Program of Biomedical Engineering for International Students (2019)

I. Introduction

The department of biomedical engineering was established in June 2016. The department currently has 16 core and affiliated 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.

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 programs in biomedical engineering at SUSTech prepare students to apply engineering and applied science to problems in biology, medicine, and the understanding of living systems and their behavior, and to develop biomedical systems and devices. Modern engineering encompasses sophisticated approaches to measurement, data acquisition and analysis, simulation, and systems identification. These approaches are useful in the study of individual cells, organs, entire organisms, and populations of organisms. The programs offered in the Department of Biomedical Engineering seek to emphasize the confluence of basic engineering science and applied engineering with the physical and biological sciences, train students to have the professional activity in any area of biomedical engineering or to go on to graduate school for further studies in related fields.

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 creidts)	Science	32
	Physical Education	4
	Chinese Languages & Culture	16
General Education (GE) Elective Courses (10creidts)	Humanities	4
	Social Sciences	4
	Arts	2
Major Course (77 creidts)	Major Foundational Courses	15
	Major Core Courses	21
	Major Elective Courses	29
	Research Projects, Internship and Undergraduate Thesis / Projects	12
Total (not including English courses)		139

Note: A minimum of 29 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 I – Statics and Dynamics, Fundamentals of Electric Circuits, Signals and Systems, Fundamentals of Materials Science and

Engineering, Cell Biology.

Major Core Courses: 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, Biomedical Engineering 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	
	MSE001	Fundamentals of Materials Science and Engineering	PHY105B, CH101A
	EE104	Fundamentals of Electric Circuits	MA101B, MA107B
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
	EE104	Fundamentals of Electric Circuits	MA101B, MA107B
	EE205	Signals and Systems	MA101B
	MSE001	Fundamentals of Materials Science and Engineering	PHY105B, CH101A
	BIO206-15	Cell Biology	BIO103

NOTES:

1. **Declare major at the end of First Year: There are 11 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.**

2. Declare major at the end of Second Year: You are required to complete the GE Required Courses. In addition, you are required to complete and pass at least 4 courses in the part of Major Foundational Courses.

VIII. Requirements for GE Required Courses

(I) Science Module

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

(II) Physical Education

Course Code	Course Name	Credit	Lab Credits	Hours/week	Term	Language Instruction	Prerequisite	Dept
GE131	Physical Education I	1		2	1/Fall	C	NA	PE Center
GE132	Physical Education II	1		2	1/Spr	C	NA	
GE231	Physical Education III	1		2	2/Fall	C	NA	
GE232	Physical Education IV	1		2	2/Spr	C	NA	
Total		4		8				

(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	
Total		16	28				

(IV) English Language

All students are required to undertake the English Placement Test before selecting courses, based on which students will be assigned to 3 levels to be ready for the courses with English as the instruction language.

SUSTech English III, English for Academic Purposes are required for Level A.

SUTech English II, SUSTech English III, English for Academic Purposes for Level B.

SUSTech English I, SUSTech English II, SUSTech English III, English for Academic for Level C.

Course Code	Course Name	Credit	Hours/week	Instruction Language	Prerequisite	Dept
CLE021	SUSTech English I	4	4	E	NA	CLE
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	

IX Requirements for GE Elective Courses

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
	EE104	Fundamentals of Electric Circuits	2		2	Spr	1/Spr	B	MA101B MA107B	EE
	EE205	Signals and Systems	3	1	4	Fall	2/Fall	B	MA101B	EE
	MSE001	Fundamentals of Materials Science and Engineering	3		3	Spr/Fall	2/Fall	E	PHY105BC H101A	MSE
	BIO206-15	Cell Biology	4		4	Spr	2/Spr	B	BIO103	BIO
	Total		15							
Major Core Courses	BMEB311	Quantitative Physiology I	3		3	Fall	3/Fall	B		BME
	BMEB318	Biomechanics	3		3	Fall	3/Fall	E		BME
	BMEB317	Principles of Medical Imaging Systems	3		3	Fall	3/Fall	B	EE103	BME
	BMEB312	Quantitative Physiology II	3		3	Spr	3/Spr	B	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	B		BME
	BMEB322	Biomedical Engineering Lab II	3	3	6	Spr	3/Spr	B	BMEB321	BME
	Total		21							
Lab Course	BMEB121*	Projects of Science and Technology Innovation	2	2	4	Start 1Spr		B		BME
	BMEB470	Professional Practice	2	2	16	Smr	3/Smr			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		12	12	24					

Table 2: Major Elective Courses

Course Code	Course Name	Credit	Lab Credits	Hours/week	Term	Advised term to take the course	Instruction language	Prerequisite	Dept.
BMEB131	Introduction to Biomedical Engineering	2		2	Fall	1/Fall	C		BME
BMEB315	Biomedical Optics	2		2	Spr	3/Spr	B		BME
BMEB324	Biomedical Optics Laboratory	2	2	4	Spr	3/Spr	B	BMEB315	BME
BMEB325	Medical Imaging Systems Laboratory	2	2	4	Spr	3/Spr	C	BMEB317	BME
BMEB211	Introduction to nanobiomedicine	3		3	Spr	1/Spr	B		BME
EE201-17	Analog Circuits	3		3	Fall	2/Fall	C	PHY105B EE104	EE
EE201-17 L	Analog Circuit Laboratory	1	1	2	Fall	2/Fall	C	EE201-17	EE
EE202-17	Digital Circuits	3		3	Spr	2/Spr	C	PHY105B	EE
EE202-17 L	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	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	BIO103 or BIO102B	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		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	Spr/ Fall	2/Spr	B	MA102a or MA102B	MA
ME102	CAD and Engineering Drawing	3		3	Fall	1/Fall	B		ME
Total		88							

Note: A minimum of 29 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	Credit	Lab Credits	Hours/week	Term	course take the term to Advised	Instruction language	Prerequisite	Dept.
BMEB321	Biomedical Engineering Lab I	3	3	6	Fall	3/Fall	B		BME
BMEB322	Biomedical Engineering Lab II	3	3	6	Spr	3/Spr	B	BMEB321	BME
BIO104	Biology Laboratory	2	2	4	Spr	1/Spr	B	BIO103 or BIO102B	BIO
CS203B	Data Structure and Algorithm AnalysisB	3	1	4	Fall	2/Fall	C	CS102A or GE105	EE
EE201-17L	Analog Circuit Laboratory	1	1	2	Fall	2/Fall	C	EE201-17	EE
MSE209	Experiments for Fundamentals of Materials Science	1	1	2	Spr/ Fall	2/Fall	E	PHY105B CH101A	MSE
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 MA107A 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		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	Start 1Spr		B		BME
BMEB470	Professional Practice	2	2	4	Smr	3/Smr			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		62	42	104					

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	52	37.4%
General Education (GE) Elective Courses			10	7.2%
Major Foundational Courses	256	15	15	10.8%
Major Core Courses	448	21	21	15.1%
Major Elective Courses	1648	88	29	20.9%
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 Biomedical Engineering

