

Biomedical Engineering: Technical Electives Selection Guideline

1. Basic Requirements

Biomedical engineering requires 9 or more units of BME technical electives, an additional 3 units of engineering technical electives and up to 9 units of general technical electives to a total of 21 elected units. In general, technical electives are upper-division (300/400 level) courses. BME technical electives are courses with BME prefix. Engineering technical electives are courses offered by departments in the College of Engineering.

2. Course Selection Guidance and Strategies

Before you read the following guidelines, the most important thing is to identify your interests and what kind of job or study after you graduated with the BS in Biomedical Engineering you will want to pursue.

You will have two possible strategies:

Strategy 1:

“I am interested in courses in biomedical engineering and I would like to select my technical electives in a BME specialization area”: Select a focus area based on your interests.

Biomechanics (Adviser: **Nima Toosizadeh**)

Description: Students with a specialization in biomechanics will be proficient in the mechanical behavior of biomaterials as well as statics and dynamic measurement and analysis of neuromuscular and musculoskeletal function in human. Skill set: Students will have a mechanical engineering focus. Mechanical engineering principles will be implemented in analyzing human movement and mechanical properties of human musculoskeletal system. Prepare for several areas in both academic and industrial pathways including but not limited to: 1) health care (musculoskeletal & orthopedic biomechanics, cardiovascular biomechanics, and rehabilitation); 2) sport biomechanics (injury mechanism and performance improvement); and 3) prosthetics.

Biomaterials (Adviser: **Minkyu Kim**)

Description: A specialization in biomaterials focuses on materials sciences. Skill set: Students will understand the basic properties of biomaterials and their interaction with living systems.

Biomedical Technology & Devices (Adviser: **Jeong-Yeol Yoon**)

Description: The Technology and Devices specialization focuses on biosignal acquisition and analysis as well as the design of biomedical devices. Skill set: Students will understand the concepts on the signal transduction (especially optics), materials (biomaterials and nanomaterials), device fabrication methods (nano- and microfabrication, as well as prototype device design and manufacturing), and data acquisition and processing techniques

Biomedical Imaging (Adviser: **Urs Utzinger**)

Description: The biomedical imaging specialization provides a focus on clinical and research imaging. Skill set: A specialization in biomedical imaging provides students the understanding of acquiring, storing, processing and visualizing medical and research images obtained with MRI, CT and optical techniques.

Biomedical Informatics (Adviser: Vignesh Subbian)

Description: The biomedical informatics specialization focuses on concepts, methods, and tools at the intersection of people, health information, and technology to improve human health and healthcare. Skill set: A specialization in biomedical informatics will provide skills to extract actionable information and/or knowledge from biomedical data using computational tools and infrastructure, and an understanding of different sub-disciplines of biomedical informatics. Potential career opportunities include healthcare informaticist/informatician, healthcare data analyst, research informatician, healthcare systems engineer, board certification in clinical informatics (after MD).

Pre-Health Specialization (Adviser: Erika Eggers)

Description: The pre-health specialization supports students who would like to apply for medical school while obtaining a traditional engineering degree. Skill set: Students will obtain basic knowledge in math, physics, chemistry and biomedical engineering with additional classes in chemistry.

Select course in that area in the following pre-approved course table. If the number of specified courses is less than 21 units you will need to add courses from other areas or choose directed research.

Course Table

Focus Area	Course Number	Course Title	Prerequisite: Advanced Standing [Units]	Typically Offered
Biomechanics	AME 324A	Mechanical Behavior of Engineering Materials	[3] CE 214 or BME 214	F – 5th Semester
	BME 302	Numerical Methods in BME	[3] MATH 223 & 254	S – 6th Semester
	BME 466	Biomechanics	[3] None	F – 7th Semester
	TE	Technical Elective	[3]	
	BME 483	Micro Biomechanics	[3] MATH 223 & BE 284	S – 8th Semester
	TE	Technical Elective	[3]	
	TE	Technical Elective	[3]	
Biomaterials	CHEM 241A & 243A	Organic Chemistry 1	[4]	
	BME 461	Biological and Synthetic Materials	[3] None	F – 7th Semester
	BME 485	Nanoscience and Nanotechnology	[3] None	
	TE	Technical Elective	[2]	
	BME 486	Biomaterial-Tissue Interaction	[3] None	S – 8th Semester
	BME 481B	Cell and Tissue Engineering	[3] MATH 254	
	TE	Technical Elective	[3]	
Biomedical Technology and Devices	BME 416	Biomedical Imaging	[3] None	S – 6th Semester
	BME 485	Nanoscience and Nano Technology	[3] None	F – 7th Semester
	BME 461 or 486 or 481B	Biological and Synthetic Materials or Biomaterial-Tissue Interaction or Cell and Tissue Engineering	[3] None, None, MATH 254	
	AME 489A	Fabrication Techniques for Micro and Nano Devices	[3] ECE 207 or ABE 447	
	TE	Technical Electives	[3]	
	BME 420	Biophotonics	[3] BME 330 or OPTI 210 or OPTI 310	S – 8th Semester
	TE	Technical Elective	[3]	
Biomedical Imaging	ECE 381A	Introductory Electromagnetics	MATH 223 & ECE 220*	S – 6th Semester
	ECE 459	Fundamental of Optics for Electrical Engineers	[3]	F – 7th Semester
	BME 485	Nanoscience and Nanotechnology	[3] None	
	TE	Technical Elective	[3]	
	BME 416	Biomedical Imaging	[3] None	S – 8th Semester
	BME 417	Measurement and Data Analysis	[3] Senior	
	BME 420	Biophotonics	[3]	

Biomedical Informatics	ESOC 414 or LIS 471	Computational Social Science or Introduction to Information Technology	[3] ESOC 214 or ISTA 116 or equivalent, None	S – 6th Semester	
	BME 477	Introduction Biomedical Informatics	[3] ECE 175 or CSC 127A or CSC 110	F – 7th Semester	
	ISTA 422	Applied Cyberinfrastructure Concepts	[3] None		
	TE	Technical Elective	[3]		
	Pre-Health	BE 487 or ECOL 346	Metagenomics or Bioinformatics	[3] None, ECOL 320 or 326 or MCB 304	S – 8th Semester
		TE	Technical Elective	[3]	
		TE	Technical Elective	[3]	
Pre-Health	CHEM 241A & 243A	Organic Chemistry 1	[4]		
	CHEM 241B & 243B	Organic Chemistry 2	[4]	S – 6th Semester	
	BIOC 385	Metabolic Chemistry (S,S,F)	[3] MCB 181R and (CHEM 152 or 105B)		
	TE	Technical Elective	[1]	F – 7th Semester	
	BME 486	Biomaterials Tissue Interactions (S)	[3] None		
	BME 481B	Cell and Tissue Engineering (S)	[3] MATH 254	S – 8th Semester	
	BME 416 or BME 477 or BME 461	Biomedical Imaging (S) or Intro Biomedical Informatics (F) or Biological and Synthetic Materials (F)	[3] None, ECE 175 or CSC 127A or CSC 110, None		

*Prerequisite is not part of the BME curriculum

Strategy 2:

“I am interested in courses in biomedical engineering, and I would like to select my technical electives in different specialization areas in BME.”

Pick 9 or more units of BME technical electives and up to 12 units of general technical electives listed in the focus areas above to a total of 21 units. The department has approved all of these courses in this list as your technical elective, and you do not need to get an approval from your faculty adviser.