

# DUAL DEGREE PROGRAM: BIOMEDICAL ENGINEERING COMBINED WITH CHEMICAL AND BIOLOGICAL ENGINEERING

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## Requirements Effective Fall 2024

### Freshman

		AUCC	Credits
BIOM 100	Overview of Biomedical Engineering		1
CBE 160	MATLAB for Chemical and Biological Eng		1
CHEM 111	General Chemistry I (GT-SC2)	3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	3A	1
CHEM 113	General Chemistry II		3
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
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	5
Select one group from the following:			3
Group A:			
CBE 101	Introduction to Chemical and Biological Engr		
Group B:			
CBE 101A	Introduction to Chemical and Biological Engr: Lecture		
CBE 101B	Introduction to Chemical and Biological Engr: Laboratory		
Group C:			
CBE 104A	Study Abroad--Denmark: Intro to Chemical and Biological Engineering		
<b>Total Credits</b>			<b>30</b>

### Sophomore

CBE 201	Material and Energy Balances		3
CBE 205	Fundamentals of Biological Engineering		3
CBE 210	Thermodynamic Process Analysis		3
CHEM 114	General Chemistry Lab II		1
CHEM 341	Modern Organic Chemistry I		3
CHEM 343	Modern Organic Chemistry II		3
CHEM 344	Modern Organic Chemistry Laboratory		2
CO 150	College Composition (GT-CO2)	1A	3
MATH 261	Calculus for Physical Scientists III		4
MATH 340	Intro to Ordinary Differential Equations		4
MECH 262	Engineering Mechanics		4
<b>Total Credits</b>			<b>33</b>

### Junior

BC 351	Principles of Biochemistry		4
BIOM 300	Problem-Based Learning Biomedical Engr Lab		4

BMS 300	Principles of Human Physiology		4
CBE 310	Molecular Concepts and Applications		3
CBE 320	Chemical and Biological Reactor Design		3
CBE 330	Process Simulation		3
CBE 331	Momentum Transfer and Mechanical Separations		3
CBE 332	Heat and Mass Transfer Fundamentals		3
CBE 393	Professional Development Seminar		1
Social and Behavioral Sciences ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences</a> )		3C	3

**Total Credits****31****Senior**

BIOM 421	Transport Phenomena in Biomedical Engineering		3
BIOM 422	Quantitative Systems and Synthetic Biology		3
CBE 333	Chemical and Biological Engineering Lab I		2
CBE 430	Process Control and Instrumentation		3
CBE 442	Separation Processes		4
CBE 443	Chemical and Biological Engineering Lab II		2
CBE 451	Chemical and Biological Engineering Design I		3
PH 142	Physics for Scientists and Engineers II (GT-SC1)	3A	5
STAT 315	Intro to Theory and Practice of Statistics		3
BME Broad Elective (see list below)			3
Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> )		3B	3

**Total Credits****34****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
BME Technical Elective <sup>1</sup>			5
CBE Technical Elective			5
Advanced Writing ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing</a> )		2	3
Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> )		3B	3
Diversity, Equity, and Inclusion ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion</a> )		1C	3
Historical Perspectives ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives</a> )		3D	3

**Total Credits****30****Program Total Credits:****158****BME Technical Electives - Select 5 credits**

Code	Title	Credits			
BC 401	Comprehensive Biochemistry I	3	BIOM 350A	Study Abroad--Ecuador. Prosthetics	1-3
BC 403	Comprehensive Biochemistry II	3	BIOM 431/ECE 431	Biomedical Signal and Image Processing	3
BC 404	Comprehensive Biochemistry Laboratory	2	BIOM 441	Biomechanics and Biomaterials	3
BC 411	Physical Biochemistry	4	Select a maximum of 3 credits from the following:		
BC 463	Molecular Genetics	3	BIOM 476	Biomedical Engineering Clinical Practicum	
BC 465	Molecular Regulation of Cell Function	3	BIOM 495	Independent Study	
BC 565	Molecular Regulation of Cell Function	4	BIOM 504/CBE 504	Fundamentals of Biochemical Engineering	3
BIOM 304	Global Challenges and Collaborations in BME	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 527A/ ECE 527A	Biosensing: Cells as Circuits	1	CHEM 539C	Principles of NMR and MRI: Advanced NMR and MRI Techniques	1
BIOM 527B/ ECE 527B	Biosensing: Signal and Noise in Biosensors	1	ECE 569/MECH 569	Micro-Electro-Mechanical Devices	3
BIOM 527C/ ECE 527C	Biosensing: Sensor Circuit Fundamentals	1	ERHS 332	Principles of Epidemiology	3
BIOM 527D/ ECE 527D	Biosensing: Electrochemical Sensors	1	ERHS 450	Introduction to Radiation Biology	3
BIOM 527E/ ECE 527E	Biosensing: Affinity Sensors	1	ERHS 502	Fundamentals of Toxicology	3
BIOM 527F/ ECE 527F	Biosensing: Biophotonic Sensors Using Refractive Index	1	ERHS 510/VS 510	Cancer Biology	3
BIOM 531/MECH 531	Materials Engineering	3	ERHS 540	Principles of Ergonomics	3
BIOM 533/CIVE 533	Biomolecular Tools for Engineers	3	FSHN 470	Integrative Nutrition and Metabolism	3
BIOM 537/ECE 537	Biomedical Signal Processing	3	HES 307	Biomechanical Principles of Human Movement	3
BIOM 570/MECH 570	Bioengineering	3	HES 319	Neuromuscular Aspects of Human Movement	4
BIOM 572/MECH 572	Regenerative Bioengineering with Stem Cells	3	HES 403	Physiology of Exercise	3
BIOM 573/MECH 573	Structure and Function of Biomaterials	3	HES 420	Electrocardiography and Exercise Management	3
BIOM 574/MECH 574	Bio-Inspired Surfaces	3	HES 476	Exercise and Chronic Disease	3
BIOM 576/MECH 576	Quantitative Systems Physiology	4	MATH 455	Mathematics in Biology and Medicine	3
BIOM 578/MECH 578	Musculoskeletal Biosolid Mechanics	3	MECH 543	Biofluid Mechanics	3
BIOM 579/MECH 579	Cardiovascular Biomechanics	3	MIP 300	General Microbiology	3
BMS 301	Human Gross Anatomy	5	MIP 302	General Microbiology Laboratory	2
BMS 302	Laboratory in Principles of Physiology	2	MIP 342	Immunology	4
BMS 310	Anatomy for the Health Professions	4	MIP 343	Immunology Laboratory	2
BMS 320	Virtual Laboratory in Physiology	2	MIP 351	Medical Bacteriology	3
BMS 325	Cellular Neurobiology	3	MIP 352	Medical Bacteriology Laboratory	3
BMS 345	Functional Neuroanatomy	4	MIP 420	Medical and Molecular Virology	4
BMS 405	Nerve and Muscle-Toxins, Trauma and Disease	3	MIP 443	Microbial Physiology	4
BMS 409	Human and Animal Reproductive Biology	3	MIP 450	Microbial Genetics	3
BMS 420	Cardiopulmonary Physiology	3	NB 500/BMS 502	Readings in Cellular Neurobiology	1
BMS 430	Endocrinology	3	<b>CBE Technical Electives - Select 5 credits</b>		
BMS 450	Pharmacology	3	<b>Code</b>	<b>Title</b>	<b>Credits</b>
BMS 500	Mammalian Physiology I	4	Select 5 credits from the following:		
BMS 501	Mammalian Physiology II	4	AB 410	Understanding Pesticides	3
BMS 503/NB 503	Developmental Neurobiology	3	ATS 555	Air Pollution	3
BMS 505/NB 505	Neuronal Circuits, Systems and Behavior	3	ATS 560	Air Pollution Measurement	2
BZ 310	Cell Biology	4	BC 401	Comprehensive Biochemistry I	3
BZ 311	Developmental Biology	4	BC 403	Comprehensive Biochemistry II	3
BZ 350	Molecular and General Genetics	4	BC 404	Comprehensive Biochemistry Laboratory	2
BZ 476/BZ 576	Genetics of Model Organisms	3	BC 406A	Investigative Biochemistry: Protein Biochemistry	2
CBE 505	Biochemical Engineering Laboratory	1	BC 406B	Investigative Biochemistry: Molecular Genetics	2
CBE 543	Membranes for Biotechnology and Biomedicine	3	BC 406C	Investigative Biochemistry: Cellular Biochemistry	2
CHEM 334	Quantitative Analysis Laboratory	1	BC 411	Physical Biochemistry	4
CHEM 335	Introduction to Analytical Chemistry	3	BC 441	3D Molecular Models for Biochemistry	1
CHEM 433	Clinical Chemistry	3	BC 463	Molecular Genetics	3
CHEM 539A	Principles of NMR and MRI: Basic NMR Principles	1	BC 464	Molecular Genetics Recitation	1
CHEM 539B	Principles of NMR and MRI: NMR Diffusion Measurements-2D NMR and MRI	1	BC 465	Molecular Regulation of Cell Function	3
			BC 517	Metabolism	2
			BC 521/CHEM 521	Principles of Chemical Biology	3
			BIOM 350A	Study Abroad-Ecuador: Prosthetics	1-3

BIOM 350B	Study Abroad--Portugal: Biomedical Engineering and Healthcare	1	CBE 540/CIVE 540	Advanced Biological Wastewater Processing	3
BIOM 441	Biomechanics and Biomaterials	3	CBE 560	Engineering of Protein Expression Systems	3
BIOM 517/ECE 517	Advanced Optical Imaging	3	CBE 570	Biomolecular Engineering/Synthetic Biology	3
BIOM 525/MECH 525	Cell and Tissue Engineering	3	CHEM 231	Foundations of Analytical Chemistry	3
BIOM 526/ECE 526	Biological Physics	3	CHEM 232	Foundations of Analytical Chemistry Lab	2
BIOM 531/MECH 531	Materials Engineering	3	CHEM 261	Fundamentals of Inorganic Chemistry	3
BIOM 532/MECH 532	Materials Issues in Mechanical Design	3	CHEM 263	Foundations of Inorganic Chemistry	4
BIOM 533/CIVE 533	Biomolecular Tools for Engineers	3	CHEM 264	Foundations of Inorganic Chemistry Laboratory	1
BIOM 537/ECE 537	Biomedical Signal Processing	3	CHEM 311	Introduction to Nanoscale Science	3
BIOM 573/MECH 573	Structure and Function of Biomaterials	3	CHEM 315	Foundations of Polymer Chemistry	3
BIOM 574/MECH 574	Bio-Inspired Surfaces	3	CHEM 320	Chemistry of Additions	3
BIOM 576/MECH 576	Quantitative Systems Physiology	4	CHEM 333	Forensic Chemistry	3
BIOM 579/MECH 579	Cardiovascular Biomechanics	3	CHEM 334	Quantitative Analysis Laboratory	1
BMS 301	Human Gross Anatomy	5	CHEM 335	Introduction to Analytical Chemistry	3
BMS 302	Laboratory in Principles of Physiology	2	CHEM 338	Environmental Chemistry	3
BMS 305	Domestic Animal Gross Anatomy	4	CHEM 355	Foundations of Sustainable Chemistry	3
BMS 325	Cellular Neurobiology	3	CHEM 431	Instrumental Analysis	4
BMS 330	Microscopic Anatomy	4	CHEM 433	Clinical Chemistry	3
BMS 345	Functional Neuroanatomy	4	CHEM 440	Advanced Organic Chemistry Laboratory	2
BMS 409	Human and Animal Reproductive Biology	3	CHEM 445	Synthetic Organic Chemistry	3
BMS 420	Cardiopulmonary Physiology	3	CHEM 448	Medicinal Chemistry	3
BMS 430	Endocrinology	3	CHEM 451	Foundations of Catalytic Chemistry	3
BMS 450	Pharmacology	3	CHEM 461	Inorganic Chemistry	3
BMS 460	Essentials of Pathophysiology	3	CHEM 462	Inorganic Chemistry Laboratory	2
BMS 500	Mammalian Physiology I	4	CHEM 465	Chemistry of Sustainable E-Waste Management	1
BMS 501	Mammalian Physiology II	4	CHEM 522	Methods of Chemical Biology	2
BMS 503/NB 503	Developmental Neurobiology	3	CHEM 532	Advanced Chemical Analysis II	3
BMS 505/NB 505	Neuronal Circuits, Systems and Behavior	3	CHEM 537	Electrochemical Methods	3
BMS 545	Neuroanatomy	5	CHEM 539A	Principles of NMR and MRI: Basic NMR Principles	1
BMS 575	Human Anatomy Dissection	4	CHEM 539B	Principles of NMR and MRI: NMR Diffusion Measurements-2D NMR and MRI	1
BSPM 302	Applied and General Entomology	2	CHEM 539C	Principles of NMR and MRI: Advanced NMR and MRI Techniques	1
BSPM 361	Elements of Plant Pathology	3	CHEM 541	Organic Molecular Structure Determination	2
BZ 240	Synthetic Biology-Principles and Applications	3	CHEM 543	Structure/Mechanisms in Organic Chemistry	2
BZ 310	Cell Biology	4	CHEM 545	Synthetic Organic Chemistry I	3
BZ 311	Developmental Biology	4	CHEM 547	Physical Organic Chemistry	3
BZ 348/MATH 348	Theory of Population and Evolutionary Ecology	4	CHEM 555	Chemistry of Sustainability	3
BZ 350	Molecular and General Genetics	4	CHEM 569	Chemical Crystallography	3
BZ 360	Bioinformatics and Genomics	4	CHEM 570	Chemical Bonding	3
CBE 406	Introduction to Transport Phenomena	3	CHEM 575	Fundamentals of Chemical Thermodynamics	1
CBE 501	Chemical Engineering Thermodynamics	3	CHEM 576	Statistical Mechanics	2
CBE 502	Advanced Reactor Design	3	CHEM 577	Surface Chemistry	3
CBE 503	Transport Phenomena Fundamentals	3	CHEM 579	Chemical Kinetics	3
CBE 504/BIOM 504	Fundamentals of Biochemical Engineering	3	CIVE 322	Basic Hydrology	3
CBE 505	Biochemical Engineering Laboratory	1	CIVE 330	Ecological Engineering	3
CBE 514	Polymer Science and Engineering	3	CIVE 360	Mechanics of Solids	3
CBE 521	Mathematical Modeling for Chemical Engineers	3			
CBE 522/BIOM 522	Bioseparation Processes	3			
CBE 524	Bioremediation	1			

CIVE 371	Study Abroad–Peru: Grand Challenges in Engineering in Peru	3	ESS 501	Principles of Ecosystem Sustainability	3
CIVE 401	Hydraulic Engineering	3	ESS 524	Foundations for Carbon/Greenhouse Gas Mgmt	3
CIVE 423	Groundwater Engineering	3	F 311	Forest Ecology	3
CIVE 438	Fundamentals of Environmental Engr	3	FTEC 447	Food Chemistry	3
CIVE 439	Applications of Environmental Engr Concepts	3	GEOL 150	Dynamic Earth (GT-SC2)	4
CIVE 440	Nonpoint Source Pollution	3	GEOL 452	Hydrogeology	4
CIVE 442	Air Quality Engineering	3	GEOL 454	Geomorphology	4
CIVE 515	River Mechanics	3	GES 362	Systems Thinking and Sustainability	3
CIVE 520	Physical Hydrology	3	GES 441	Analysis of Sustainable Energy Solutions	3
CIVE 531	Groundwater Hydrology	3	GES 465/MSE 465	Sustainable Strategies for E-Waste Management	3
CIVE 538	Aqueous Chemistry	3	GES 528/CIVE 528	Assessing the Food, Energy, Water Nexus	3
CIVE 560	Advanced Mechanics of Materials	3	GES 542	Biobased Fuels, Energy, and Chemicals	3
CS 165	CS2–Data Structures	4	HES 307	Biomechanical Principles of Human Movement	3
CS 220	Discrete Structures and their Applications	4	HES 319	Neuromuscular Aspects of Human Movement	4
CS 270	Computer Organization	4	HES 403	Physiology of Exercise	3
ECE 204	Introduction to Electrical Engineering	3	HES 420	Electrocardiography and Exercise Management	3
ECE 430/MATH 430	Fourier and Wavelet Analysis with Apps	3	HORT 579	Mass Spectrometry Omics-Methods and Analysis	3
ECE 527A/ BIOM 527A	Biosensing: Cells as Circuits	1	LIFE 201B	Introductory Genetics: Molecular/ Immunological/Developmental (GT-SC2)	3
ECE 527B/ BIOM 527B	Biosensing: Signal and Noise in Biosensors	1	LIFE 202B	Introductory Genetics Recitation: Molecular	1
ECE 527C/ BIOM 527C	Biosensing: Sensor Circuit Fundamentals	1	LIFE 203	Introductory Genetics Laboratory	2
ECE 527D/ BIOM 527D	Biosensing: Electrochemical Sensors	1	LIFE 210	Introductory Eukaryotic Cell Biology	3
ECE 527E/ BIOM 527E	Biosensing: Affinity Sensors	1	LIFE 211	Introductory Cell Biology Honors Recitation	1
ECE 527F/ BIOM 527F	Biosensing: Biophotonic Sensors Using Refractive Index	1	LIFE 212	Introductory Cell Biology Laboratory	2
ENGR 478	Applied Engineering Data Analytics	3	LIFE 320	Ecology	3
ENGR 510	Engineering Optimization: Method/ Application	3	MATH 301	Introduction to Combinatorial Theory	3
ENGR 550/ MATH 550	Numerical Methods in Science and Engineering	3	MATH 331	Introduction to Mathematical Modeling	3
ERHS 320	Environmental Health–Water Quality	3	MATH 332	Partial Differential Equations	3
ERHS 332	Principles of Epidemiology	3	MATH 360	Mathematics of Information Security	3
ERHS 410	Environmental Health–Air and Waste Management	3	MATH 366	Introduction to Abstract Algebra	3
ERHS 446	Environmental Toxicology	3	MATH 369	Linear Algebra I	3
ERHS 448	Environmental Contaminants	3	MATH 405	Introduction to Number Theory	3
ERHS 450	Introduction to Radiation Biology	3	MATH 419	Introduction to Complex Variables	3
ERHS 502	Fundamentals of Toxicology	3	MATH 450	Introduction to Numerical Analysis I	3
ERHS 503	Toxicology Principles	1	MATH 451	Introduction to Numerical Analysis II	3
ERHS 510/VS 510	Cancer Biology	3	MATH 455	Mathematics in Biology and Medicine	3
ERHS 530	Radiological Physics and Dosimetry I	3	MATH 460	Information and Coding Theory	3
ERHS 542	Biostatistical Methods for Qualitative Data	3	MATH 466	Abstract Algebra I	3
ERHS 547	Equipment and Instrumentation	3	MATH 467	Abstract Algebra II	3
ESS 311	Ecosystem Ecology	3	MATH 469	Linear Algebra II	3
ESS 312	Sustainability Science	3	MATH 525	Optimal Control	3
ESS 330	Quantitative Reasoning for Ecosystem Science	3	MATH 530	Mathematics for Scientists and Engineers	3
ESS 440	Practicing Sustainability	4	MATH 532	Mathematical Modeling of Large Data Sets	3
			MATH 535	Foundations of Applied Mathematics	3
			MATH 546	Partial Differential Equations II	3
			MATH 560	Linear Algebra	3
			MECH 307	Mechatronics and Measurement Systems	4

MECH 324	Dynamics of Machines	4	MSE 502C	Materials Science and Engineering Methods: Materials Microscopy	1
MECH 325	Machine Design	3	MSE 502D	Materials Science and Engineering Methods: Materials Spectroscopy	1
MECH 331	Introduction to Engineering Materials	4	MSE 502E	Materials Science and Engineering Methods: Bulk Properties and Performance	1
MECH 403	Energy Engineering	3	MSE 502F	Materials Science and Engineering Methods: Experimental Methods for Materials Research	1
MECH 407	Laser Applications in Mechanical Engineering	3	MSE 503	Mechanical Behavior of Materials	3
MECH 424	Advanced Dynamics	3	MSE 504	Thermodynamics of Materials	3
MECH 425	Mechanical Engineering Vibrations	4	MSE 505	Kinetics of Materials	3
MECH 431	Metals and Alloys	3	NR 319	Introduction to Geospatial Science	4
MECH 432	Engineering of Nanomaterials	3	NR 323/GR 323	Remote Sensing and Image Interpretation	3
MECH 436/MSE 436	Green Engineering–Materials and Environment	3	NR 505	Concepts in GIS	4
MECH 502	Advanced/Additive Manufacturing Engineering	3	PH 314	Introduction to Modern Physics	4
MECH 507	Laser Diagnostics for Thermosciences	3	PH 315	Modern Physics Laboratory	2
MECH 509	Design and Analysis in Engineering Research	3	PH 341	Mechanics	4
MECH 513	Simulation Modeling and Experimentation	3	PH 351	Electricity and Magnetism	4
MECH 516	Life Cycle and Techno-Economic Assessment	3	PH 353	Optics and Waves	4
MECH 524	Principles of Dynamics	3	PH 361	Physical Thermodynamics	3
MECH 527	Hybrid Electric Vehicle Powertrains	3	PH 451	Introductory Quantum Mechanics I	3
MECH 529	Advanced Mechanical Systems	3	PH 452	Introductory Quantum Mechanics II	3
MECH 530	Advanced Composite Materials	3	PH 517	Chaos, Fractals, and Nonlinear Dynamics	3
MECH 543	Biofluid Mechanics	3	PH 521	Introduction to Lasers	3
MECH 552	Applied Computational Fluid Dynamics	3	PH 522	Introductory Laser Laboratory	1
MIP 300	General Microbiology	3	PH 531	Introductory Condensed Matter Physics	3
MIP 302	General Microbiology Laboratory	2	PH 561	Elementary Particle Physics	3
MIP 315	Pathology of Human and Animal Disease	3	PH 571	Mathematical Methods for Physics I	3
MIP 334	Food Microbiology	3	PHIL 410	Gödel's Incompleteness Theorems	3
MIP 335	Food Microbiology Laboratory	2	SOCR 322	Principles of Microclimatology	3
MIP 342	Immunology	4	SOCR 330	Principles of Genetics	3
MIP 343	Immunology Laboratory	2	SOCR 375	Soil Biogeochemistry	3
MIP 351	Medical Bacteriology	3	SOCR 400	Soils and Global Change-Impacts and Solutions	3
MIP 352	Medical Bacteriology Laboratory	3	SOCR 455	Microbiomes of Soil Systems	3
MIP 410	Foundations of Modern Biotechnology	2	SOCR 456	Soil Microbiology Laboratory	1
MIP 420	Medical and Molecular Virology	4	SOCR 467	Soil and Environmental Chemistry	3
MIP 425	Virology and Cell Culture Laboratory	2	SOCR 470	Soil Physics	3
MIP 432/ESS 432	Microbial Ecology	3	SOCR 471	Soil Physics Laboratory	1
MIP 433/ESS 433	Microbial Ecology Laboratory	1	SOCR 567	Environmental Soil Chemistry	4
MIP 443	Microbial Physiology	4	STAR 512	Design and Data Analysis for Researchers II	4
MIP 450	Microbial Genetics	3	STAT 305	Sampling Techniques	3
MIP 530	Advanced Molecular Virology	4	STAT 307	Introduction to Biostatistics	3
MIP 543	RNA Biology	3	STAT 341	Statistical Data Analysis I	3
MIP 550	Microbial and Molecular Genetics Laboratory	4	STAT 342	Statistical Data Analysis II	3
MIP 555	Principles and Mechanisms of Disease	3	STAT 400	Statistical Computing	3
MSE 501	Materials Technology Transfer	1	STAT 420	Probability and Mathematical Statistics I	3
MSE 502A	Materials Science and Engineering Methods: Materials Structure and Scattering	1	STAT 421	Introduction to Stochastic Processes	3
MSE 502B	Materials Science and Engineering Methods: Computational Materials Methods	1	STAT 430	Probability and Mathematical Statistics II	3
			STAT 460	Applied Multivariate Analysis	3

SYSE 530	Overview of Systems Engineering Processes	3
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SYSE 532/ECE 532	Dynamics of Complex Engineering Systems	3
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A maximum of 3 credits may be selected from the following courses:

ENGR 422	Technology Entrepreneurship	
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ENGR 502	Engineering Project and Program Management	
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ENGR 525	Intellectual Property and Invention Systems	
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FIN 305	Fundamentals of Finance	
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IDEA 310B	Design Thinking Toolbox: 3D Modeling	
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IDEA 310D	Design Thinking Toolbox: Digital Imaging	
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MGT 305	Fundamentals of Management	
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MGT 340	Fundamentals of Entrepreneurship	
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MKT 305	Fundamentals of Marketing	
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### BME Broad Electives – Select 3 credits

Code	Title	Credits
AB 410	Understanding Pesticides	3
ATS 550	Atmospheric Radiation and Remote Sensing	3
ATS 555	Air Pollution	3
ATS 560	Air Pollution Measurement	2
BC 401	Comprehensive Biochemistry I	3
BC 403	Comprehensive Biochemistry II	3
BC 404	Comprehensive Biochemistry Laboratory	2
BC 406A	Investigative Biochemistry: Protein Biochemistry	2
BC 406B	Investigative Biochemistry: Molecular Genetics	2
BC 406C	Investigative Biochemistry: Cellular Biochemistry	2
BC 411	Physical Biochemistry	4
BC 441	3D Molecular Models for Biochemistry	1
BC 463	Molecular Genetics	3
BC 464	Molecular Genetics Recitation	1
BC 465	Molecular Regulation of Cell Function	3
BC 517	Metabolism	2
BC 521/CHEM 521	Principles of Chemical Biology	3
BC 563	Molecular Genetics	4
BIOM 304	Global Challenges and Collaborations in BME	3
BIOM 350A	Study Abroad–Ecuador: Prosthetics	1-3
BIOM 350B	Study Abroad–Portugal: Biomedical Engineering and Healthcare	1
BIOM 431/ECE 431	Biomedical Signal and Image Processing	3
BIOM 441	Biomechanics and Biomaterials	3
BIOM 504/CBE 504	Fundamentals of Biochemical Engineering	3
BIOM 517/ECE 517	Advanced Optical Imaging	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 527A/ECE 527A	Biosensing: Cells as Circuits	1
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BIOM 527B/ECE 527B	Biosensing: Signal and Noise in Biosensors	1
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BIOM 527C/ECE 527C	Biosensing: Sensor Circuit Fundamentals	1
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BIOM 527D/ECE 527D	Biosensing: Electrochemical Sensors	1
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BIOM 527E/ECE 527E	Biosensing: Affinity Sensors	1
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BIOM 527F/ECE 527F	Biosensing: Biophotonic Sensors Using Refractive Index	1
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BIOM 531/MECH 531	Materials Engineering	3
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BIOM 532/MECH 532	Materials Issues in Mechanical Design	3
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BIOM 533/CIVE 533	Biomolecular Tools for Engineers	3
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BIOM 537/ECE 537	Biomedical Signal Processing	3
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BIOM 570/MECH 570	Bioengineering	3
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BIOM 572/MECH 572	Regenerative Bioengineering with Stem Cells	3
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BIOM 573/MECH 573	Structure and Function of Biomaterials	3
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BIOM 574/MECH 574	Bio-Inspired Surfaces	3
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BIOM 576/MECH 576	Quantitative Systems Physiology	4
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BIOM 578/MECH 578	Musculoskeletal Biosolid Mechanics	3
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BIOM 579/MECH 579	Cardiovascular Biomechanics	3
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BMS 301	Human Gross Anatomy	5
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BMS 302	Laboratory in Principles of Physiology	2
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BMS 305	Domestic Animal Gross Anatomy	4
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BMS 310	Anatomy for the Health Professions	4
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BMS 320	Virtual Laboratory in Physiology	2
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BMS 325	Cellular Neurobiology	3
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BMS 330	Microscopic Anatomy	4
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BMS 345	Functional Neuroanatomy	4
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BMS 405	Nerve and Muscle-Toxins, Trauma and Disease	3
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BMS 409	Human and Animal Reproductive Biology	3
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BMS 420	Cardiopulmonary Physiology	3
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BMS 430	Endocrinology	3
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BMS 450	Pharmacology	3
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BMS 460	Essentials of Pathophysiology	3
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BMS 500	Mammalian Physiology I	4
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BMS 501	Mammalian Physiology II	4
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BMS 503/NB 503	Developmental Neurobiology	3
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BMS 505/NB 505	Neuronal Circuits, Systems and Behavior	3
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BMS 545	Neuroanatomy	5
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BMS 575	Human Anatomy Dissection	4
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BSPM 302	Applied and General Entomology	2
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BSPM 361	Elements of Plant Pathology	3
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BZ 240	Synthetic Biology-Principles and Applications	3
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BZ 310	Cell Biology	4
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BZ 311	Developmental Biology	4
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BZ 348/MATH 348	Theory of Population and Evolutionary Ecology	4
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BZ 350	Molecular and General Genetics	4
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BZ 360	Bioinformatics and Genomics	4	CHEM 547	Physical Organic Chemistry	3
BZ 420	Evolutionary Medicine	3	CHEM 555	Chemistry of Sustainability	3
BZ 476/BZ 576	Genetics of Model Organisms	3	CHEM 560	Foundations of Inorganic Synthesis	1
CBE 406	Introduction to Transport Phenomena	3	CHEM 566	Bioinorganic Chemistry	3
CBE 501	Chemical Engineering Thermodynamics	3	CHEM 567	Crystallographic Computation	1
CBE 502	Advanced Reactor Design	3	CHEM 569	Chemical Crystallography	3
CBE 503	Transport Phenomena Fundamentals	3	CHEM 570	Chemical Bonding	3
CBE 505	Biochemical Engineering Laboratory	1	CHEM 575	Fundamentals of Chemical Thermodynamics	1
CBE 514	Polymer Science and Engineering	3	CHEM 576	Statistical Mechanics	2
CBE 521	Mathematical Modeling for Chemical Engineers	3	CHEM 577	Surface Chemistry	3
CBE 524	Bioremediation	1	CHEM 578A	Computational Chemistry: Electronic Structure	1
CBE 540/CIVE 540	Advanced Biological Wastewater Processing	3	CHEM 579	Chemical Kinetics	3
CBE 560	Engineering of Protein Expression Systems	3	CIVE 322	Basic Hydrology	3
CBE 570	Biomolecular Engineering/Synthetic Biology	3	CIVE 330	Ecological Engineering	3
CHEM 231	Foundations of Analytical Chemistry	3	CIVE 360	Mechanics of Solids	3
CHEM 232	Foundations of Analytical Chemistry Lab	2	CIVE 367	Structural Analysis	3
CHEM 261	Fundamentals of Inorganic Chemistry	3	CIVE 371	Study Abroad--Peru: Grand Challenges in Engineering in Peru	3
CHEM 263	Foundations of Inorganic Chemistry	4	CIVE 401	Hydraulic Engineering	3
CHEM 264	Foundations of Inorganic Chemistry Laboratory	1	CIVE 423	Groundwater Engineering	3
CHEM 311	Introduction to Nanoscale Science	3	CIVE 438	Fundamentals of Environmental Engr	3
CHEM 315	Foundations of Polymer Chemistry	3	CIVE 439	Applications of Environmental Engr Concepts	3
CHEM 320	Chemistry of Addictions	3	CIVE 440	Nonpoint Source Pollution	3
CHEM 333	Forensic Chemistry	3	CIVE 442	Air Quality Engineering	3
CHEM 334	Quantitative Analysis Laboratory	1	CIVE 515	River Mechanics	3
CHEM 335	Introduction to Analytical Chemistry	3	CIVE 520	Physical Hydrology	3
CHEM 338	Environmental Chemistry	3	CIVE 524/WR 524	Modeling Watershed Hydrology	3
CHEM 355	Foundations of Sustainable Chemistry	3	CIVE 531	Groundwater Hydrology	3
CHEM 431	Instrumental Analysis	4	CIVE 538	Aqueous Chemistry	3
CHEM 433	Clinical Chemistry	3	CIVE 560	Advanced Mechanics of Materials	3
CHEM 440	Advanced Organic Chemistry Laboratory	2	CIVE 562	Fundamentals of Vibrations	3
CHEM 445	Synthetic Organic Chemistry	3	CS 152	Python for STEM	2
CHEM 448	Medicinal Chemistry	3	CS 164	CS1--Computational Thinking with Java	4
CHEM 451	Foundations of Catalytic Chemistry	3	CS 165	CS2--Data Structures	4
CHEM 461	Inorganic Chemistry	3	CS 220	Discrete Structures and their Applications	4
CHEM 462	Inorganic Chemistry Laboratory	2	CS 253	Software Development with C++	4
CHEM 465	Chemistry of Sustainable E-Waste Management	1	CS 270	Computer Organization	4
CHEM 522	Methods of Chemical Biology	2	CS 314	Software Engineering	3
CHEM 532	Advanced Chemical Analysis II	3	CS 320	Algorithms--Theory and Practice	3
CHEM 537	Electrochemical Methods	3	CS 356	Systems Security	3
CHEM 539A	Principles of NMR and MRI: Basic NMR Principles	1	CS 370	Operating Systems	3
CHEM 539B	Principles of NMR and MRI: NMR Diffusion Measurements-2D NMR and MRI	1	CS 4** - Any 400-level CS course except CS 495		
CHEM 539C	Principles of NMR and MRI: Advanced NMR and MRI Techniques	1	CS 5** - Any 500-level CS course		
CHEM 541	Organic Molecular Structure Determination	2	DSCI 320	Optimization Methods in Data Science	3
CHEM 543	Structure/Mechanisms in Organic Chemistry	2	DSCI 369	Linear Algebra for Data Science (credit not allowed for both DSCI 369 and MATH 369)	3-4
CHEM 545	Synthetic Organic Chemistry I	3	or MATH 369	Linear Algebra I	
			ECE 204	Introduction to Electrical Engineering	3
			ECE 312	Linear System Analysis II	3
			ECE 4** - any ECE course at the 400-level except ECE 495		



ECE 5** - any ECE course at the 500-level			GES 542	Biobased Fuels, Energy, and Chemicals	3
ENGR 300	3D Printing Lab for Engineers	1	GR 305	Geography of Global Health	3
ENGR 422	Technology Entrepreneurship	3	HES 207	Anatomical Kinesiology	4
ENGR 478	Applied Engineering Data Analytics	3	HES 307	Biomechanical Principles of Human Movement	3
ENGR 502	Engineering Project and Program Management	3	HES 319	Neuromuscular Aspects of Human Movement	4
ENGR 510	Engineering Optimization: Method/Application	3	HES 345	Population Health and Disease Prevention	3
ENGR 525	Intellectual Property and Invention Systems	3	HES 403	Physiology of Exercise	3
ENGR 531	Engineering Risk Analysis	3	HES 420	Electrocardiography and Exercise Management	3
ENGR 550/ MATH 550	Numerical Methods in Science and Engineering	3	HES 476	Exercise and Chronic Disease	3
ENGR 570	Coupled Electromechanical Systems	3	HORT 579	Mass Spectrometry Omics-Methods and Analysis	3
ERHS 320	Environmental Health–Water Quality	3	IDEA 310B	Design Thinking Toolbox: 3D Modeling	2
ERHS 332	Principles of Epidemiology	3	IDEA 310D	Design Thinking Toolbox: Digital Imaging	1
ERHS 400	Radiation Safety	3	IDEA 310H/CS 310H	Design Thinking Toolbox: Mixed Reality Design	3
ERHS 410	Environmental Health-Air and Waste Management	3	IDEA 455/MGT 455	Designing for Defense	3
ERHS 430	Human Disease and the Environment	3	LIFE 201B	Introductory Genetics: Molecular/Immunological/Developmental (GT-SC2)	3
ERHS 446	Environmental Toxicology	3	LIFE 202B	Introductory Genetics Recitation: Molecular	1
ERHS 448	Environmental Contaminants	3	LIFE 203	Introductory Genetics Laboratory	2
ERHS 450	Introduction to Radiation Biology	3	LIFE 210	Introductory Eukaryotic Cell Biology	3
ERHS 502	Fundamentals of Toxicology	3	LIFE 211	Introductory Cell Biology Honors Recitation	1
ERHS 503	Toxicology Principles	1	LIFE 212	Introductory Cell Biology Laboratory	2
ERHS 510/VS 510	Cancer Biology	3	LIFE 320	Ecology	3
ERHS 530	Radiological Physics and Dosimetry I	3	LSPA 340	Spanish for Animal Health and Care Fields	3
ERHS 540	Principles of Ergonomics	3	LSPA 346	Spanish for Health Care	3
ERHS 542	Biostatistical Methods for Qualitative Data	3	MATH 229	Matrices and Linear Equations	2
ERHS 547	Equipment and Instrumentation	3	MATH 235	Introduction to Mathematical Reasoning	2
ERHS 560	Health Impact Assessment	2	MATH 301	Introduction to Combinatorial Theory	3
ESS 311	Ecosystem Ecology	3	MATH 317	Advanced Calculus of One Variable	3
ESS 312	Sustainability Science	3	MATH 331	Introduction to Mathematical Modeling	3
ESS 330	Quantitative Reasoning for Ecosystem Science	3	MATH 332	Partial Differential Equations	3
ESS 353	Global Change Impacts, Adaptation, Mitigation	3	MATH 360	Mathematics of Information Security	3
ESS 440	Practicing Sustainability	4	MATH 366	Introduction to Abstract Algebra	3
ESS 501	Principles of Ecosystem Sustainability	3	MATH 405	Introduction to Number Theory	3
ESS 524	Foundations for Carbon/Greenhouse Gas Mgmt	3	MATH 417	Advanced Calculus I	3
F 311	Forest Ecology	3	MATH 418	Advanced Calculus II	3
FIN 305	Fundamentals of Finance	3	MATH 419	Introduction to Complex Variables	3
FSHN 470	Integrative Nutrition and Metabolism	3	MATH 430/ECE 430	Fourier and Wavelet Analysis with Apps	3
FTEC 447	Food Chemistry	3	MATH 450	Introduction to Numerical Analysis I	3
GEOL 150	Dynamic Earth (GT-SC2)	4	MATH 451	Introduction to Numerical Analysis II	3
GEOL 452	Hydrogeology	4	MATH 455	Mathematics in Biology and Medicine	3
GEOL 454	Geomorphology	4	MATH 460	Information and Coding Theory	3
GES 362	Systems Thinking and Sustainability	3	MATH 463	Post-Quantum Cryptography	3
GES 441	Analysis of Sustainable Energy Solutions	3	MATH 466	Abstract Algebra I	3
GES 450	Global Sustainability and Health	3	MATH 467	Abstract Algebra II	3
GES 465/MSE 465	Sustainable Strategies for E-Waste Management	3	MATH 469	Linear Algebra II	3
GES 528/CIVE 528	Assessing the Food, Energy, Water Nexus	3	MATH 470	Euclidean and Non-Euclidean Geometry	3
			MATH 474	Introduction to Differential Geometry	3
			MATH 525	Optimal Control	3

MATH 530	Mathematics for Scientists and Engineers	3	MSE 502C	Materials Science and Engineering Methods: Materials Microscopy	1
MATH 532	Mathematical Modeling of Large Data Sets	3	MSE 502D	Materials Science and Engineering Methods: Materials Spectroscopy	1
MATH 535	Foundations of Applied Mathematics	3	MSE 502E	Materials Science and Engineering Methods: Bulk Properties and Performance	1
MATH 546	Partial Differential Equations II	3	MSE 502F	Materials Science and Engineering Methods: Experimental Methods for Materials Research	1
MATH 550/ ENGR 550	Numerical Methods in Science and Engineering	3	MSE 503	Mechanical Behavior of Materials	3
MATH 560	Linear Algebra	3	MSE 504	Thermodynamics of Materials	3
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	1	MSE 505	Kinetics of Materials	3
MATH 569B	Linear Algebra for Data Science: Geometric Techniques for Data Reduction	1	NR 319	Introduction to Geospatial Science	4
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	1	NR 323/GR 323	Remote Sensing and Image Interpretation	3
MATH 569D	Linear Algebra for Data Science: Theoretical Foundations	1	NR 505	Concepts in GIS	4
MECH 200	Introduction to Manufacturing Processes	3	PH 314	Introduction to Modern Physics	4
MECH 307	Mechatronics and Measurement Systems	4	PH 315	Modern Physics Laboratory	2
MECH 324	Dynamics of Machines	4	PH 341	Mechanics	4
MECH 325	Machine Design	3	PH 351	Electricity and Magnetism	4
MECH 331	Introduction to Engineering Materials	4	PH 353	Optics and Waves	4
MECH 4** - Any 400-level MECH course except MECH 495			PH 361	Physical Thermodynamics	3
MECH 5** - Any 500-level MECH course			PH 425	Advanced Physics Laboratory	2
MGT 305	Fundamentals of Management	3	PH 451	Introductory Quantum Mechanics I	3
MGT 340	Fundamentals of Entrepreneurship	3	PH 452	Introductory Quantum Mechanics II	3
MIP 300	General Microbiology	3	PH 462	Statistical Physics	3
MIP 302	General Microbiology Laboratory	2	PH 517	Chaos, Fractals, and Nonlinear Dynamics	3
MIP 315	Pathology of Human and Animal Disease	3	PH 521	Introduction to Lasers	3
MIP 334	Food Microbiology	3	PH 522	Introductory Laser Laboratory	1
MIP 335	Food Microbiology Laboratory	2	PH 531	Introductory Condensed Matter Physics	3
MIP 342	Immunology	4	PH 561	Elementary Particle Physics	3
MIP 343	Immunology Laboratory	2	PH 571	Mathematical Methods for Physics I	3
MIP 351	Medical Bacteriology	3	PHIL 322	Biomedical Ethics	3
MIP 352	Medical Bacteriology Laboratory	3	PHIL 410	Gödel's Incompleteness Theorems	3
MIP 410	Foundations of Modern Biotechnology	2	PSY 253	Human Factors and Engineering Psychology	3
MIP 420	Medical and Molecular Virology	4	SOCR 322	Principles of Microclimatology	3
MIP 425	Virology and Cell Culture Laboratory	2	SOCR 330	Principles of Genetics	3
MIP 432/ESS 432	Microbial Ecology	3	SOCR 375	Soil Biogeochemistry	3
MIP 433/ESS 433	Microbial Ecology Laboratory	1	SOCR 400	Soils and Global Change-Impacts and Solutions	3
MIP 443	Microbial Physiology	4	SOCR 455	Microbiomes of Soil Systems	3
MIP 450	Microbial Genetics	3	SOCR 456	Soil Microbiology Laboratory	1
MIP 530	Advanced Molecular Virology	4	SOCR 467	Soil and Environmental Chemistry	3
MIP 543	RNA Biology	3	SOCR 470	Soil Physics	3
MIP 550	Microbial and Molecular Genetics Laboratory	4	SOCR 471	Soil Physics Laboratory	1
MIP 555	Principles and Mechanisms of Disease	3	SOCR 567	Environmental Soil Chemistry	4
MKT 305	Fundamentals of Marketing	3	SPCM 434	Intercultural Communication	3
MSE 501	Materials Technology Transfer	1	STAR 512	Design and Data Analysis for Researchers II	4
MSE 502A	Materials Science and Engineering Methods: Materials Structure and Scattering	1	STAT 158	Introduction to R Programming	1
MSE 502B	Materials Science and Engineering Methods: Computational Materials Methods	1	STAT 305	Sampling Techniques	3
			STAT 307	Introduction to Biostatistics	3
			STAT 331	Intermediate Applied Statistical Methods	3

STAT 341	Statistical Data Analysis I	3
STAT 342	Statistical Data Analysis II	3
STAT 400	Statistical Computing	3
STAT 420	Probability and Mathematical Statistics I	3
STAT 421	Introduction to Stochastic Processes	3
STAT 430	Probability and Mathematical Statistics II	3
STAT 460	Applied Multivariate Analysis	3
SYSE 501	Foundations of Systems Engineering	3
SYSE 530	Overview of Systems Engineering Processes	3
SYSE 532/ECE 532	Dynamics of Complex Engineering Systems	3
SYSE 534	Human Systems Integration	3
VS 333	Domestic Animal Anatomy	4

## Major Completion Map

### Distinctive Requirements for Degree Program:

**TO DECLARE MAJOR:** Engineering is a controlled major: students are admitted into the major only if they meet established academic standards. Please see competitive major requirements or the advisor in the Department for more information.

**TO PREPARE FOR FIRST SEMESTER:** The curriculum for this major assumes students enter college prepared to take calculus and chemistry.

To qualify for graduation, students in the biomedical engineering combined with chemical and biological engineering program must achieve a minimum 2.000 grade point average at CSU in all courses in engineering, mathematics, computer science, statistics, physics, and chemistry as well as courses taken as technical electives.

<sup>1</sup> Select a total of 5 credits from Approved BME Technical Electives for BME+CBE Program. A maximum of 3 total credits of BIOM 476 and BIOM 495 may count as BME Technical Elective credit.

### Freshman

Semester 1		Critical	Recommended	AUCC	Credits
BIOM 100	Overview of Biomedical Engineering	X			1
CHEM 111	General Chemistry I (GT-SC2)	X		3A	4
CHEM 112	General Chemistry Lab I (GT-SC1)	X		3A	1
LIFE 102	Attributes of Living Systems (GT-SC1)	X		3A	4
MATH 160	Calculus for Physical Scientists I (GT-MA1)	X		1B	4
<b>Total Credits</b>					<b>14</b>

Semester 2		Critical	Recommended	AUCC	Credits
CBE 160	MATLAB for Chemical and Biological Eng	X			1
CHEM 113	General Chemistry II	X			3
MATH 161	Calculus for Physical Scientists II (GT-MA1)	X		1B	4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	X		3A	5
Select one group from the following:					3

#### Group A:

CBE 101 Introduction to Chemical and Biological Engr

#### Group B:

CBE 101A Introduction to Chemical and Biological Engr: Lecture

CBE 101B Introduction to Chemical and Biological Engr: Laboratory

#### Group C:

CBE 104A Study Abroad--Denmark: Intro to Chemical and Biological Engineering

**Total Credits** **16**

### Sophomore

Semester 3		Critical	Recommended	AUCC	Credits
CBE 201	Material and Energy Balances	X			3
CBE 205	Fundamentals of Biological Engineering	X			3
CHEM 114	General Chemistry Lab II	X			1
CHEM 341	Modern Organic Chemistry I	X			3
CO 150	College Composition (GT-CO2)		X	1A	3
MATH 261	Calculus for Physical Scientists III	X			4
<b>Total Credits</b>					<b>17</b>

Semester 4		Critical	Recommended	AUCC	Credits
CBE 210	Thermodynamic Process Analysis	X			3

CHEM 343	Modern Organic Chemistry II	X			3	
CHEM 344	Modern Organic Chemistry Laboratory	X			2	
MATH 340	Intro to Ordinary Differential Equations	X			4	
MECH 262	Engineering Mechanics			X	4	
<b>Total Credits</b>					<b>16</b>	
<b>Junior</b>						
<b>Semester 5</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>	
BMS 300	Principles of Human Physiology	X			4	
CBE 310	Molecular Concepts and Applications	X			3	
CBE 330	Process Simulation	X			3	
CBE 331	Momentum Transfer and Mechanical Separations	X			3	
Social and Behavioral Sciences ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences</a> )				X	3C	3
<b>Total Credits</b>					<b>16</b>	
<b>Semester 6</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>	
BC 351	Principles of Biochemistry		X		4	
BIOM 300	Problem-Based Learning Biomedical Engr Lab	X			4	
CBE 320	Chemical and Biological Reactor Design	X			3	
CBE 332	Heat and Mass Transfer Fundamentals	X			3	
CBE 393	Professional Development Seminar	X			1	
<b>Total Credits</b>					<b>15</b>	
<b>Senior</b>						
<b>Semester 7</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>	
BIOM 421	Transport Phenomena in Biomedical Engineering	X			3	
CBE 333	Chemical and Biological Engineering Lab I	X			2	
CBE 442	Separation Processes	X			4	
CBE 451	Chemical and Biological Engineering Design I	X			3	
STAT 315	Intro to Theory and Practice of Statistics	X			3	
BME Broad Elective (see list below)					3	
<b>Total Credits</b>					<b>18</b>	
<b>Semester 8</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>	
BIOM 422	Quantitative Systems and Synthetic Biology	X			3	
CBE 430	Process Control and Instrumentation				3	
CBE 443	Chemical and Biological Engineering Lab II	X			2	
PH 142	Physics for Scientists and Engineers II (GT-SC1)		X	3A	5	
Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> )					3B	3
<b>Total Credits</b>					<b>16</b>	
<b>Fifth Year</b>						
<b>Semester 9</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>	
BIOM 486A	Biomedical Design Practicum: Capstone Design I	X		4A,4B,4C	4	
BME Technical Elective (See List on Requirements Tab)			X		3	
CBE Technical Elective (See List on Requirements Tab)			X		2	
Diversity, Equity, and Inclusion ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion</a> )				1C	3	
Advanced Writing ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing</a> )				2	3	
<b>Total Credits</b>					<b>15</b>	
<b>Semester 10</b>		<b>Critical</b>	<b>Recommended</b>	<b>AUCC</b>	<b>Credits</b>	
BIOM 486B	Biomedical Design Practicum: Capstone Design II	X		4A,4B,4C	4	
BME Technical Elective (See List on Requirements Tab)			X		2	
CBE Technical Elective (See List on Requirements Tab)			X		3	

Arts and Humanities ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities</a> )	3B	3
Historical Perspectives ( <a href="http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives">http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives</a> )	3D	3
The benchmark courses for the 10th semester are the remaining courses in the entire program of study	X	
<b>Total Credits</b>		<b>15</b>
<b>Program Total Credits:</b>		<b>158</b>