

Biomedical Engineering

Faculty: Wagner (*Chair*), BuSha, Hall, Lau, 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:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Academic Policies and Standards

A student may repeat any course without seeking approval. However, if a student wishes to repeat a course more than once, permission must be obtained from the chair of the department or coordinator of the program of study and, if appropriate, the chair of the department offering the course. Permission to repeat a major course more than once will be granted only in cases of extreme extenuating circumstances, e.g., illness, financial, etc. When an engineering course is repeated, only the most recent earned grade is counted in the grade point average, although all grades earned will appear on the student's transcript.

Given the nature of the engineering curricula, it is extremely important to follow the recommended course sequence. Violations of this guideline may result in dismissal from the engineering major.

Program Entrance, Retention, and Exit Standards

Every major program at the College has set standards for allowing students to remain in that program, to transfer within the College from one program to another, and to graduate from a program. The following are the standards for engineering majors. Minimum grades are noted in parentheses.

- Retention in the engineering programs is based on the following performance standards in these "critical content courses": PHY 201 (C-); MAT 127 (C-), MAT 128 (C-). A student who does not achieve these minimum performance standards, earns a grade of F, and/or has a cumulative GPA of less than 2.0 will be placed on the Engineering Programs Academic Warning List. Placement on the Engineering Programs Academic Warning List for two consecutive semesters or three non-consecutive semesters will result in dismissal from the major. Students dismissed from the major may appeal for re-entry into the major.
- To ensure academic success, first year, sophomore, and first-semester junior students will not be permitted to take more than 4.5 course units unless they have a GPA of 2.75 or greater. Upper class students can register for 5.5 course units if they are in good academic standing.
- Entrance (internal transfer) into the engineering programs from another program within the College is based upon the following performance standards in these "foundation courses": PHY 201 (C); MAT 127 (C), Internal transfer within engineering programs will be considered as long as enrollment limits are not exceeded.
- Graduation requires an in-major cumulative GPA of 2.0.

Bachelor of Science in Biomedical Engineering**First Year****Fall**

ENG 144	Fundamentals of Engineering Design	0.5 course unit
MAT 127	Calculus A	1 course unit
CHE 201	General Chemistry I	1 course unit
FYW 102	First Year Writing (if needed)	
	College Core Elective	1 course unit
ENG 095	Introduction to Engineering	0 course unit

Spring

BME 145	Introduction to Biomedical Engineering	0.5 course unit
MAT 128	Calculus B	1 course unit
CHE 202	General Chemistry II	1 course unit
PHY 201	General Physics I	1 course unit
FYS 16X	First Year Seminar	1 course unit

Sophomore Year**Fall**

BME 2xx	Probability and Statistics for BME (in development)	0.5 course unit
BME 251	Fundamental Systems in BME	1 course unit
ENG 272	Advanced Engineering Mathematics I	1 course unit
PHY 202	General Physics II	1 course unit
IDS 252	Society, Ethics and Technology	1 course unit

Spring

BME 222	Introduction to Mechanics	1 course unit
ENG 212	Circuit Analysis	1 course unit
CSC 216	Computer Science I for Science and Engineering	1 course unit
BIO 201	Foundations of Biological Inquiry	1 course unit
MAT 229	Multivariable Calculus	1 course unit

Junior Year**Fall**

BME 311	Physiological Systems I	1 course unit
BME 313	Biomedical Measurements Laboratory	0.5 course unit
BME 343	Biomechanics	1 course unit
BME 350	Biofluid Mechanics	1 course unit
BIO 211	Cell Biology and Biochemistry	1 course unit
ENG 093	Engineering Seminar III	0 course unit

Spring

BME 323	Introduction to Biomaterials	1 course unit
BME 371	Physiological Systems II & lab	1 course unit
ELC 321	Signals and Systems	1 course unit
	Engineering Elective (3xx/4xx, 2xx by permission)	1 course unit
	College Core Elective	1 course unit
ENG 094	Engineering Seminar IV	0 course unit

Senior Year**Fall**

BME 450	Mass and Heat Biotransport	1 course unit
BME 473	Bioinstrumentation & Lab	1 course unit
BME 495	Senior Project I	0.5 course unit
	Biomedical Engineering Elective (400-level)	1 course unit
	College Core 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	0.5 course unit
	Biomedical Engineering Elective (400-level)	1 course unit
	Technical Elective	1 course unit
	College Core Elective	1 course unit

Total course units**36 course units**

Seven-Year BS in Biomedical Engineering/MD**First Year****Summer**

PHY 201	General Physics I*	1 course unit
PHY 202	General Physics II*	1 course unit

Fall

BME 251	Fundamental Systems in BME	1 course unit
BME 222	Introduction to Mechanics	1 course unit
ENG 144	Fundamentals of Engineering Design	0.5 course unit
ENG 272	Advanced Engineering Mathematics I	1 course unit
IDS 252	Society, Ethics and Technology	1 course unit
FYS 16X	First Year Seminar	1 course unit
ENG 095	Introduction to Engineering	0 course unit
ENG 091	Engineering Seminar I	0 course unit

Spring

BME 145	Introduction to Biomedical Engineering	0.5 course unit
ENG 212	Circuit Analysis	1 course unit
ENG 214	Circuit Analysis Laboratory	0.5 course unit
CSC 216	Computer Science I for Science and Engineering	1 course unit
BIO 201	Foundations of Biological Inquiry	1 course unit
MAT 229	Multivariable Calculus	1 course unit

Second Year**Summer**

CHE 201	General Chemistry I	1 course unit
CHE 202	General Chemistry II	1 course unit

Fall

BME 311	Physiological Systems I	1 course unit
BME 313	Biomedical Measurements Laboratory	0.5 course unit
	Engineering Elective (3xx/4xx, 2xx by permission)	1 course unit
BIO 211	Cell Biology and Biochemistry	1 course unit
	College Core Elective	1 course unit
ENG 093	Engineering Seminar III	0 course unit

Spring

BME 323	Introduction to Biomaterials	1 course unit
BME 343	Biomechanics	1 course unit
BME 350	Biofluid Mechanics	1 course unit
BME 371	Physiological Systems II & lab	1 course unit
ELC 321	Signals and Systems	1 course unit
ENG 094	Engineering Seminar IV	0 course unit

Senior Year**Fall**

BME 450	Mass and Heat Biotransport	1 course unit
BME 473	Bioinstrumentation & Lab	1 course unit
BME 495	Senior Project I	0.5 course unit
CHE 331	Organic Chemistry I	1 course unit
	Biomedical Engineering Elective (400-level)	1 course unit
	College Core 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	0.5 course unit
CHE 332	Organic Chemistry II**	1 course unit
	Biomedical Engineering Elective (400-level)	1 course unit
	College Core Elective	1 course unit
	College Core Elective	1 course unit

Total course units at TCNJ**35 course units*******Senior Year at New Jersey Medical School**

* Students entering the program must hold advanced placement credit in Calculus A and B, and complete General Physics I and II during the summer prior to their first semester at TCNJ.

** 7 year Medical students must take CHE 332 as the technical elective

***Total course units, including AP credit, are 37.