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Biomedical Engineering

Faculty: Hall, Chair, BuSha, Wagner, Wei

Biomedical engineers integrate engineering skills with the understanding of the complexity of physiological systems, from the cellular level to the whole body, in order to improve healthcare. Biomedical engineers design instruments, devices, and develop computational models of physiological systems and signals. Some of the well established specialty areas within the field of biomedical engineering are: bioinstrumentation; biomaterials; biomechanics; cell and tissue engineering; medical imaging; rehabilitation engineering; and quantitative modeling of physiology. Biomedical engineers are employed in universities, in industry, in hospitals, in research facilities of educational and medical institutions, in teaching, and in government regulatory agencies.

Program Educational Objectives:

The biomedical engineering program has established the following educational objectives. These objectives outline what TCNJ biomedical engineers are expected to attain within the first few years after graduation.

- To contribute to the economic development of New Jersey, the nation and /or the global community through the ethical practice of engineering;
- To become successful in their chosen career path, whether it is in the practice of engineering, in advanced studies in engineering or science, or in other complementary disciplines;
- To assume leadership roles in their chosen profession;
- To enhance career skills through life-long learning.

Student Outcomes:

The student outcomes listed below are expected of all graduates of the biomedical engineering program. These outcomes outline what TCNJ biomedical engineering graduates are expected to know and be able to do by the time of graduation. These outcomes outline the knowledge, abilities, tools, and skills the program gives the graduates to enable them to accomplish the biomedical engineering program educational objectives.

Biomedical engineering graduates will have:

- an ability to apply knowledge of mathematics, science, and engineering;
- an ability to design and conduct experiments, as well as to analyze and interpret data;
- 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
- an ability to function on multidisciplinary teams;
- an ability to identify, formulate, and solve engineering problems;
- an understanding of professional and ethical responsibility;
- an ability to communicate effectively;
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context;

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- a recognition of the need for and an ability to engage in life-long learning;
- a knowledge of contemporary issues;
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- (l) the ability to apply principles of mathematics, including differential equations and statistics to biomedical engineering problems
- (m) The ability to solve biomedical engineering problems addressing the interaction between living and non-living systems

Bachelor of Science in Biomedical Engineering

First Year

Fall

CHE	201/General Chemistry I	1 course unit
ENG	142/Fundamentals of Engineering Design	
<i>or</i>		
CSC	215/Computer Science I	1 course unit
ENG	095/Introduction to Engineering	0 course unit
ENG	091/Engineering Seminar I	0 course unit
FSP	First Seminar	1 course unit
MAT	127/Calculus A	1 course unit
PHY	201/General Physics I	1 course unit

Spring

CHE	202/General Chemistry II	1 course unit
CSC	215/Computer Science I	
<i>or</i>		
ENG	142/Fundamentals of Engineering Design	1 course unit
ENG	092/Engineering Seminar II	0 course unit
MAT	128/Calculus B	1 course unit
PHY	202/General Physics II	1 course unit
WRI	102/Academic Writing (if not exempted)	(1 course unit)

Sophomore Year

Fall

BME	251/Fundamentals of Biomedical Engineering	1 course unit
BME	222/Introduction to Mechanics	1 course unit
ENG	212/Circuit Analysis	1 course unit
ENG	214/Circuit Analysis Laboratory	.5 course unit
ENG	272/Advanced Engineering Mathematics I	1 course unit

Spring

BME	323 Introduction to Biomaterials	1 course unit
BIO	185/Themes in Biology	1 course unit
MAT	229/Multivariable Calculus	1 course unit
ELC	321 Signals and Systems	1 course unit
	Liberal Learning Elective	1 course unit

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Junior Year

Fall

BME	313/Biomedical Instrumentation and Measurements Lab	.5 course unit
BME	311/Physiological Systems	1 course unit
CHE	331/Organic Chemistry I	1 course unit
BIO	211/Biology of the Eukaryotic Cell	1 course unit
ENG	093/Engineering Seminar III	0 course unit
ENG	342/Advanced Engineering Mathematics II	1 course unit
	Biomedical Engineering Elective	1 course unit

Spring

BME	333/Physiological Systems Laboratory	.5 course unit
BME	343/Biomechanics	1 course unit
ENG	094/Engineering Seminar IV	0 course unit
BME	350/Biofluid Mechanics	1 course unit
BME	371/Physiological Systems II	1 course unit
	Biomedical Engineering or Math/Science Elective	1 course unit
TST	161/Creative Design	1 course unit

Senior Year

Fall

BME	450/Mass and Heat Biotransport	1 course unit
BME	473/Bioinstrumentation	1 course unit
BME	433/Bioinstrumentation Laboratory	.5 course unit
BME	495/Senior Project I	.5 course unit
	Biomedical Engineering Elective	1 course unit
	Liberal Learning Elective	1 course unit
ENG	099/Senior Professional Seminar	0 course unit

Spring

BME	480/Physiological Modeling	1 course unit
BME	496/Senior Project II	.5 course unit
	Biomedical Engineering Elective	1 course unit
ENG	098/Fundamentals of Engineering Review	0 course unit
	Liberal Learning Elective	1 course unit
IDS	252/Society, Ethics and Technology	1 course unit

Total course units

39 course units

Curricula for students entering prior to Fall 2014

Bachelor of Science in Biomedical Engineering, Electrical Option

First Year

Fall

CHE	201/General Chemistry I	1 course unit
ENG	142/Fundamentals of Engineering Design	
	<i>or</i>	
CSC	215/Computer Science I	1 course unit
ENG	095/Introduction to Engineering	0 course unit

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ENG	091/Engineering Seminar I	0 course unit
FSP	First Seminar (Social Sciences)*	1 course unit
MAT	127/Calculus A	1 course unit
PHY	201/General Physics I	1 course unit

**By advisement only.*

Spring

CHE	202/General Chemistry II	1 course unit
CSC	215/Computer Science I	
<i>or</i>		
ENG	142/Fundamentals of Engineering Design	1 course unit
ENG	092/Engineering Seminar II	0 course unit
MAT	128/Calculus B	1 course unit
PHY	202/General Physics II	1 course unit
WRI	102/Academic Writing (if not exempted)	(1 course unit)

Sophomore Year

Fall

BIO	185/Themes in Biology	1 course unit
ENG	212/Circuit Analysis	1 course unit
ENG	214/Circuit Analysis Laboratory	.5 course unit
ENG	272/Advanced Engineering Mathematics I	1 course unit
ENG	312/Digital Circuits and Microprocessors	1 course unit

Spring

BME	251/Fundamentals of Biomedical Engineering	1 course unit
ELC	251/Electronics	1 course unit
ELC	321/Signals and Systems	1 course unit
ELC	333/Electrical Engineering Laboratory I	.5 course unit
TST	161/Creative Design	1 course unit
ECO	101/Principles of Microeconomics	1 course unit

Junior Year

Fall

BIO	211/Biology of the Eukaryotic Cell**	1 course unit
BME	311/Physiological Systems	1 course unit
BME	333/Physiological Systems Laboratory	.5 course unit
CHE	331/Organic Chemistry I	1 course unit
ENG	093/Engineering Seminar III	0 course unit
MAT	229/Multivariable Calculus	1 course unit

Spring

ENG	094/Engineering Seminar IV	0 course unit
ENG	322/Thermodynamics I	1 course unit
ENG	342/Advanced Engineering Mathematics II	1 course unit
ENG	352/Control Systems	1 course unit
BME	371/Physiological Systems II	1 course unit
IDS	252/Society, Ethics, and Technology	1 course unit

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Senior Year

Fall

BME	423/Introduction to Biomaterials	1 course unit
ELC	423/Digital Signal Processing	1 course unit
ELC	433/Electrical Engineering Laboratory III	.5 course unit
ENG	099/Senior Professional Seminar	0 course unit
BME	495/Senior Project I	0 course unit
ENG	372/Engineering Economy	1 course unit
	Liberal Learning Elective*	1 course unit
	Biomedical Engineering Elective*	1 course unit

Spring

BME	473/Bioinstrumentation	1 course unit
BME	496/Senior Project II	1 course unit
ENG	098/Fundamentals of Engineering Review	0 course unit
	Engineering Elective (3xx or 4xx)*	1 course unit
	Liberal Learning Elective*	1 course unit
	Biomedical Engineering Elective*	1 course unit

Total course units

39 course units

**By advisement only.*

*** Students whose goal is admission to medical school can substitute a laboratory-based biology course in lieu of BIO 211 and must complete CHE 332/Organic Chemistry II in addition to program requirements*

Bachelor of Science in Biomedical Engineering, Mechanical Option

First Year

Fall

CHE	201/General Chemistry I	1 course unit
ENG	142/Fundamentals of Engineering Design	
	<i>or</i>	
CSC	215/Computer Science I	1 course unit
ENG	095/Introduction to Engineering	0 course unit
ENG	091/Engineering Seminar I	0 course unit
FSP	First Seminar (Social Sciences)*	1 course unit
MAT	127/Calculus A	1 course unit
PHY	201/General Physics I	1 course unit

**By advisement only*

Spring

CHE	202/General Chemistry II	1 course unit
CSC	215/Computer Science I	
	<i>or</i>	
ENG	142/Fundamentals of Engineering Design	1 course unit
ENG	092/Engineering Seminar II	0 course unit
MAT	128/Calculus B	1 course unit
PHY	202/General Physics II	1 course unit
WRI	102/Academic Writing (if not exempted)	(1 course unit)

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Sophomore Year

Fall

BIO	185/Themes in Biology	1 course unit
ENG	212/Circuit Analysis	1 course unit
ENG	214/Circuit Analysis Laboratory	.5 course unit
ENG	222/Statics	1 course unit
ENG	272/Advanced Engineering Mathematics I	1 course unit

Spring

BME	251/Fundamentals of Biomedical Engineering	1 course unit
MAT	229/Multivariable Calculus	1 course unit
MEC	251/Strength of Materials	1 course unit
MEC	263/Mechanical Engineering Laboratory I	.5 course unit
TST	161/Creative Design	1 course unit
ECO	101/Principles of Microeconomics	1 course unit

Junior Year

Fall

BIO	211/Biology of the Eukaryotic Cell**	1 course unit
BME	311/Physiological Systems	1 course unit
BME	333/Physiological Systems Laboratory	.5 course unit
CHE	331/Organic Chemistry I	1 course unit
ENG	093/Engineering Seminar III	0 course unit
ENG	322/Thermodynamics I	1 course unit
IDS	252/Society, Ethics and Technology	1 course unit

*** Students whose goal is admission to medical school can substitute a laboratory-based biology course in lieu of BIO 211 and must complete CHE 332/Organic Chemistry II in addition to program requirements*

Spring

BME	343/Biomechanics	1 course unit
ENG	094/Engineering Seminar IV	0 course unit
ENG	342/Advanced Engineering Mathematics II	1 course unit
ELC	251/Electronics	1 course unit
ELC	333/Electrical Engineering Laboratory I	.5 course unit
BME	371/Physiological Systems II	1 course unit

Senior Year

Fall

BME	423/Introduction to Biomaterials	1 course unit
ENG	099/Senior Professional Seminar	0 course unit
MEC	311/Mechanical Design I	1 course unit
BME	495/Senior Project I	0 course unit
MEC	361/Fluid Mechanics	1 course unit
	Liberal Learning Elective*	1 course unit
	Biomedical Engineering Elective*	1 course unit

Spring

BME	473/Bioinstrumentation	1 course unit
BME	496/Senior Project II	1 course unit
ENG	372/Engineering Economy	1 course unit
ENG	098/Fundamentals of Engineering Review	0 course unit

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Liberal Learning Elective*

1 course unit

Biomedical Engineering Elective*

1 course unit

Total course units

39 course units

**By advisement only.*