (not including English courses)			52	37.4%
General Education (GE) Elective Courses			10	7.2%
Major Foundational Courses	272	16	16	11.5%
Major Core Courses	464	23	23	16.5%
Major Elective Courses	2224	113	26	18.7%
Research Projects, Internship and Undergraduate Thesis/Projects	384	12	12	8.6%
Total (not including English courses)			139	

* Percentage of the total= Credit requirements of each line / Total credit requirements

Curriculum Structure of Program of Biomedical Engineering for Class 2021

