



جامعة الفيصل
Alfaisal University

Bachelor of Biomedical Engineering

**College of Engineering & Advanced Computing,
Alfaisal University**

Effective: Fall 2026 with tracks



About the Program

The Bachelor of Biomedical Engineering at Alfaisal University provides a broad and rigorous education across the core areas of the discipline, at the interface of engineering, biology, and medicine. The curriculum integrates foundational knowledge in biomaterials, biomechanics, human anatomy and physiology, biomedical signals and instrumentation, imaging, and the modeling and control of biomedical systems. Breadth is supported through university electives drawn from the humanities, social sciences, and general sciences.

Students gain depth through major electives and may pursue a track in Biomedical Imaging or Biomedical Devices & Instrumentation. Additional opportunities exist to complement the major across the university. Real-world preparation is emphasized through a required summer internship and a year-long capstone design project.

Graduates gain strong analytical grounding, practical engineering competence, and professional readiness. They pursue careers across sectors such as medical device design, clinical and hospital engineering, biomedical imaging, rehabilitation engineering, healthcare technology management, and emerging health-technology domains, or pursue advanced study.



Curriculum Structure and Study Plan

The Bachelor of Biomedical Engineering curriculum is composed of **135** Credit Hours (CRHs) divided as follows:

- I. **University General Education Requirements (18 CRHs)**
 - a. Arts & Humanities (9 CRHs)
 - b. Social Sciences (6 CRHs)
 - c. Sciences (3 CRHs)

- II. **College Requirements (41 CRHs)**
 - a. Mathematics and Statistics (21 CRHs)
 - b. Basic Sciences (12 CRHs)
 - c. Engineering Requirements (8 CRHs)

- III. **Major Requirements (76 CRHs)**
 - a. Core Major Requirements (64 CRHs)
 - b. Major Electives (12 CRHs)
 - c. Summer Internship (0 CRHs)



Biomedical Engineering Program

I. University General Education Requirements (18 CRHs)

a) Arts & Humanities (9 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
ENG 101	University Writing	3	3	0	0		
ENG 222	Technical Writing	3	3	0	0	ENG 101	
—	Arts & Humanities Elective I*	3	3	0	0		

* Select any 3-CRHs course from the University-approved list of Arts & Humanities courses.

b) Social Sciences (6 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
—	Social Sciences Elective I*	3	3	0	0		
—	Social Sciences Elective II*	3	3	0	0		

* Select any two 3-CRH courses (i.e., 6 CRHs in total) from the University-approved list of Social Sciences courses.

c) Sciences (3 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
AI 102	AI for Everyone: Foundations and Applications	3	3	0	0		



II. College Requirements (41 CRHs)

a) Mathematics and Statistics (21 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
MAT 101	Calculus I	3	3	0	0		
MAT 112	Calculus II	3	3	0	0	MAT 101	
MAT 211	Calculus III	3	3	0	0	MAT 112	
MAT 212	Linear Algebra	3	3	0	0	MAT 112	
MAT 213	Differential Equations	3	3	0	0	MAT 112	MAT 212
MAT 224	Numerical Methods	3	3	0	0	MAT 212	
STA 212	Probability and Statistics	3	3	0	0	MAT 112	

b) Basic Sciences (12 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
CHM 101	General Chemistry I	3	3	0	1		
CHM 101 L	General Chemistry I Lab	1	0	2	0		CHM 101
PHU 103	Physics I	3	3	0	1		MAT 101
PHU 103 L	Physics I Lab	1	0	2	0		PHU 103
PHU 124	Physics II	3	3	0	1	PHU 103, MAT 101	
PHU 124 L	Physics II Lab	1	0	2	0	PHU 103, MAT 101	PHU 124

c) Engineering Requirements (8 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
COE 100	Student Orientation and Academic Success	1	1	0	0		
SE 100	Programming for Engineers	3	3	0	0		
SE 100 L	Programming for Engineers Lab	1	0	2	0		SE 100
EE 209	Applied Electromagnetics	3	3	0	0	BME 201, MAT 211	



III. Major Requirements (76 CRHs)

a) Core Major Requirements (64 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
BME 100	Introduction to Biomedical Engineering	3	3	0	0		
BME 102	Foundations of Biomaterials Engineering	3	3	0	0	CHM 101	BME 102 L
BME 102 L	Foundations of Biomaterials Engineering Lab	1	0	2	0		BME 102
BME 200	Human Anatomy	3	3	0	0	BME 100	BME 200 L
BME 200 L	Human Anatomy Lab	1	0	2	0		BME 200
BME 201	Electrical Circuits for Biomedical Applications	3	3	0	0	BME 100, PHU 124	BME 201 L
BME 201 L	Electrical Circuits for Biomedical Applications Lab	1	0	2	0		BME 201
BME 202	Biomechanics	3	3	0	0	BME 200, MAT 212	
BME 210	Human Physiology	3	3	0	0	BME 200	
BME 301	Biomedical Signals and Systems	3	3	0	0	BME 201, MAT 224	BME 301 L
BME 301 L	Biomedical Signals and Systems Lab	1	0	2	0		BME 301
BME 302	Modelling and Control of Biomedical Systems	3	3	0	0	BME 301, MAT 224	BME 302 L
BME 302 L	Modelling and Control of Biomedical Systems Lab	1	0	2	0		BME 302
BME 303	Biomedical Electronics	3	3	0	0	BME 201	BME 303 L
BME 303 L	Biomedical Electronics Lab	1	0	2	0		BME 303
BME 304	Biomedical Image Processing	3	3	0	0	BME 301, BME 305	BME 304 L
BME 304 L	Biomedical Image Processing Lab	1	0	2	0		BME 304
BME 305	Biomedical Imaging Systems	3	3	0	0	EE 209	
BME 306	Biomedical Instrumentation	3	3	0	0	BME 202, BME 303	BME 306 L



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Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
BME 306 L	Biomedical Instrumentation Lab	1	0	2	0		BME 306
BME 307	Bio Fluid Dynamics	3	3	0	0	BME 202, MAT 213	BME 307 L
BME 307 L	Bio Fluid Dynamics Lab	1	0	2	0		BME 307
BME 308	Healthcare Management Systems	3	3	0	0	BME 100	
BME 402	Medical Device Quality & Regulatory Affairs	3	3	0	0	BME 306, BME 308	
BME 405	Artificial Intelligence in Biomedical Engineering	3	3	0	0	BME 304, STA 212	
BME 495	Capstone Project I	3	0	6	0	BME 306	
BME 496	Capstone Project II	3	0	6	0	BME 495	
BME 499	Ethics and Professional Development	1	1	0	0		



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b) Major Electives (12 CRHs)

Select four courses from the following list:

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
BME 401	Undergraduate Research in Biomedical Engineering	3	0	6	0	BME 302, BME 304, BME 306, BME 308	
BME 408	Lasers & Coherent Optics	3	3	0	0	BME 305	
BME 410	Clinical Imaging Block	3	3	0	0	BME 304	
BME 412	Deep Learning in Biomedical Imaging	3	3	0	0	BME 304, STA 212	
BME 414	Radiation Therapy	3	3	0	0	BME 304, BME 308	
BME 420	Prosthetics & Orthotics	3	3	0	0	BME 306	
BME 421	Advanced Biomedical Instrumentation	3	3	0	0	BME 306	
BME 422	Medical Device Innovation & Entrepreneurship	3	3	0	0	BME 306, BME 308	
BME 423	Biomedical Mechatronic Systems	3	3	0	0	BME 302, BME 306	
BME 424	Biomedical Sensors	3	3	0	0	BME 306	
BME 425	Perfusion & Pumping Engineering	3	3	0	0	BME 307, BME 306	
BME 426	Tissue Engineering	3	3	0	0	BME 102, BME 210	
BME 427	Cardiovascular Instrumentation	3	3	0	0	BME 306, BME 307	
BME 428	Fundamentals of BioMEMS & Medical Microdevices	3	3	0	0	BME 306	
BME 429	Biomechanics of Movement	3	3	0	0	BME 202	
BME 430	Special Topics in Biomedical Engineering	3	3	0	0		
BME 431	Genetics & Molecular Biology	3	3	0	0	BME 200	
BME 433	Biomedical Data Analytics	3	3	0	0	STA 212, SE 100	
BME 434	Bioinformatics	3	3	0	0	STA 212, SE 100, BME 431	



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Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
BME 435	Cognitive Neuroscience	3	3	0	0	BME 210, BME 302	
BME 436	Photonic Information Processing	3	3	0	0	BME 304, BME 305	
BME 438	Nanotechnology	3	3	0	0	BME 102	

* BME 401 requires Department Chair approval, a minimum 3.0 GPA, and a signed research contract.

c) Summer Internship (0 CRHs)

Course Code	Course-Title	Credit Hours (CRHs)				Prerequisite Course Code	Co-Requisite Course Code
		Total-CRHs	Lect.	Lab	Tut		
BME 390	Biomedical Engineering Internship	0	0	0	0	BME 302, BME 304, BME 306, BME 308	



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IV. Typical Study Plan — Biomedical Engineering Program (135 CRHs)

4-Year Curriculum: 135 Credit Hours Total

Each course below follows the format:

Course Code, Course Title, and Course Credit Hours (Lecture – Lab – Tutorial contact hours)

<i>1st Year</i>			
	Course Code	Course-Title	CRHs
Fall	CoE 100	Student Orientation and Academic Success	1 (1-0-0)
	CHM 101	General Chemistry I	3 (3-0-1)
	CHM 101 L	General Chemistry I Lab	1 (0-2-0)
	MAT 101	Calculus I	3 (3-0-0)
	PHU 103	Physics I	3 (3-0-1)
	PHU 103 L	Physics I Lab	1 (0-2-0)
	ENG 101	University Writing	3 (3-0-0)
	AI 102	AI Foundations for Everyone	3 (3-0-0)
Total			18

	Course Code	Course-Title	CRHs
Spring	BME 100	Introduction to Biomedical Engineering	3 (3-0-0)
	BME 102	Foundations of Biomaterials Engineering	3 (3-0-0)
	BME 102 L	Foundations of Biomaterials Engineering Lab	1 (0-2-0)
	SE 100	Programming for Engineers	3 (3-0-0)
	SE 100 L	Programming for Engineers Lab	1 (0-2-0)
	MAT 112	Calculus II	3 (3-0-0)
	PHU 124	Physics II	3 (3-0-1)
	PHU 124 L	Physics II Lab	1 (0-2-0)
Total			18



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<i>2nd Year</i>			
	Course Code	Course-Title	CRHs
Fall	BME 200	Human Anatomy	3 (3-0-0)
	BME 200 L	Human Anatomy Lab	1 (0-2-0)
	BME 201	Electrical Circuits for Biomedical Applications	3 (3-0-0)
	BME 201 L	Electrical Circuits for Biomedical Applications Lab	1 (0-2-0)
	MAT 211	Calculus III	3 (3-0-0)
	MAT 212	Linear Algebra	3 (3-0-0)
	MAT 213	Differential Equations	3 (3-0-0)
	Total		

	Course Code	Course-Title	CRHs
Spring	BME 202	Biomechanics	3 (3-0-0)
	BME 210	Human Physiology	3 (3-0-0)
	EE 209	Applied Electromagnetics	3 (3-0-0)
	MAT 224	Numerical Methods	3 (3-0-0)
	STA 212	Probability and Statistics	3 (3-0-0)
	ENG 222	Technical Writing	3 (3-0-0)
	Total		



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<i>3rd Year</i>			
	Course Code	Course-Title	CRHs
Fall	BME 301	Biomedical Signals and Systems	3 (3-0-0)
	BME 301 L	Biomedical Signals and Systems Lab	1 (0-2-0)
	BME 303	Biomedical Electronics	3 (3-0-0)
	BME 303 L	Biomedical Electronics Lab	1 (0-2-0)
	BME 305	Biomedical Imaging Systems	3 (3-0-0)
	BME 307	Bio Fluid Dynamics	3 (3-0-0)
	BME 307 L	Bio Fluid Dynamics Lab	1 (0-2-0)
	_____	Social Sciences Elective I	3 (3-0-0)
Total			18

	Course Code	Course-Title	CRHs
Spring	BME 302	Modelling and Control of Biomedical Systems	3 (3-0-0)
	BME 302 L	Modelling and Control of Biomedical Systems Lab	1 (0-2-0)
	BME 304	Biomedical Image Processing	3 (3-0-0)
	BME 304 L	Biomedical Image Processing Lab	1 (0-2-0)
	BME 306	Biomedical Instrumentation	3 (3-0-0)
	BME 306 L	Biomedical Instrumentation Lab	1 (0-2-0)
	BME 308	Healthcare Management Systems	3 (3-0-0)
	_____	Social Sciences Elective II	3 (3-0-0)
Total			18

	Course Code	Course-Title	CRHs
Summer	BME 390	Biomedical Engineering Internship	0 (0-0-0)
Total			0



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<i>4th Year</i>			
	Course Code	Course-Title	CRHs
Fall	BME 405	Artificial Intelligence in Biomedical Engineering	3 (3-0-0)
	BME 4 __	BME Elective I	3 (3-0-0)
	BME 4 __	BME Elective II	3 (3-0-0)
	BME 495	Capstone Project I	3 (0-6-0)
	BME 499	Ethics and Professional Development	1 (1-0-0)
Total			13
	Course Code	Course-Title	CRHs
Spring	BME 402	Medical Device Quality & Regulatory Systems	3 (3-0-0)
	BME 4 __	BME Elective III	3 (3-0-0)
	BME 4 __	BME Elective IV	3 (3-0-0)
	BME 496	Capstone Project II	3 (0-6-0)
	_____	Arts and Humanities Elective I	3 (3-0-0)
Total			15



Biomedical Engineering Tracks

All BME students select their electives in the fourth year according to their desired academic objective and in consultation with their academic advisor and available offerings within the department. Students may select a general (non-track) option or one of the two tracks below. All options share the same required courses; the track determines the electives chosen in the senior year.

Biomedical Imaging Track (18 CRHs)

Core courses (15 CRHs):

- BME 402 Medical Device Quality & Regulatory Affairs
- BME 405 Artificial Intelligence in Biomedical Engineering
- BME 410 Clinical Imaging Block
- BME 412 Deep Learning in Biomedical Imaging
- BME 414 Radiation Therapy
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Elective course: select 3 CRHs from the list of major electives.

- BME 401 Undergraduate Research in Biomedical Engineering (3 CRHs)
- BME 408 Lasers and Coherent Optics (3 CRHs)
- BME 420 Prosthetics and Orthotics (3 CRHs)
- BME 421 Advanced Biomedical Instrumentation (3 CRHs)
- BME 422 Medical Device Innovation and Entrepreneurship (3 CRHs)
- BME 423 Biomedical Mechatronic Systems (3 CRHs)
- BME 424 Biomedical Sensors (3 CRHs)
- BME 425 Perfusion & Pumping Engineering (3 CRHs)
- BME 426 Tissue Engineering (3 CRHs)
- BME 427 Cardiovascular Instrumentation (3 CRHs)
- BME 428 Fundamentals of BioMEMS and Medical Microdevices (3 CRHs)
- BME 429 Biomechanics of Movement (3 CRHs)
- BME 430 Special Topics in Biomedical Engineering (3 CRHs)
- BME 431 Genetics & Molecular Biology (3 CRHs)
- BME 433 Biomedical Data Analytics (3 CRHs)
- BME 434 Bioinformatics (3 CRHs)
- BME 435 Cognitive Neuroscience (3 CRHs)
- BME 436 Photonic Information Processing (3 CRHs)
- BME 438 Nanotechnology (3 CRHs)



Biomedical Devices & Instrumentation Track (18 CRHs)

Core courses (15 CRHs):

- BME 402 Medical Device Quality & Regulatory Affairs
- BME 405 Artificial Intelligence in Biomedical Engineering
- BME 420 Prosthetics & Orthotics
- BME 421 Advanced Biomedical Instrumentation
- BME 423 Biomedical Mechatronic Systems

Elective course: select 3 CRHs from the list of major electives.

- BME 401 Undergraduate Research in Biomedical Engineering (3 CRHs)
- BME 408 Lasers and Coherent Optics (3 CRHs)
- BME 412 Deep Learning in Biomedical Imaging (3 CRHs)
- BME 414 Radiation Therapy (3 CRHs)
- BME 422 Medical Device Innovation and Entrepreneurship (3 CRHs)
- BME 424 Biomedical Sensors (3 CRHs)
- BME 425 Perfusion & Pumping Engineering (3 CRHs)
- BME 426 Tissue Engineering (3 CRHs)
- BME 427 Cardiovascular Instrumentation (3 CRHs)
- BME 428 Fundamentals of BioMEMS and Medical Microdevices (3 CRHs)
- BME 429 Biomechanics of Movement (3 CRHs)
- BME 430 Special Topics in Biomedical Engineering (3 CRHs)
- BME 431 Genetics & Molecular Biology (3 CRHs)
- BME 433 Biomedical Data Analytics (3 CRHs)
- BME 434 Bioinformatics (3 CRHs)
- BME 435 Cognitive Neuroscience (3 CRHs)
- BME 436 Photonic Information Processing (3 CRHs)
- BME 438 Nanotechnology (3 CRHs)



Course Descriptions

The following descriptions cover the Biomedical Engineering (BME) courses in the program. University and college courses (ENG, MAT, STA, CHM, PHU, SE, COE, AI, EE) follow their home-department catalog entries.

BME 100: Introduction to Biomedical Engineering 3 (3-0-0)

An overview of the biomedical engineering discipline and its role at the interface of engineering, biology, and medicine. Topics include the major sub-fields (biomechanics, biomaterials, bioinstrumentation, biomedical imaging, and clinical engineering), the structure of the healthcare system, the engineering design process applied to medical problems, and the professional, ethical, and regulatory context of medical technology.

Prerequisites: None

Co-requisites: None

BME 102: Foundations of Biomaterials Engineering 3 (3-0-0)

Fundamentals of materials used in contact with biological systems. Topics include the structure and properties of metals, ceramics, polymers, and composites; biocompatibility and host response; degradation and corrosion in physiological environments; and selection criteria for implants, scaffolds, and medical devices.

Prerequisites: CHM 101

Co-requisites: BME 102 L

BME 102 L: Foundations of Biomaterials Engineering Lab 1 (0-2-0)

Laboratory experiments dealing with the characterization and testing of biomaterials, including mechanical testing, surface analysis, and biocompatibility assessment.

Prerequisites: None

Co-requisites: BME 102

BME 200: Human Anatomy 3 (3-0-0)

Structural organization of the human body from the cellular level to organ systems, with an engineering perspective. Coverage includes the skeletal, muscular, cardiovascular, respiratory, nervous, and renal systems and their anatomical relationships relevant to the design of medical devices and diagnostic tools.

Prerequisites: BME 100

Co-requisites: BME 200 L

BME 200 L: Human Anatomy Lab 1 (0-2-0)

Laboratory experiments and structured observation dealing with human anatomy, including the use of models, imaging data, and digital anatomy tools.

Prerequisites: None

Co-requisites: BME 200

BME 201: Electrical Circuits for Biomedical Applications 3 (3-0-0)

Principles of electrical circuit analysis with emphasis on biomedical applications. Topics include DC and AC circuits, network theorems, transient and steady-state response, operational amplifiers, and the front-end circuits used to acquire and condition physiological signals.

Prerequisites: BME 100, PHU 124

Co-requisites: BME 201 L



BME 201 L: Electrical Circuits for Biomedical Applications Lab 1 (0-2-0)

Laboratory experiments dealing with electrical circuits and bio-signal conditioning, including measurement, breadboarding, and op-amp circuits.

Prerequisites: None

Co-requisites: BME 201

BME 202: Biomechanics 3 (3-0-0)

Application of the principles of mechanics to biological systems. Topics include the statics and dynamics of the musculoskeletal system, the mechanical properties of biological tissues, stress and strain analysis, and the biomechanics of human motion, gait, and load-bearing.

Prerequisites: BME 200, MAT 212

Co-requisites: None

BME 210: Human Physiology 3 (3-0-0)

Quantitative study of the function of human organ systems with an engineering and systems perspective. Topics include cellular physiology, membrane transport, electrophysiology, cardiovascular and respiratory dynamics, and homeostatic regulation and control.

Prerequisites: BME 200

Co-requisites: None

BME 301: Biomedical Signals and Systems 3 (3-0-0)

Analysis of continuous- and discrete-time signals and linear systems with biomedical applications. Topics include time- and frequency-domain representation, the Fourier and Laplace transforms, sampling, and the characterization of physiological signals such as ECG, EEG, and EMG.

Prerequisites: BME 201, MAT 224

Co-requisites: BME 301 L

BME 301 L: Biomedical Signals and Systems Lab 1 (0-2-0)

Laboratory experiments dealing with biomedical signals and systems, including signal acquisition, filtering, and spectral analysis using computational tools.

Prerequisites: None

Co-requisites: BME 301

BME 302: Modeling and Control of Biomedical Systems 3 (3-0-0)

Mathematical modeling and feedback control of physiological and biomedical systems. Topics include compartmental and state-space models, system response, stability, and the design of controllers for devices such as drug-delivery and life-support systems.

Prerequisites: BME 301, MAT 224

Co-requisites: BME 302 L

BME 302 L: Modeling and Control of Biomedical Systems Lab 1 (0-2-0)

Laboratory experiments dealing with the modeling, simulation, and control of biomedical systems.

Prerequisites: None

Co-requisites: BME 302



BME 303: Biomedical Electronics 3 (3-0-0)

Analog and digital electronics for biomedical instrumentation. Topics include semiconductor devices, amplifiers, filters, data converters, and the design of low-noise electronic circuits for the safe measurement of physiological signals.

Prerequisites: BME 201

Co-requisites: BME 303 L

BME 303 L: Biomedical Electronics Lab 1 (0-2-0)

Laboratory experiments dealing with biomedical electronic circuits, including amplifier and filter design and bio-signal acquisition front-ends.

Prerequisites: None

Co-requisites: BME 303

BME 304: Biomedical Image Processing 3 (3-0-0)

Theory and techniques of digital processing of medical images. Topics include image acquisition and representation, enhancement, restoration, segmentation, registration, and feature extraction applied to clinical imaging modalities.

Prerequisites: BME 301, BME 305

Co-requisites: BME 304 L

BME 304 L: Biomedical Image Processing Lab 1 (0-2-0)

Laboratory experiments dealing with biomedical image processing, including enhancement, segmentation, and analysis of medical images using software tools.

Prerequisites: None

Co-requisites: BME 304

BME 305: Biomedical Imaging Systems 3 (3-0-0)

Physical principles and instrumentation of medical imaging modalities, including X-ray and computed tomography, ultrasound, magnetic resonance imaging, and nuclear medicine. The course covers image formation, system components, resolution and contrast, and clinical applications.

Prerequisites: EE 209

Co-requisites: None

BME 306: Biomedical Instrumentation 3 (3-0-0)

Principles and design of instruments used to measure physiological variables. Topics include sensors and transducers, biopotential electrodes and amplifiers, measurement of pressure, flow, and temperature, electrical safety, and medical device standards.

Prerequisites: BME 202, BME 303

Co-requisites: BME 306 L

BME 306 L: Biomedical Instrumentation Lab 1 (0-2-0)

Laboratory experiments dealing with biomedical instrumentation, including sensor interfacing, physiological measurement, and electrical safety testing.

Prerequisites: None

Co-requisites: BME 306



BME 307: Bio Fluid Dynamics 3 (3-0-0)

Application of fluid mechanics to biological systems. Topics include the properties of blood and biological fluids, laminar and turbulent flow, the mechanics of the cardiovascular and respiratory systems, and the design of fluid-handling medical devices.

Prerequisites: BME 202, MAT 213

Co-requisites: BME 307 L

BME 307 L: Bio Fluid Dynamics Lab 1 (0-2-0)

Laboratory experiments dealing with bio-fluid dynamics, including flow measurement and the characterization of cardiovascular flow models.

Prerequisites: None

Co-requisites: BME 307

BME 308: Healthcare Management Systems 3 (3-0-0)

Organization, management, and engineering of healthcare delivery systems. Topics include hospital and clinical engineering, medical equipment management, healthcare informatics, quality and safety systems, and the economics of healthcare technology.

Prerequisites: BME 100

Co-requisites: None

BME 390: Biomedical Engineering Internship 0 (0-0-0)

Supervised professional training in a hospital, clinical engineering department, medical device company, or research facility. Students apply their academic preparation in a real engineering environment and submit a report documenting their experience and outcomes.

Prerequisites: BME 302, BME 304, BME 306, BME 308

Co-requisites: None

BME 401: Undergraduate Research in Biomedical Engineering 3 (0-6-0)

Supervised research with a faculty member, undertaken either as an independent project or as assistance on a faculty member's project. The student and supervisor agree on a research plan and academic requirements, and the student is expected to be an active and reliable participant who reports progress throughout the semester.

Prerequisites: Department Chair approval, a minimum 3.0/4.0 GPA, and a signed research contract

Co-requisites: None

BME 402: Medical Device Quality & Regulatory Affairs 3 (3-0-0)

Quality systems and regulatory frameworks governing medical devices. Topics include design controls, risk management, quality management systems, and the major international regulatory pathways and standards for the approval and marketing of medical devices.

Prerequisites: BME 306, BME 308

Co-requisites: None

BME 405: Artificial Intelligence in Biomedical Engineering 3 (3-0-0)

Foundations and applications of artificial intelligence and machine learning in biomedical engineering. Topics include supervised and unsupervised learning, neural networks, and the application of AI methods to physiological signals, medical images, and clinical decision support.

Prerequisites: BME 304, STA 212

Co-requisites: None



BME 408: Lasers & Coherent Optics 3 (3-0-0)

Principles of lasers and coherent optics with biomedical applications. Topics include laser physics, light-tissue interaction, and the use of lasers in diagnosis, therapy, and surgery.

Prerequisites: BME 305

Co-requisites: None

BME 410: Clinical Imaging Block 3 (3-0-0)

Integrated study of clinical imaging in the diagnostic workflow. Topics include modality selection, protocol design, image interpretation support, and the integration of imaging systems into clinical practice.

Prerequisites: BME 304

Co-requisites: None

BME 412: Deep Learning in Biomedical Imaging 3 (3-0-0)

Deep learning methods applied to biomedical imaging. Topics include convolutional and modern neural network architectures, training and validation strategies, and applications to detection, segmentation, and classification of medical images.

Prerequisites: BME 304, STA 212

Co-requisites: None

BME 414: Radiation Therapy 3 (3-0-0)

Physics and engineering of radiation therapy. Topics include radiation sources and interactions, dosimetry, treatment planning, and the instrumentation and safety systems used in radiation oncology.

Prerequisites: BME 304, BME 308

Co-requisites: None

BME 420: Prosthetics & Orthotics 3 (3-0-0)

Engineering design of prosthetic and orthotic devices. Topics include biomechanics of amputation and impairment, materials and actuation, socket and interface design, and the evaluation of assistive devices.

Prerequisites: BME 306

Co-requisites: None

BME 421: Advanced Biomedical Instrumentation 3 (3-0-0)

Advanced topics in the design of biomedical instrumentation, including multi-channel acquisition systems, wireless and implantable devices, and the integration of sensing, processing, and communication in modern medical instruments.

Prerequisites: BME 306

Co-requisites: None

BME 422: Medical Device Innovation & Entrepreneurship 3 (3-0-0)

The process of bringing a medical device from concept to market. Topics include needs identification, design and prototyping, intellectual property, regulatory strategy, and business planning for medical technology ventures.

Prerequisites: BME 306, BME 308

Co-requisites: None



BME 423: Biomedical Mechatronic Systems 3 (3-0-0)

Integration of mechanical, electronic, and computational elements in biomedical systems. Topics include actuators and sensors, embedded control, and the design of robotic and mechatronic devices for medical and rehabilitation applications.

Prerequisites: BME 302, BME 306

Co-requisites: None

BME 424: Biomedical Sensors 3 (3-0-0)

Principles, design, and application of sensors for physiological and biochemical measurement. Topics include transduction mechanisms, biosensors, wearable and implantable sensors, and sensor interfacing and calibration.

Prerequisites: BME 306

Co-requisites: None

BME 425: Perfusion & Pumping Engineering 3 (3-0-0)

Engineering of perfusion and circulatory support systems. Topics include the mechanics of pumps, oxygenators, and extracorporeal circulation, and the design and operation of cardiopulmonary support devices.

Prerequisites: BME 307, BME 306

Co-requisites: None

BME 426: Tissue Engineering 3 (3-0-0)

Principles of tissue engineering and regenerative medicine. Topics include cell sources, scaffolds and biomaterials, growth factors, bioreactors, and strategies for engineering functional tissues.

Prerequisites: BME 102, BME 210

Co-requisites: None

BME 427: Cardiovascular Instrumentation 3 (3-0-0)

Instrumentation and devices for the cardiovascular system. Topics include hemodynamic monitoring, electrocardiography, pacemakers and defibrillators, and the measurement of cardiovascular function.

Prerequisites: BME 306, BME 307

Co-requisites: None

BME 428: Fundamentals of BioMEMS & Medical Microdevices 3 (3-0-0)

Micro-electro-mechanical systems for biomedical applications. Topics include microfabrication, microfluidics, lab-on-a-chip systems, and the design of miniaturized diagnostic and therapeutic devices.

Prerequisites: BME 306

Co-requisites: None

BME 429: Biomechanics of Movement 3 (3-0-0)

Advanced study of the biomechanics of human movement. Topics include motion capture and analysis, musculoskeletal modeling, gait and posture, and applications in rehabilitation and sports.

Prerequisites: BME 202

Co-requisites: None



BME 430: Special Topics in Biomedical Engineering 3 (3-0-0)

Selected advanced or emerging topics in biomedical engineering not covered by the regular curriculum. Content varies by offering and is announced in advance.

Prerequisites: None

Co-requisites: None

BME 431: Genetics & Molecular Biology 3 (3-0-0)

Foundations of genetics and molecular biology for engineers. Topics include DNA, RNA, and protein structure and function, gene expression and regulation, and the molecular basis of disease relevant to biomedical engineering.

Prerequisites: BME 200

Co-requisites: None

BME 433: Biomedical Data Analytics 3 (3-0-0)

Methods for the analysis of biomedical and health data. Topics include data management, statistical analysis, visualization, and predictive modeling applied to clinical and physiological datasets.

Prerequisites: STA 212, SE 100

Co-requisites: None

BME 434: Bioinformatics 3 (3-0-0)

Computational methods for the analysis of biological data. Topics include sequence alignment, genomics, and the algorithms and databases used to analyze molecular biology data.

Prerequisites: STA 212, SE 100, BME 431

Co-requisites: None

BME 435: Cognitive Neuroscience 3 (3-0-0)

The neural basis of cognition from an engineering perspective. Topics include neural signaling, brain organization, sensory and motor systems, and methods for measuring and modeling brain function.

Prerequisites: BME 210, BME 302

Co-requisites: None

BME 436: Photonic Information Processing 3 (3-0-0)

Optical and photonic methods for information processing in biomedical systems. Topics include optical sensing, imaging, and the processing of optically acquired biomedical data.

Prerequisites: BME 304, BME 305

Co-requisites: None

BME 438: Nanotechnology 3 (3-0-0)

Principles and biomedical applications of nanotechnology. Topics include nanomaterials, nanofabrication, nanoparticles for drug delivery and imaging, and the safety and characterization of nanoscale systems.

Prerequisites: BME 102

Co-requisites: None



Biomedical Engineering Program

BME 495: Capstone Project I 3 (0-6-0)

First part of the year-long capstone design experience. Working in teams, students identify a biomedical engineering problem, conduct background research, define requirements, and develop a design concept and project plan under faculty supervision.

Prerequisites: BME 306

Co-requisites: None

BME 496: Capstone Project II 3 (0-6-0)

Continuation of the capstone design experience. Teams implement, test, and evaluate their design, and present and document their results in a formal report and presentation.

Prerequisites: BME 495

Co-requisites: None

BME 499: Ethics and Professional Development 1 (1-0-0)

Professional, ethical, and societal responsibilities of the biomedical engineer. Topics include engineering ethics, biomedical ethics, professional licensure and conduct, lifelong learning, and the social and regulatory context of medical technology.

Prerequisites: None

Co-requisites: None