Department of Biomedical Engineering

Program of Biomedical Engineering for International Students

(2022)

I. Introduction

The department of biomedical engineering was established in June 2016. The department currently has 21 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.

Academic subject area: Biomedical Engineering; Program code: 082601

II. Objectives and Learning Outcomes

1. Objectives

(1) Professional employment in areas such as the medical device industry, engineering consulting, and biotechnology;

(2) Graduate studies in biomedical engineering or related fields;

(3) Attendance at medical, dental, or other professional schools.

2. Learning Outcomes

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, Degree, and Graduation Requirements

1. Study length: 4 years. The academic credit system of SUSTech allows flexible study years, but not less than 3 years or more than 6 years

2. Degree conferred: Students who complete and meet the degree requirements of the undergraduate program will be awarded a bachelor's degree in Engineering.

3. The minimum credit requirement for graduation: 155 credits. The specific requirements are as follows.

Module		**Category**	**Minimum Credit Requirement**
General Education Courses	Chinese Language and Culture Module	Chinese Language and Culture	16
	Arts and Physical Education Module	Physical Education	4
		Arts	2
	Competence Development Module	Computer Programming	3
		Writing	2
		Chinese Studies	2
		Foreign Languages	14
	Humanities and Social Sciences Module	Humanities	6
		Social Sciences	
	Mathematics and Natural Sciences Module	Mathematics	12
		Physics	10
		Chemistry	3
		Biology	3
	Introduction to Majors Module	Introduction to Majors	2
Major Courses	Major Required Courses	Major Foundational Courses	15
		Major Core Courses	23
		Practice-based Learning (Undergraduate Thesis, Internships, Research projects, etc.)	16
	Major Elective Courses	Major Elective Courses	22 (including a minimum of 6 lab credits)
Total			155
Note: please see the General Education Requirement for more details on Chinese Language and Culture Module, Arts and Physical Education Module, Competence Development Module（Foreign Languages & Chinese Studies & Writing）, Humanities and Social Sciences Module, and Introduction to Majors Module.			

IV. Course Requirements for the Mathematics and Natural Sciences Module and Computer Programming

Course Category	Course Code	Course Name	Credits	Terms	Prerequisite	Dept.
Mathematics	MA117/ MA101a	Calculus I/ Mathematical Analysis I	4/5	1 Fall	None	Department of Mathematics
	MA127/ MA102a	Calculus II/ Mathematical Analysis II	4/5	1 Spring	Calculus I/Mathematical Analysis I	
	MA113/ MA107	Linear Algebra/ Advanced Linear Algebra I	4	1 Spring & Fall	None	
Physics	PHY105/ PHY101	College Physics I/ General Physics I	4/5	1 Fall	None	Department of Physics
	PHY106/ PHY102	College Physics II/ General Physics II	4/5	1 Spring	College Physics I/General Physics I	
	PHY104B	Experiments of Fundamental Physics	2	1-2 Spring & Fall	None	
Chemistry	CH105/ CH103	Chemistry: The Central Science/ General Chemistry	3/4	1-2 Spring & Fall	None	Department of Chemistry
Biology	BIO103	Principles of Biology	3	1-2 Spring & Fall	None	Department of Biology
Computer Programming ①	CS109	Introduction to Computer Programming	3	1-2 Spring & Fall	None	Dept. of Computer Science and Engineering
	CS110	Introduction to Java Programming	3	1-2 Spring & Fall	None	
	CS111	Introduction to C programming	3	1-2 Spring & Fall	None	
	CS112	Introduction to Python Programming Python	3	1-2 Spring & Fall	None	
	CS113	Introduction to Matlab Programming	3	1-2 Spring & Fall	None	
	①NOTES: You are required to complete and pass at least 1 course in the part of Computer Programming.					

V. Prerequisites for Major Declaration

Major Declaration Time	Course Code	Course Name	Prerequisite
Declare major at the end of the first academic year	MA117/MA101a	Calculus I/ Mathematical Analysis I	None
	MA127/MA102a	Calculus II/ Mathematical Analysis II	MA117/MA101a
	MA113/MA107	Linear Algebra/ Advanced Linear Algebra I	None
	PHY105/PHY101	College Physics I/ General Physics I	None
	PHY106/PHY102	College Physics II/ General Physics II	PHY105/PHY102
	CH105/CH103	Chemistry: The Central Science/ General Chemistry	None
		Computer Programming①	None
	BIO103	Principles of Biology	None
	PHY104B	Experiments of Fundamental Physics	None
	Notes: There are 9 courses in the list of Pre-requisites courses at the end of First Year and you are required to complete and pass at least 4 courses of them. ① **For the Computer Programming, you are required to complete and pass at least 1 course.**		
Declare major at the end of the second academic year	MA117/MA101a	Calculus I/ Mathematical Analysis I	None
	MA127/MA102a	Calculus II/ Mathematical Analysis II	MA117/MA101a
	MA113/MA107	Linear Algebra/ Advanced Linear Algebra I	None
	PHY105/PHY101	College Physics I/ General Physics I	None
	PHY106/PHY102	College Physics II/ General Physics II	PHY105/PHY102
	CH105/CH103	Chemistry: The Central Science/ General Chemistry	None
		Computer Programming①	None
	BIO103	Principles of Biology	None
	PHY104B	Experiments of Fundamental Physics	None
	Notes: There are 9 courses in the list of Pre-requisites courses at the end of Second Year and you are required to complete and pass at least 7 courses of them. ① **For the Computer Programming, you are required to complete and pass at least 1 course.**		

Note:

1. **If the number of students entering a major at the end of the first academic year in the department is greater than or equal to the total number of the teaching-research faculty (PI)*2*60%, all majors in the department may implement the prerequisites for major declaration at the end of the second academic year.**
2. **If the number of students entering a major at the end of the first academic year in the department is less than the total number of the teaching-research faculty (PI)*2*60%, all majors in the department do not implement the prerequisites for major declaration at the end of the second academic year.**
3. **Suppose the number of students applying for a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), then the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).**
4. **For departments that do not implement prerequisites for major declaration at end of the second academic year, if the cumulative number of students applying for a major at the end of the second academic year and the number of students who have entered a major at the end of the first academic year exceeds four times the total number of the teaching-research faculty (PI), the department may select students according to predetermined rules. In principle, the rules set by the department shall examine the students' suitability for the major and not based on weighted GPA (Specific rules shall be set by the department and announced in advance).**

VI: Major Course Arrangement

Table 1: Major Required Courses

Program of Biomedical Engineering

Course Category	Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
Major Foundational Courses	BMEB111	Principles of Electric Circuits	3		1/Spring		BME
	EE205	Signals and Systems	3	1	2/Fall	MA117	EE
	BMEB217	Fundamentals of Engineering Mechanics	3		2/Fall		BME
	BMEB214	Fundamentals of Biomedical Materials	3		2/Spring & Fall		BME
	BMEB218	Molecular Cell Biology	3		2/Fall		BME
	Total		15	1			
Major Core Courses	BMEB315	Biomedical Optics	2		2/Spring		BME
	BMEB311	Quantitative Physiology I	3		3/Fall		BME
	BMEB318	Biomechanics	3		3/Fall		BME
	BMEB317	Principles of Medical Imaging Systems	3		3/Fall	BMEB111	BME
	BMEB321	Biomedical Engineering Lab I	3	3	3/Fall		BME
	BMEB312	Quantitative Physiology II	3		3/Spring	BMEB311	BME
	BMEB319	Biomaterials and Tissue Engineering	3		3/Spring		BME
	BMEB322	Biomedical Engineering Lab II	3	3	3/Spring		BME
	Total		23	6			
Practice-based Courses	BMEB121*	Projects of Science and Technology Innovation	2	2	Start from 1 Spring		BME
	BMEB470	Professional Practice	2	2	Summer		BME
	BMEB492	Biomedical Engineering Design I	6	6	Fall		BME
	BMEB493	Biomedical Engineering Design II	6	6	Spring	BMEB492	BME
	Total		16	16			
Total			54	23			

Note: Students who have completed Comprehensive Design I&II are not required to take the BMEB492 &BMEB493.

Table 2: Major Elective Courses

Program of Biomedical Engineering

Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
BMEB211	Introduction to Nanobiomedicine	3		1/Spring		BME
BMEB213	Medical Materials and Devices	3		2/Fall		
BMEB324	Biomedical Optics Laboratory	2	2	2/Spring	BMEB315	
BMEB215	Machine Learning and its Medical Engineering Applications	3		2/Spring	MA113,MA212	
BMEB216	Anatomy and Physiology	3		2/Spring		
BMEB326	Clinical Perception for Biomedical Engineering I	2		2/Spring		
BMEB327	Clinical Perception for Biomedical Engineering II	2	2	2/Summer	BMEB326	
BMEB316	Medical Image Processing	3	1	3/Fall		
BMEB333	Neural Engineering and Brain-computer Interface	3		3/Fall	MA113	
BMEB325	Medical Imaging Systems Laboratory	2	2	3/Spring	BMEB317	
BMEB330	Medical Robotics	3		3/Spring	MA113	
BMEB331	Medical Big Data	3		3/Spring	MA127 MA113 MA212	
BMEB332	Intelligent Sensing Technology	3		3/Spring		
EE202-17	Digital Circuits	3		2/Spring	PHY105	EE
EE202-17L	Digital Circuits Laboratory	1	1	2/Spring	EE202-17	
EE323	Digital Signal Processing	3	1	3/Fall	EE205	
EE303	Fundamentals of Optoelectronic Technology	3	1	3/Fall	PHY105	
EE306	Introduction to MEMS	3	1	3/Spring	PHY105	
EE419	Biosensors	3	1	4/Fall		
EEE5011	BioMEMS and Lab-on-a-Chip	3		4/Fall		
BIO104	General Biology Laboratory	2	2	1Spring	BIO103	BIO
BIO320	Molecular Biology	3		2/Fall	BIO103	
BIO201	Biochemistry（Macromolecules）	3		2/Fall	BIO103, CH103	
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	2/Spring	BIO201, BIO104	
BIO202	Biochemistry II (metabolism)	3		2/Spring	BIO201	
BIO203	Microbiology	3		2/Spring		
BIO208	Cell biology laboratory	2	2	2/Spring	BIO206-15	
BIO304	Systems Biology	3		3/Fall	BIO103, MA212	
BIO310	Neurobiology	3		3/Fall	BIO201	
BIO332	Stem Cell and Regenerative Biology	2		3/Spring	BIO206-15	
BIO306	Bioinformatics	4	2	3/Spring	BIO309	

BIO309	Computational Biology	3	1	3/Spring		
BIO405	Immunology	3		4/Fall	BIO206-15	
CS203B	Data Structures and Algorithm Analysis B	3	1	2/Fall	CS109	CS
CS202	Computer Organization	3	1	2/Spring	EE202-17 EE202-17L CS207	
CS207	Digital Logic	3	1	2/Spring		
CS301	Embedded System and Microcomputer Principle	3	1	3/Fall	EE202-17 EE202-17L CS207	
MED306	Histology and Embryology	3	1	3/Fall		MED
MA212	Probability and Statistics	3		2/Spring	MA127	MA
MA305	Numerical Analysis	3		3/Fall	MA203a or MA213	
ME102	CAD and Engineering Drawing	3	1.5	1/Fall		ME
CH216	Analytical Chemistry I	3		2/Fall	CH101	CH
Total		117	27.5			

Note:
(1) A minimum of 22 credits are required from Major Elective Courses (including a minimum of 6 lab credits).
(2) If students have completed the part of Introduction to Majors and have more credits, you can use the course of "Introduction to Biomedical Engineering" and "Introduction to Intelligent Medical Engineering" to exchange the major elective credits.

Table 3: Overview of Practice-based Learning

Program of Biomedical Engineering

Course Code	Course Name	Credits	Practice-based Learning Credits	Terms	Prerequisite	Dept.
BMEB121*	Projects of Science and Technology Innovation	2	2	Start from 1 Spring		BME
BMEB470	Professional Practice	2	2	3/Summer		
BMEB492	Biomedical Engineering Design I	6	6	4/Fall		
BMEB493	Biomedical Engineering Design II	6	6	4/Spring	BMEB492	
BMEB321	Biomedical Engineering Lab I	3	3	3/Fall		
BMEB322	Biomedical Engineering Lab II	3	3	3/Spring	BMEB321	
BMEB324	Biomedical Optics Laboratory	2	2	3/Spring	BMEB315	
BMEB325	Medical Imaging Systems Laboratory	2	2	3/Spring	BMEB317	
BMEB316	Medical image processing	3	1	3/Fall		
BMEB327	Clinical Perception for Biomedical Engineering II	2	2	2/Summer	BMEB326	
EE205	Signals and Systems	3	1	2/Fall	MA117	EE
EE202-17L	Digital Circuit Laboratory	1	1	2/Spring	EE202-17	
EE323	Digital Signal Processing	3	1	3/Fall	EE205	
EE303	Fundamental of Optoelectronic Technology	3	1	3/Fall	PHY105	
EE419	Biosensors	3	1	4/Fall		
EE306	Introduction to MEMS	3	1	3/Spring	PHY105	
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	2/Spring	BIO201 BIO104	BIO
BIO208	Cell biology laboratory	2	2	2/Spring	BIO206-15	
BIO306	Bioinformatics	4	2	3/Spring	BIO309	
BIO309	Computational Biology	3	1	3/Spring		
BIO104	General Biology Laboratory	2	2	1/Spring	BIO103	
MED306	Histology and Embryology	3	1	3/Fall		MED
CS301	Embedded System and Microcomputer Principle	3	1	3/Fall	EE202-17 EE202-17L	CS
CS202	Computer Organization	3	1	2/Spring	EE202-17 EE202-17L CS207	
CS207	Digital Logic	3	1	2/Spring		
CS203B	Data Structures and Algorithm Analysis B	3	1	2/Fall	CS109	
ME102	CAD and Engineering Drawing	3	1.5	1/Fall		ME
Total		78	50.5			

Curriculum Structure of Biomedical Engineering