

DUAL DEGREE PROGRAM: BIOMEDICAL ENGINEERING COMBINED WITH COMPUTER ENGINEERING

requires a cumulative grade point average of at least 2.000 in Electrical Engineering courses as a graduation requirement. It is the responsibility of any student who fails to maintain a 2.000 average to work with their advisor to correct grade point deficiencies. In addition, it is required that students retake any Electrical Engineering course at the 300-level or below in which they receive a grade below C (2.000).

Requirements Effective Fall 2024

In order to maintain professional standards required of practicing engineers, the Department of Electrical and Computer Engineering

Freshman

		AUCC	Credits
BIOM 100	Overview of Biomedical Engineering		1
CO 150	College Composition (GT-CO2)	1A	3
Select one group from the following: ¹			7
Group A:			
CS 150B	Culture and Coding: Python (GT-AH3)	3B	
CS 164	CS1—Computational Thinking with Java		
Group B:			
CS 152	Python for STEM		
CS 162	CS1—Introduction to Java Programming		
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
Group C:			
CS 163	CS1—No Prior Programming Experience		
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
ECE 102	Digital Circuit Logic		4
ECE 251	Introduction to Microcontrollers and IoT		4
LIFE 102	Attributes of Living Systems (GT-SC1)	3A	4
MATH 160	Calculus for Physical Scientists I (GT-MA1)	1B	4
MATH 161	Calculus for Physical Scientists II (GT-MA1)	1B	4
Total Credits			31

Sophomore

BIOM 200	Fundamentals of Biomedical Engineering		2
CS 165	CS2—Data Structures		4
ECE 103	DC Circuit Analysis		3
ECE 202	Circuit Theory Applications		4
ECE 232	Introduction to Project Practices		1
ECE 303/STAT 303	Introduction to Communications Principles		3
MATH 261	Calculus for Physical Scientists III		4
MATH 340	Intro to Ordinary Differential Equations		4
MECH 262	Engineering Mechanics		4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	5
Total Credits			34

Junior

BIOM 300	Problem-Based Learning Biomedical Engr Lab		4
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CHEM 111	General Chemistry I (GT-SC2)	3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	3A	1
CS 214	Software Development		3
CS 220	Discrete Structures and their Applications		4
ECE 311	Linear System Analysis I		3
PH 142	Physics for Scientists and Engineers II (GT-SC1)	3A	5
Select one course from the following:			3-4
DSCI 369	Linear Algebra for Data Science		
MATH 369	Linear Algebra I		
CpE Electives (see list below) ²			4

Total Credits	31-32
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Senior

BIOM 431/ECE 431	Biomedical Signal and Image Processing		3
BMS 300	Principles of Human Physiology		4
CHEM 113	General Chemistry II		3
CHEM 245	Fundamentals of Organic Chemistry		4
CT 301	C++ Fundamentals		2
ECON 202	Principles of Microeconomics (GT-SS1)	3C	3
MECH 337	Thermodynamics		4
Diversity, Equity, and Inclusion (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion)		1C	3
CpE Electives (see list below) ²			7-8

Total Credits	33-34
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Fifth Year

BIOM 486A	Biomedical Design Practicum: Capstone Design I	4A,4B,4C	4
BIOM 486B	Biomedical Design Practicum: Capstone Design II	4A,4B,4C	4
Select one course from the following:			3
CO 301B	Writing in the Disciplines: Sciences (GT-CO3)	2	
JTC 300	Strategic Writing and Communication (GT-CO3)	2	
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
Historical Perspectives (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
CpE Electives (see list below) ²			0-6
Technical Electives (see list below) ²			1-8
BME Technical Electives (see list below) ²			3

Total Credits	27-28
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Program Total Credits:	157-158
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Computer Engineering (CpE) Electives (11-18 credits)

Code	Title	Credits
Group 1 - Choose 11-12 credits from the list below: ²		11-12
ECE 450	Digital System Design Laboratory	
ECE 451	Digital System Design	
ECE 452	Computer Organization and Architecture	
ECE 456	Computer Networks	
ECE 528/CS 528	Embedded Systems and Machine Learning	
Group 2 - Choose 0-3 credits from the list below: ²		0-3
DSCI 320	Optimization Methods in Data Science	
ECE 312	Linear System Analysis II	
Group 3 - Chose 0-3 credits from the list below: ^{2,3}		0-3

ECE 101	Foundations in ECE	
ECE 395A	Independent Study ³	
ECE 395B	Independent Study: Open Option Project ³	
ECE 395C	Independent Study : Vertically Integrated Project ³	

Technical Electives (1-8 credits)

Code	Title	Credits
Choose 2 - 8 credits from the list below: ^{2,3}		
CS 310H/IDEA 310H	Design Thinking Toolbox: Mixed Reality Design	3
CS 314	Software Engineering	3

CS 320	Algorithms--Theory and Practice	3	BIOM 533/CIVE 533	Biomolecular Tools for Engineers	3
CS 345	Machine Learning Foundations and Practice	3	BIOM 537/ECE 537	Biomedical Signal Processing	3
CS 356	Systems Security	3	BIOM 570/MECH 570	Bioengineering	3
CS 370	Operating Systems	3	BIOM 572/MECH 572	Regenerative Bioengineering with Stem Cells	3
CS 4XX Any CS course at the 400-level, excluding CS 457 and CS 470			BIOM 573/MECH 573	Structure and Function of Biomaterials	3
CS 5XX Any CS course at the 500-level			BIOM 574/MECH 574	Bio-Inspired Surfaces	3
DSCI 475	Topological Data Analysis	2	BIOM 576/MECH 576	Quantitative Systems Physiology	4
ECE 340	Electromagnetics for Computer Engineering	3	BIOM 578/MECH 578	Musculoskeletal Biosolid Mechanics	3
ECE 495A	Independent Study ³	1-3	BMS 301	Human Gross Anatomy	5
ECE 495B	Independent Study: Open Option Project ³	1	BMS 302	Laboratory in Principles of Physiology	2
ECE 495C	Independent Study: Vertically Integrated Projects ³	1	BMS 310	Anatomy for the Health Professions	4
ECE 4XX Any ECE course at the 400-level			BMS 320	Virtual Laboratory in Physiology	2
ECE 5XX Any ECE course at the 500-level, excluding ECE 532/SYSE 532			BMS 325	Cellular Neurobiology	3
MATH 360	Mathematics of Information Security	3	BMS 345	Functional Neuroanatomy	4
MATH 450	Introduction to Numerical Analysis I	3	BMS 405	Nerve and Muscle-Toxins, Trauma and Disease	3
MATH 451	Introduction to Numerical Analysis II	3	BMS 409	Human and Animal Reproductive Biology	3
MATH 460	Information and Coding Theory	3	BMS 420	Cardiopulmonary Physiology	3
MECH 564	Fundamentals of Robot Mechanics and Controls	3	BMS 430	Endocrinology	3
STAT 421	Introduction to Stochastic Processes	3	BMS 450	Pharmacology	3
			BMS 500	Mammalian Physiology I	4
			BMS 501	Mammalian Physiology II	4
			BMS 503/NB 503	Developmental Neurobiology	3
			BZ 311	Developmental Biology	4
			BZ 350	Molecular and General Genetics	4
			BZ 476/BZ 576	Genetics of Model Organisms	3
			CBE 330	Process Simulation	3
			CBE 543	Membranes for Biotechnology and Biomedicine	3
			CHEM 334	Quantitative Analysis Laboratory	1
			CHEM 335	Introduction to Analytical Chemistry	3
			CHEM 343	Modern Organic Chemistry II	3
			CHEM 344	Modern Organic Chemistry Laboratory	2
			CHEM 346	Organic Chemistry II	4
			CHEM 433	Clinical Chemistry	3
			CHEM 539A	Principles of NMR and MRI: Basic NMR Principles	1
			CHEM 539B	Principles of NMR and MRI: NMR Diffusion Measurements-2D NMR and MRI	1
			CHEM 539C	Principles of NMR and MRI: Advanced NMR and MRI Techniques	1
			ECE 569/MECH 569	Micro-Electro-Mechanical Devices	3
			ERHS 332	Principles of Epidemiology	3
			ERHS 450	Introduction to Radiation Biology	3
			ERHS 502	Fundamentals of Toxicology	3
			ERHS 510/VS 510	Cancer Biology	3
			ERHS 540	Principles of Ergonomics	3
			FSHN 470	Integrative Nutrition and Metabolism	3
			HES 307	Biomechanical Principles of Human Movement	3
			HES 319	Neuromuscular Aspects of Human Movement	4

Biomedical Engineering (BME) Technical Electives (3 credits)

Code	Title	Credits			
BC 351	Principles of Biochemistry	4			
BC 401	Comprehensive Biochemistry I	3			
BC 403	Comprehensive Biochemistry II	3			
BC 404	Comprehensive Biochemistry Laboratory	2			
BC 411	Physical Biochemistry	4			
BC 463	Molecular Genetics	3			
BC 465	Molecular Regulation of Cell Function	3			
BC 565	Molecular Regulation of Cell Function	4			
BIOM 304	Global Challenges and Collaborations in BME	3			
BIOM 350A	Study Abroad--Ecuador: Prosthetics	1-3			
BIOM 421	Transport Phenomena in Biomedical Engineering	3			
BIOM 422	Quantitative Systems and Synthetic Biology	3			
BIOM 441	Biomechanics and Biomaterials	3			
BIOM 476	Biomedical Engineering Clinical Practicum ³	1-3			
BIOM 495	Independent Study ³	1-6			
BIOM 504/CBE 504	Fundamentals of Biochemical Engineering	3			
BIOM 518/ECE 518	Biophotonics	3			
BIOM 522/CBE 522	Bioseparation Processes	3			
BIOM 525/MECH 525	Cell and Tissue Engineering	3			
BIOM 526/ECE 526	Biological Physics	3			
BIOM 531/MECH 531	Materials Engineering	3			

HES 403	Physiology of Exercise	3
HES 420	Electrocardiography and Exercise Management	3
HES 476	Exercise and Chronic Disease	3
MATH 455	Mathematics in Biology and Medicine	3
MECH 432	Engineering of Nanomaterials	3
MECH 543	Biofluid Mechanics	3
MIP 300	General Microbiology	3
MIP 302	General Microbiology Laboratory	2
MIP 342	Immunology	4
MIP 343	Immunology Laboratory	2
MIP 351	Medical Bacteriology	3
MIP 352	Medical Bacteriology Laboratory	3
MIP 420	Medical and Molecular Virology	4
MIP 443	Microbial Physiology	4
MIP 450	Microbial Genetics	3
NB 500/BMS 502	Readings in Cellular Neurobiology	1
NB 501	Cellular and Molecular Neurophysiology	2
NB 503/BMS 503	Developmental Neurobiology	3
NB 505/BMS 505	Neuronal Circuits, Systems and Behavior	3

¹ Students must take a total of 7 credits from either of these groups: Group A: CS 150B + CS 164 - OR - Group B: AUCC 3B + CS 163 - OR - Group C: AUCC 3B + CS 152 + CS 162. Recommended sequence for most incoming students is Group A: **CS 150B to CS 164**.

² Students are required to complete 19 credits of CpE electives (11 - 18 credits of CpE Electives and 1 - 8 credits of Technical Electives), in addition to 3 credits of BME Technical Electives to reach the required 157-158 total program credits.

³ A maximum total 6 credits of ECE Independent Study may apply toward total degree requirements, including ECE 395A, ECE 395B, ECE 395C and ECE 495A, ECE 495B, ECE 495C combined. A maximum total 3 credits of BIOM Independent Study may apply toward total degree requirements, including BIOM 476 and BIOM 495.