Department of Biomedical Engineering

Program of Biomedical Engineering (2017)

I. Introduction

SUSTech Biomedical Engineering Department absorbed Columbia University's Department of biomedical engineering undergraduate training courses, established the cultivating way of the enhanced version of the Columbia University Biomedical Engineering. The programs in biomedical engineering at SUSTech (B.S.,M.S., Ph.D., Eng.Sc.D., and M.D./Ph.D.) prepare students to apply engineering and apply 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 increasing value of mathematical models in the analysis of living systems is an important sign of the success of contemporary activity. 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, particularly in the areas of biomechanics, cell and tissue engineering, and biosignals and biomedical imaging.

Programs of biomedical engineering are taught by its own faculty, members of other Engineering departments, and faculty from other University divisions who have strong interests and involvement in biomedical engineering. Several of the faculty holds joint appointments in Biomedical Engineering and other University departments. Educational programs at all levels are based on engineering and biological fundamentals. From this basis, the program branches into concentrations along three tracks: biomechanics, cell and tissue engineering, and biosignals and biomedical imaging. The intrinsic breadth of these tracks, and a substantial elective content, prepare bachelor's and master's students to commence professional activity in any area of biomedical engineering or to go on to graduate school for further studies in related fields.

II. Objectives

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.

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 issues;
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. Period of Study and Degree Requirement

Program length: 4 years
Degree conferred: Bachelor of Engineering
The minimum credit requirement for graduation: 137.5 credits (not including English courses)

IV. Discipline

Biomedical Engineering

V. Main Courses

Major Foundational Courses: The Fundamentals of Electric Circuits, Fundamentals of Materials Science and Technology, Engineering Mechanics I – Statics and Dynamics, Probability and Mathematical Statistics, Cell Biology, General Biology Laboratory.

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

Engineering I, Biomedical Engineering II, Biomedical Engineering Lab I, Biomedical Engineering Lab II.

VI. Practice-Based Courses

Projects of Science and Technology Innovation, Internship, Biomedical Engineering Design I, Biomedical Engineering Design II.

VII. Course Structure and Credit Requirements

General Education (GE) Required Courses: 52.5 credits (not including English courses);

General Education (GE) Elective Courses: 10 credits;

Major Foundational Courses：18 credits;

Major Core Courses: 18 credits;

Major Elective Courses: 27 credits;

Undergraduate Thesis/Projects, Research Projects, Internship: 12 credits;

The minimum credit requirement for graduation: 137.5 credits (not including English courses).

VIII. Requirement for GE Required Courses

Course Code	Course Name	Credits
MA101B	Calculus 1 A	4
MA102B	Calculus II A	4
MA103A	Linear Algebra I A	4
PHY103B	General Physics I B	4
PHY105B	General Physics II B	4
CH101-A	General Chemistry A	4
CS102B	Computer programming fundamentals B	3
BIO102A	General Biology	4
PHY104	Experiment for Foundation of Physics	1.5

IX. Pre-requisites for Major Declaration

Course Code	Course Name	Notes
MA101B	Caculus 1 A	4
MA102B	Caculus II A	4
MA103A	Linear Algebra I-A	4
PHY103B	General Physics B (I)	4
PHY105B	General Physics B (II)	4
CH101-A	General Chemistry A	4
CS102B	Computer programming fundamentals B	3
BIO102A	General Biology	4
NOTE: For the major required courses, there are 6 courses (18 credits) in the first two years and you should complete at least 3 courses of them.		

X. Course Arrangement

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

Course Category	Course Code	Course Name	Credits	Lab Credits	Hours/week	Terms	Advised term to take the course	Instruction language	Prerequisite	Dept.
Major Fundamental Courses	EE104	The Fundamentals of Electric Circuits	2		2	Spr.	1/Spr.		MA101B, MA103B	EEE
	MSE201	Fundamentals of Materials Science and Technology	4	1	5	Fall	2/Fall		PHY105B, CH101-A	MSE
	MAE203B	Engineering Mechanics I – Statics and Dynamics	3		3	Fall	2/Fall		MA102B, PHY105B	MAE
	MA212	Probability and Mathematical Statistics	3		3	Spr./ Fall	2/Spr.		MA102a or MA102B	MATH
	BIO206-15	Cell Biology	4		4	Fall	2/Fall		BIO102A	BIO
	BIO104	General Biology Laboratory	2	2	4	Spr.	2/Spr.		BIO102A or BIO102B	BIO
	Total		**18**	**3**	**21**					
Major Core Course	BMEB 311	Quantitative Physiology I	3		3	Fall	3/Fall			BME
	BMEB 312	Quantitative Physiology II	3		3	Spr.	3/Spr.		BMEB311	BME
	BMEB 313	Biomedical Engineering I	3		3	Fall	3/ Fall			BME
	BMEB 314	Biomedical Engineering II	3		3	Spr.	3/Spr.		BMEB313	BME
	BMEB 321	Biomedical Engineering Lab I	3	3	6	Fall	3/Fall			BME
	BMEB 322	Biomedical Engineering Lab II	3	3	6	Spr.	3/Spr.		BMEB321	BME
	Total		**18**	**6**	**24**					

Table 2: Major Elective Courses

Course Code	Course Name	Credits	Lab Credits	Hours/week	Terms	Advised term to take the course	Instruction language	Prerequisite	Dept.
BMEB131	Introduction to Biomedical Engineering	2		2	Spr.	1/Spr.			BME
BMEB317	Principles of Medical Imaging Systems	3		3	Fall	3/Fall		EE104, EE205	BME
BMEB325	Medical Imaging Systems Laboratory	2		2	Spr.	3/Spr.		BMEB317, EE205	BME
BMEB221	Biomedical instrumentation	4	2	6	Spr.	2/Spr.			BME
BMEB318	Biomechanics	3	1	4	Fall	3/Fall			BME
BIO411-16	Dynamical Systems Simulation in Biology	3		3	Fall	4/Fall		BIO102A，MA103B，MA101B	BIO
BIO332	Stem Cell and Regenerative Medicine	2		2	Spr.	3/Spr.		BIO206-15	BIO
BIO203	Microbiology	3		3	Fall	2/Fall			BIO
BIO201	Biochemistry（Macromolecules）	3		3	Fall	2/Fall		BIO102A, CH101A	BIO
BIO405	Immunology	3		3	Fall	4/Fall		BIO206-15	BIO
BIO208	Cell Biology Laboratory	2	2	4	Fall	3/Fall		BIO206-15，BIO104	BIO
BIO202	Biochemistry（Metabolism）	3		3	Spr.	2/Spr.		BIO201	BIO
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	4	Spr.	2/Spr.		BIO201, BIO104,BIO320	BIO
BIO306	Bioinformatics	4	2	6	Spr.	3/Spr.		BIO309	BIO
BIO304	Systems Biology	3		3	Spr.	3/Spr.		BIO102A , MA212, BMEB311	BIO
BIO311-14	Animal Physiology	3		3	Fall	3/Fall			BIO
BIO313-15	Animal Physiology Laboratory	2	2	4	Fall	3/Fall		BIO311-14, BIO104	BIO
BIO320	Molecular Biology	3		3	Spr.	2/Spr.		BIO102A	BIO
BIO310	Neurobiology	3		3	Spr.	3/Spr.		BIO201	BIO
BMEB316	Medical image processing	3	1	4	Fall	3/Fall			BIO
EE326	Digital image processing	3	1	4	Spr.	3/Spr.		EE205	EEE
BMEB315	Biomedical Optics	2		2	Spr.	3/Spr.	CH/EN		BME
BMEB324	Biomedical Optics Laboratory	2	2	4	Spr.	3/Spr.	CH/EN	BMEB315	BME
MSE316	Biomaterials	4	2	6	Spr.	3/Spr.	EN		MSE
MA305	Numerical Analysis	3		3	Fall	3/Fall	CH	MA203a or MA213	MATH
EE306	Introduction to MEMS	3	1	4	Spr.	3/Spr.	CH/EN	PHY105B	EEE
EE407	Energy Harvesting Technologies	3		3	Fall	4/Fall			EEE
EE419	Biosensors	3	1	4	Fall	4/Fall			EEE
EE208	Engineering electromagnetics	3	1	4	Spr.	2/Spr.	CH/EN	MA101B, MA103A, EE104	EEE
EE202-17	Digital Circuit	3	0	3	Spr.	2/Spr.	CH	PHY105B	EEE

EE202-17L	Digital Circuit Laboratory	1	1	2	Spr.	2/Spr.	CH	EE202-17	EEE
EE205	Signals and Systems	3	1	4	Fall	2/Fall	CH/EN		EEE
EE323	Digital Signal Processing	3	1	4	Fall	3/Fall	EN	EE205	EEE
EE303	Fundamental of Optoelectronic Technology	3	1	4	Fall	3/Fall		PHY105B	EEE
CS301	Embedded system and microcomputer principle	3	1	4	Fall	3/Fall		CS207	CS
CS203	Data structures and algorithm analysis	3	1	4	Fall	2/Fall		CS102A	CS
CS202	Computer organization Principle	3	1	4	Spr.	2/Spr.		CS207	CS
EE201-17	Analog circuit	3	0	3	Fall	2/Fall		PHY105B, EE104	EEE
EE201-17L	Analog Circuit Laboratory	1	1	2	Fall	2/Fall		EE201-17	EEE
EE429	Image and Video Processing	3	1	4	Fall	4/Fall		EE205, MA103A, MA212	EEE
EE431	BioMEMS and Lab-on-a-Chip	3		3	Fall	4/Fall			EEE
MED302	Preventive Medicine	2		2	Fall	2/Fall			MED
MED306	Histology and Embryology	3	1	4	Fall	3Fall		BIO320; BIO206-15	MED
Total		119	32	151					

Note: The minimum requirement is 27 credits.

Table 3: Overview of Practice-Based Courses

Course Code	Course Name	Credits	Lab Credits	Hours/week	Terms	Advised term to take the course	Instruction language	Prerequisite	Dept.
BIO313-15	Animal Physiology Laboratory	2	2	4	Fall	3/Fall		BIO311-14, BIO104	BIO
BIO306	Bioinformatics	4	2	6	Spr.	3/Spr.		BIO309	BIO
BIO222	Biochemistry and Molecular Biology Laboratory	2	2	4	Spr.	2/Spr.		BIO201, BIO104	BIO
BIO208	Cell Biology Laboratory	2	2	4	Fall	Spr.		BIO206-15 ,BIO104	BIO
BMEB316	Medical Image Processing	3	1	4	Fall	3/Fall	CH/EN		BME
CS203	Data Structure and Algorithm Analysis	3	1	4	Fall	2/Fall		CS102A	EEE
BMEB325	Medical Imaging Systems Laboratory	2		2	Fall	3/Fall	CH	BMEB317	BME
BMEB221	Biomedical instrumentation	4	2	6	Spr.	2/Spr.	CH		BME
BMEB318	Biomechanics	3	1	4	Fall	3/Fall			BME
BMEB324	Biomedical Optics Laboratory	2	2	4	Spr.	3/Spr.	CH/EN	BMEB315	BME
EE202-17L	Digital Circuit Laboratory	1	1	2	Spr.	2/Spr.	CH	EE202-17	EEE
EE326	Digital image processing	3	1	4	Spr.	3/Spr.		EE205	EEE
EE208	Engineering electromagnetics	3	1	4	Spr.	2/Spr.	CH/EN	MA101B, MA103A, EE104	EEE
EE303	Fundamental of Optoelectronic Technology	3	1	4	Fall	3/Fall	CH/EN	PHY105B	EEE
EE323	Digital Signal Processing	3	1	4	Fall	3/Fall	EN	EE205	EEE
CS301	Embedded system and microcomputer principle	3	1	4	Fall	3/Fall		CS207	CS
EE205	Signals and Systems	3	1	4	Fall	2/Fall	CH/EN		EEE
EE306	Introduction to MEMS	3	1	4	Spr.	3/Spr.	CH/EN	PHY105B	EEE
MSE201	Fundamentals of Materials Science and Technology	4	1	5	Fall	2/Fall	EN	PHY105B, CH101-A	MSE
MSE316	Biomaterials	4	2	6	Spr.	3/Spr.	EN	MSE201	MSE
CS202	Computer organization Principle	3	1	4	Spr.	2/Spr.		CS207	CS
EE201-17L	Analog Circuit Laboratory	1	1	2	Fall	2/Fall		EE201-17	EEE
BIO104	General Biology Laboratory	2	2	4	Spr.	2/Spr.		BIO102A or BIO102B	BIO
EE429	Image and Video Processing	3	1	4	Fall	4/Fall		EE205, MA103A, MA212	EEE
EE419	Biosensors	3	1	4	Fall	4/Fall			EEE
BMEB321	Biomedical Engineering Lab I	3	3	6	Fall	3/Fall			BME

BMEB322	Biomedical Engineering Lab II	3	3	6	Spr.	3/Spr.		BMEB321	BME
MED306	Histology and Embryology	3	1	4	Fall	3Fall		BIO320；BIO206-15	MED
BMEB121	Projects of Science and Technology Innovation	2	2	4					BME
BMEB321	*Internship	2	2	4	Sum.	3/ Sum.			BME
BMEB422	Biomedical Engineering Design I	4	4	8	Fall	4/Fall	EN		BME
BMEB423	Biomedical Engineering Design II	4	4	8	Spr.	4/Spr.	EN	BMEB422	BME
Total		90	53	143					

Table 4: Overview of Course Hours and Credits

Course Category	Total Course Hours	Total Credits	The Minimum Credit Requirement
General Education (GE) Required Courses		52.5	52.5
General Education (GE) Elective Courses			10
Major Foundational Courses	336	18	18
Major Core Courses	384	18	18
Major Elective Courses	2416	151	27
Research Projects, Internship and Undergraduate Thesis/Projects	448	12	12
Total			137.5