



B.S. Biomedical Engineering + B.S. Chemical & Biological Engineering **BME+CBE Curriculum and Career Guide Fall 2018**

This Guide is designed to help students understand the academic requirements and selected career resources in the Colorado State University undergraduate dual-degree program in Biomedical Engineering and Chemical & Biological Engineering (BME+CBE). Students graduate with full BS degrees in *both* disciplines and benefit from classroom and experiential learning through lecture, team projects, laboratory, and design courses in a unique multidisciplinary environment. Ours is the first ABET-Accredited BME program in Colorado, and the only accredited BME degree in the country that has an obligatory tie to a partner degree.

During the first and second years, BME+CBE students are introduced to biomedical and chemical and biological engineering in addition to learning the fundamentals of physics and mathematics. The third year of study provides continued depth in BME and CBE, including a multidisciplinary, hands-on problem-based BME learning lab. The fourth year rounds out the CBE curriculum and adds two 'gateway' BME courses that transition key CBE concepts into BME applications. The fifth year culminates in a year-long capstone Senior Design course in which students work in multidisciplinary teams creating solutions to BME industry or research problems.

Students are required to satisfy the scholastic standards of the university, college, and engineering department. (Note that many CBE courses must be passed with a minimum grade of "C".) Full course descriptions and prerequisites can be found at <http://www.catalog.colostate.edu>. All-University Core Curriculum (AUCC – "General Education") [courses can be found here](#). Students will also meet with their advisors each semester to review academic plans and university resources.

We also encourage students to get involved in experiential learning via research and internships. BME faculty are spread among four different colleges, providing students a broad range of research opportunities. BME's academic home is the Scott Bioengineering Building, a cutting-edge interdisciplinary research and academic facility that opened in 2013. The Student Success Center in the Scott Building helps students develop resumes and interviewing skills, and gain access to internships and co-ops. Study Abroad is also encouraged in our program, as biomedical engineering is a global field. Visit www.engr.colostate.edu/sbme for further information!

We are here to support your CSU experience and warmly welcome you to BME @ CSU!

Sincerely,

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Curriculum Checklist - Effective Summer 2018 and Prior

Program Total Credits = 158

COURSE	NAME (PREREQS)	TERM*	CR	COURSE	NAME (PREREQS)	TERM*	CR
1st Year Fall				1st Year Spring			
BIOM 101	Introduction to Biomedical Engineering	F	3	CHEM 113	Gen Chem II (CHEM 107 or 111 or 117; MATH 124 or MATH 141, 155, 160, 161, 229, 261 or conc.)	F, S, SS	3
CBE 101	Chem and Biological Engineering I (CBE 160 or conc.)	F,S	3	LIFE 102	Attributes of Living Systems	F, S, SS	4
CBE 160	MATLAB for Chemical and Biological Engineers	F, S	1	MATH 161	Calc for Physical Sci II (MATH 124; MATH 159 or 160)	F, S, SS	4
CHEM 111	General Chemistry I (MATH 118 or 141 or 155 or 160 or 161 or 229 or 261)	F,S, SS	4	PH 141	Physics for Scientists and Engineers I (MATH 126 or conc.; MATH 155 or 159 or 160 or conc.)	F, S, SS	5
CHEM 112	General Chem Lab I (CHEM 111 or 117 or conc.)	F, S, SS	1				
MATH160	Calculus for Physical Scientists I (MATH 124 (B or better); MATH 126 (B or better))	F, S, SS	4				
Total 16				Total 16			
2nd Year Fall				2nd Year Spring			
CBE 201	Material and Energy Balances (CBE 101 or 160 or MATH 151 or conc.; CHEM 111; LIFE 102 or conc.; PH 141 or conc.)	F	3	CBE 210	Thermodynamic Process Analysis (CBE 201; MATH 261 or conc.)	S	3
CBE 205	Introduction to Biological Engineering (CBE 101; CBE 160; LIFE 102)	F	3	MATH 340	Introduction to Ordinary Differential Equations (MATH 255 or 261)	F, S, SS	4
CHEM 341	Modern Organic Chemistry I (CHEM 113)	F, S, SS	3	CHEM 343	Modern Organic Chem II (CHEM 245 or 341 or 345)	F, S, SS	3
CHEM 114	General Chemistry Lab II (CHEM 112; CHEM 113 or conc.)	F, S, SS	1	CHEM 344	Modern Organic Chemistry Laboratory (CHEM 114; CHEM343 or conc)	F, S, SS	2
CO 150	College Composition (CO 130 or placement by ACT/SAT or DSP Survey or Challenge Exam)	F, S, SS	3	PH 142	Physics for Scientists and Engineers II (PH 141; MATH 161 or 255 or 271 or conc.)	F, S	5
MATH 261	Calculus for Physical Scientists III (MATH 161)	F, S, SS	4				
Total 17				Total 17			
3rd Year Fall				3rd Year Spring			
BMS 300	Principles of Human Physiology (BZ 101 or 110 or LIFE 102; CHEM 103 or 107 or 111)	F, S, SS	4	BIOM 300	Problem-Based Learning BME Lab (BIOM 101 or BIOM 200 or (BIOM 100; CBE 205; MECH 262); MATH 340 or 345)	S	4
CBE 310*	Molecular Concepts and Applications (CBE 210; MATH 340)	F	3	BC 351	Principles of Biochemistry (BZ 110 or 120 or LIFE 102; CHEM 245 or 341 or 345)	F, S, SS	4
CBE 330*	Process Simulation (CBE 210; MATH 340)	F	3	CBE 320	Chem and Bio Reactor Design (CBE 310; CBE 330)	S	3
CBE 331*	Momentum Transfer and Mechanical Separations (CBE 210; MATH 340)	F	3	CBE 332	Heat and Mass Transfer Fundamentals (CBE 310; CBE 330; CBE 331)	S	3
LIFE 210	Introductory Eukaryotic Cell Biology (LIFE 102; CHEM 111; CHEM 112)	F	3	CBE 493	Professional Development Seminar	S	1
				AUCC		F, S, SS	3
Total 16				NOTE- 18 cr OK b/c 493 is a 1-cr 'light' class; no CBE labs; 3 cr AUCC Total 18			
4th Year Fall				4th Year Spring			
BIOM 421	Transport Phenomena in BME (BMS 300; CBE 332 or MECH 344)	F	3	BIOM 422	Kinetics of Biomolecular and Cellular Systems (BIOM 421 or CBE 320)	S	3
CBE 333	Chemical & Biological Engineering Transfer Laboratory (CBE 332 or conc.)	F	2	CBE 443	Chemical and Biological Engineering Lab II (CBE 442 or conc. or ENVE 442 or conc.)	S	2
CBE 442	Separation Processes (CBE 332)	F	4	MECH 262	Engineering Mechanics (MATH 161; PH 141)	S	4
CBE 451	Chemical and Biological Engineering Design I (CBE 320; CBE 442 or conc.)	F	3	STAT 315	Statistics for Engineers and Scientists (MATH 155 or 160)	F, S, SS	3
AUCC			3	AUCC		F, S, SS	3
Total 15				Total 15			
5th Year Fall				5th Year Spring			
BIOM 486A	Biomedical Design Practicum: Capstone Design I (BIOM 300; (BIOM 421; CBE 320; CBE 442) or (BIOM 431; ECE 311; ECE 332; ECE 342) or (BIOM 441; MECH 301; MECH 307)	F	4	BIOM 486B	Biomedical Design Practicum: Capstone Design II (BIOM 486A; (CBE 451) or (ECE 312) or (MECH 325; MECH 344; MECH 402) or (PH 353)	S	4
BME-TE	BME Technical Elective _____		3	CBE 430	Process Control & Instrumentation (CBE 320 & 442)	S	3
CBE-TE	CBE Technical Elective _____		3	CBE-TE	CBE Technical Elective _____		2
AUCC		F, S, SS	3	AUCC		F, S, SS	3
Advanced Writing	CHEM 301 or CO300 or CO301B or JTC 300 or LB 300 (CO150 or HONR193)	F, S, SS	3				
Total 16				Total 12			

* - The combination of 3rd year ECE courses is exceptionally challenging

Please note that curricula can change; be sure to check with your advisers regularly to ensure you are on track.

Additional All University Core Courses (AUCCs)
6 cr - 3B Arts and Humanities: _____
3 cr - 3C Social/Behavioral Science: _____
3 cr - 3D Historical Perspective: _____
3 cr - 3E Global/Cultural Awareness: _____

Key:
conc. = concurrent enrollment Term: F = Fall, S = Spring, SS = Summer Session
Grey indicates Biomedical Engineering courses
Light green indicates labs
Red indicates exceptionally time-consuming/difficult courses
Must have at least a "C" in BOLDED courses

BME+CBE Technical Electives

Technical Electives (TEs) are designed to provide additional breadth and depth in the Biomedical and partner major degrees.

BME+CBE students must take 3-5 credits of BME TEs and 5-6 credits of CBE TEs chosen from the following lists.

Key:	
F - Fall	* Available Every Other Year (Even)
S - Spring	** Available Every Other Year (Odd)
SS - Summer	
♦ See last page of this document for information on how to obtain course overrides	

- NOTE:**
1. Classes otherwise required for the degree are not allowed for TE credit.
 2. Course availability changes frequently. Please check with individual departments regarding course availability.
 3. Crosslisted courses (e.g. BIOM/MECH 570) are in italics and must be taken as **BIOM** courses to count for BME Technical Elective credit.

• From the following BME TE list: BME+CBE Students who started SM18 take 3 credits; students who started FA18 and after take 5 credits:

BME Technical Electives			
COURSE	NAME	TERM	CR
BC 401	Comprehensive Biochemistry I	F	3
BC 403	Comprehensive Biochemistry II	S	3
BC 404	Comprehensive Biochemistry Laboratory	F,S	2
BC 411	Physical Biochemistry	F	4
BC 463	Molecular Genetics	F	3
BC 465	Molecular Regulation & Cell Function	S	3
BC 565	Molecular Regulation of Cell Function	S	4
BIOM 431	Biomedical Signal and Image Processing	S	3
BIOM 441	Biomechanics & Biomaterials	F	3
<i>BIOM/MECH 470</i>	Biomedical Engineering (Not currently available)	N/A	3
BIOM 476 ¹	Biomedical Clinical Practicum (formerly BIOM 486)	F,S,SS	Δ 2-4
BIOM 495 ¹	BME Independent Study	F,S,SS	Δ 3
<i>BIOM/CBE 504</i>	Fundamentals of Biochemical Engineering	S	3
<i>BIOM/ECE 518</i>	Biophotonics	F	3
<i>BIOM/CBE 522</i>	Bioseparation Processes	F	3
<i>BIOM/MECH 525</i>	Cell and Tissue Engineering	S	3
<i>BIOM/ECE 526</i>	Biological Physics	S	3
<i>BIOM/MECH 531</i>	Materials Engineering	S	3
<i>BIOM/CIVE 533</i>	Biomolecular Tools for Engineers	F	3
<i>BIOM/ECE 537</i>	Biomedical Signal Processing	S	3
<i>BIOM/CBE 543</i>	Membranes for Biotechnology and Biomedicine	F	3
<i>BIOM/MECH 570</i>	Bioengineering	F	3
<i>BIOM/MECH 573</i>	Structure and Function of Biomaterials	S	3
<i>BIOM/MECH 574</i>	Bio-Inspired Surfaces	S	3
<i>BIOM/MECH 576</i>	Quantitative Systems Physiology	S	4
<i>BIOM/MECH 578</i>	Musculoskeletal Biosolid Mechanics	F	3
BMS 301	Human Gross Anatomy	F,S,SS	5
BMS 302	Laboratory in Principles in Physiology	F,S	2
BMS 310	Anatomy for the Health Professions (online)	F, S, SS	4
BMS 325	Cellular Neurobiology	F	3
BMS 345	Functional Neuroanatomy	S	4
BMS 405	Nerve and Muscle-Toxins, Trauma and Disease	S	3
BMS 409	Human and Animal Reproductive Biology	F	3
BMS 420	Cardiopulmonary Physiology	F	3
BMS 430	Endocrinology	F	3
BMS 450	Pharmacology	S	3
BMS 500	Mammalian Physiology I	F	4
BMS 501	Mammalian Physiology II	S	4

BME Technical Electives (Continued)			
COURSE	NAME	TERM	CR
BMS/NB 503	Developmental Neurobiology	S	3
BMS/NB 505	Neuronal Circuits, Systems and Behavior	S	3
BZ 311	Developmental Biology	S,SS	4
BZ 350	Molecular and General Genetics	F,S,SS	4
BZ 476/BZ 576	Topics in Advanced Genetics	F	3
CHEM 334	Quantitative Analysis Laboratory	F, S	1
CHEM 335	Intro to Analytical Chemistry	F,S	3
CHEM 433**	Clinical Chemistry	S	3
CHEM 539 A-C	Principles of NMR and MRI	S	1
CM 501	Advanced Cell Biology	F	4
CM/NB 502	Techniques in Molecular & Cellular Biology	F	2
ECE/MECH 569*	Micro-Electro-Mechanical Devices	S	3
ERHS 450	Introduction to Radiation Biology	S	3
ERHS 502	Fundamentals of Toxicology	F	3
ERHS 510	Cancer Biology	S	3
ERHS 540	Principles of Ergonomics	F	3
FSHN 470	Integrated Nutrition & Metabolism	F,S	3
HES 307	Biomechanical Principles of Human Movement	F,S,SS	3
HES 319	Neuromuscular Aspects of Human Movement	F,S	3
HES 403	Physiology of Exercise	F,S,SS	4
HES 405	Exercise Testing Instrumentation	F,S	2
HES 476	Exercise and Chronic Disease	F,S,SS	3
MATH 455**	Mathematics in Biology and Medicine	F	3
MECH 432	Engineering of Nanomaterials	F	3
MECH 543**	Biofluid Mechanics	S	3
MIP 300	General Microbiology	F,S,SS	3
MIP 302	General Microbiology Laboratory	F,S	2
MIP 342	Immunology	F,S	4
MIP 343	Immunology Laboratory	S	2
MIP 351	Medical Bacteriology	S	3
MIP 352	Medical Bacteriology Lab	S	3
MIP 420	Medical and Molecular Virology	F	4
MIP 436*	Industrial Microbiology	F	4
MIP 443	Microbial Physiology	S	4
MIP 450	Microbial Genetics	F	3
MIP/BSPM 576*	Bioinformatics	F,S	3
NB 500	Readings in Cellular Neurobiology	F	1
NB 501	Cellular and Molecular Neurophysiology	F	2

¹ A maximum total of 3 credits of BIOM 476 and/or BIOM 495 may be applied towards BME technical elective degree requirements.

- From the following CBE TE list, BME+CBE students who have taken CBE 160 must take 5 credits:
- From the following CBE TE list, BME+CBE students who have not taken CBE 160 must take 6 credits:

CBE Technical Electives			
COURSE	NAME	TERM	CR
AA 301	Astrophysics I	F	5
AA 302	Astrophysics II	S	5
AA 303	Astrophysics III	F	5
ATS 555	Air Pollution	S	3
ATS 560	Air Pollution Measurement	F	2
BC 401	Comprehensive Biochemistry I	F	3
BC 403	Comprehensive Biochemistry II	S	3
BC 404	Comprehensive Biochemistry Lab	F,S	2
BC 463	Molecular Genetics	F	3
BC 465	Molecular Regulation of Cell Function	S	3
BIOM 470	Biomedical Engineering	F	3
BIOM 476 A/B	(Formerly BIOM 486) Biomedical Design Practicum	F,S,SS	4
BIOM/ECE 518	Biophotonics	F	3
BIOM/CBE 522	Bioseparation Processes	F	3
BIOM/MECH 525	Cell and Tissue Engineering	S	3
BIOM/MECH531	Materials Engineering	S	3
BIOM/MECH532	Material Issues in Mechanical Design	F	3
BIOM/CIVE 533	Biomolecular Tools for Engineers	F	3
BIOM/ECE 537	Biomedical Signal Processing	S	3
BIOM/MECH 570	Bioengineering	S	3
BIOM/MECH 573	Structure and Function of Biomaterials	S	3
BIOM/MECH 578	Musculoskeletal Biosolid Mechanics	F	3
BMS 301	Human Gross Anatomy	F,S,SS	5
BMS 302	Laboratory in Principles in Physiology	F,S	2
BMS 360	Fundamentals of Physiology	S	4
BMS 420	Cardiopulmonary Physiology	F	3
BMS 430	Endocrinology	F	3
BMS 450	Pharmacology	S	3
BMS 500	Mammalian Physiology I	F	4
BMS 501	Mammalian Physiology II	S	4
BSPM 302	Applied and General Entomology	F	2
BSPM 303A	Entomology Lab	F	2
BSPM 361	Elements of Plant Pathology	S	3
BSPM 450	Molecular Plant-Microbe Interactions	S	3
BZ 310	Cell Biology	F,S,SS	4
BZ 311	Developmental Biology	S,SS	4
BZ 346	Population and Evolutionary Genetics	F	3
BZ/MATH 348	Theory of Population and Evolutionary Ecology	F	4
BZ 350	Molecular and General Genetics	F,S,SS	4
BZ 415**	Marine Biology	S	4
BZ 440	Plant Physiology	S	3
BZ 441	Plant Physiology Laboratory	S	2

CBE Technical Electives (Continued)			
COURSE	NAME	TERM	CR
BZ 450	Plant Ecology	S	4
BZ 476/BZ 576	Topics in Advanced Genetics	F	3
BZ 572	Phytoremediation	F	3
CBE 406	Introduction to Transport Phenomena - BIOM 330???	F	3
CBE 495	Independent Study	Var	Var
CBE 501	Chemical Engineering Thermodynamics	F	3
CBE 502	Advanced Reactor Design	F	3
CBE 503	Transport Phenomena Fundamentals	S	3
CBE/BIOM 504	Fundamentals of Biochemical Engineering	F	3
CBE 514	Polymer Science and Engineering	S	3
CBE 521	Mathematical Modeling for Chemical Engineers	F	3
CBE/BIOM 522	Bioseparation Processes	F	3
CBE 524	Bioremediation	F	3
CBE/CIVE 540	Advanced Biological Wastewater Processing	S	3
CBE/BIOM 543	Membranes for Biotechnology and Biomedicine	F	3
CHEM 261	Fundamentals of Inorganic Chemistry	S	3
CHEM 334	Quantitative Analysis Laboratory	F,S	1
CHEM 335	Introduction to Analytical Chemistry	F,S	3
CHEM 431	Instrumental Analysis	F	4
CHEM 433	Clinical Chemistry	S	3
CHEM 440	Advanced Organic Laboratory	F	2
CHEM 461	Inorganic Chemistry	S	3
CHEM 462	Inorganic Chemistry Laboratory	S	2
CHEM 511	Solid State Chemistry	F	3
CHEM 515	Polymer Chemistry	F	3
CHEM 517	Chemistry of Electronic Materials	F	3
CHEM 537	Electrochemical Methods	S	3
CHEM 539 (A,B,C)	Principles of NMR and MRI	S	1
CHEM 543	Structure/Mechanisms in Organic Chemistry	F	3
CHEM 547	Physical Organic Chemistry	S	3
CHEM 551	Organometallic Chemistry	F,S	3
CHEM 565	Inorganic Mechanisms	F	3
CHEM 569	Chemical Crystallography	S	3
CHEM 570	Chemical Bonding	F	3
CHEM 571 A&B	Quantum Chemistry	F	3
CHEM 575	Chemical Thermodynamics	F	3
CHEM 576	Statistical Mechanics	S	3
CHEM 577	Surface Chemistry	S	3
CHEM 579	Chemical Kinetics	F	3
CIVE 260	Engineering Mechanics - Statics BIOM requires MECH 262	F,S	3
CIVE 261	Engineering Mechanics - Dynamics BIOM requires MECH 262	F,S	3
CIVE 322	Basic Hydrology	F,S	3

CBE Technical Electives (Continued)			
COURSE	NAME	TERM	CR
CIVE 360	Mechanics of Solids	F,S	3
CIVE 401	Hydraulic Engineering	S	3
CIVE 413	Environmental River Mechanics	S	3
CIVE 423	Groundwater Engineering	S	3
CIVE 425	Soil and Water Engineering	S	3
CIVE 438	Environmental Engineering Concepts/ Pollution Control Engineering	F,S	4
CIVE 440	Nonpoint Source Pollution	F	3
CIVE 504	Wind Engineering	F	3
CIVE 520	Physical Hydrology	F	3
CIVE 531	Groundwater Hydrology	F	3
CIVE 538	Aqueous Chemistry	S	3
CIVE 560	Advanced Mechanics of Materials	F	3
CM 501	Advanced Cell Biology	F	4
CM/NB 502	Techniques in Molecular & Cellular Biology	F	2
CS 161	Object-Oriented Problem Solving	F,S,SS	4
CS 163/CS 164	Java (CS1) No Prior Programming/ Java (CS1) Prior Programming	F,S,SS	4
CS165/CS 200	Java (CS2) Data Structures & Algorithms/Algorithms and Data Structures	F,S,SS	4
CS 220	Discrete Structures and Their Applications	F,S	4
CS 270	Computer Organization	F,S	4
CS 420	Introduction to Analysis of Algorithms	F	4
ECE 204	Introduction to Electrical Engineering	S	3
ENGR 298	Undergraduate Research	Var.	Var.
ENGR 498	Undergraduate Research	Var.	Var.
ENGR 510	Linear Programming and Network Flows	F	3
ENVE 322	Basic Hydrology	F,S	3
ENVE 438	Pollution Control Engineering	F,S	4
ENVE 441	Water and Wastewater Characterization	S	1
ERHS 450	Introduction to Radiation Biology	S	3
ERHS 446	Environmental Toxicology	F	3
ERHS 448	Environmental Contaminants: Exposure and Fate	S	3
ERHS 450	Introduction to Radiation Biology	S	3
ERHS 502	Fundamentals of Toxicology	F	3
ERHS 510	Cancer Biology	S	3
ERHS 547	Equipment and Instrumentation	S	3
F 311	Forest Ecology	F,S	3
FTEC 447	Food Chemistry	S	2
FTEC 572	Food Biotechnology	S	2
GEOL 150	Physical Geology for Scientists and Engineers	F	4
GEOL 454	Geomorphology	S	4
HES 307	Biomechanical Principles of Human Movement	F,S,SS	3
HES 319	Neuromuscular Aspects of Human Movement	F,S	3
HES 403	Physiology of Exercise	F,S,SS	4
LIFE 201B	Introductory Genetics	F,S	2
LIFE 202B	Introductory Genetics Recitation	F,S	1

CBE Technical Electives (Continued)			
COURSE	NAME	TERM	CR
LIFE 203	Introductory Genetics Laboratory	S	2
LIFE 212	Introductory Cell Biology Laboratory	F,S	2
LIFE 320	Ecology	F,S	3
MATH 317	Advanced Calculus of One Variable	F,S,SS	4
MATH 332	Partial Differential Equations	S	3
MATH 366	Introduction to Abstract Algebra	F,S,SS	3
MATH 369	Linear Algebra	F,S,SS	3
MATH 405	Introduction to Number Theory	S	3
MATH 417	Advanced Calculus I	F	3
MATH 418	Advanced Calculus II	S	3
MATH 419	Introduction to Complex Variables	F	3
MATH 460	Information and Coding Theory	S	2
MATH 469	Linear Algebra II	S	3
MATH 501	Combinatorics I	F	3
MATH 502	Combinatorics II	S	3
MATH 510	Linear Programming and Network Flows	F,S,SS	3
MATH 520	Nonlinear Programming	S	3
MATH 525	Optimal Control	S	3
MATH 530	Mathematics for Scientists and Engineers	F	4
MATH 532	Mathematical Modeling of Large Data Sets	S	3
MATH 545	Partial Differential Equations I	F	3
MATH 546	Partial Differential Equations II	S	3
MECH 307	Mechatronics and Measurement Systems	F,S	4
MECH 331	Introduction to Engineering Materials	F,S	4
MECH 431	Metals and Alloys	F	3
MECH 437	Internal Combustion Engines	F	3
MECH 460	Aeronautics	S	3
MECH 463	Building Energy Systems	S	3
MECH 468	Space Propulsion and Power Engineering	F	3
MECH 530	Advanced Composite Materials	F	3
MECH 531	Materials Engineering	S	3
MECH 558	Combustion	F	3
MECH 575	Solar and Alternative Energies	F	3
MIP 300	General Microbiology	F,S,SS	3
MIP 301	Fundamental Microbiology Laboratory Techniques	?	1
MIP 302	General Microbiology Laboratory	F,S,SS	2
MIP 334	Food Microbiology	F	3
MIP 335	Food Microbiology Laboratory	F	2
MIP 342	Immunology	F,S	3
MIP 343	Immunology Laboratory	F,S	2
MIP 350	Microbial Diversity	S	3
MIP 351	Medical Bacteriology	S	3
MIP 352	Medical Bacteriology Laboratory	S	2
MIP 420	Medical and Molecular Virology	F	4

CBE Technical Electives (Continued)			
MIP 432	Microbial Ecology	S	3
MIP 433	Microbial Ecology Laboratory	S	1
MIP 436	Industrial Microbiology	F	4
MIP 443	Microbial Physiology	S	4
MIP 450	Microbial Genetics	F	3
MIP/BSPM 576	Bioinformatics	F,S	3
MIP/BZ 578	Genetics of Natural Populations	F	4
NR 300	Biological Diversity	S	3
NR 322	Introduction to Geographic Information Systems	F,S	4
NR/GR 323	Remote Sensing of Natural Resources	F	3
PH 314	Introduction to Modern Physics	S	4
PH 315	Modern Physics Laboratory	S	2
PH 341	Mechanics	F	4
PH 351	Electricity and Magnetism	S	4
PH 353	Optics and Waves	F	4
PH 361	Physical Thermodynamics	S	3
PH 451	Introductory Quantum Mechanics I	F	3
PH 452	Introductory Quantum Mechanics II	S	3
PH 521	Introduction to Lasers	S	3
PH 522	Introductory Laser Laboratory	S	1
PH 531	Introductory Solid State Physics	S	3

CBE Technical Electives (Continued)			
PH 561	Elementary Particle Physics	S	3
PH 571	Mathematical Methods for Physicists I	F	3
PH 572	Mathematical Methods for Physicists II	S	3
SOCR 240	Introductory Soil Science	F,S	4
SOCR 330	Principles of Genetics	F,S	3
SOCR 331	Genetics Laboratory	F,S	1
SOCR 455	Soil Microbiology	F	3
SOCR 456	Soil Microbiology Laboratory	F	1
SOCR 467	Soil and Environmental Chemistry	S	3
SOCR 470	Soil Physics	F	3
SOCR 471	Soil Physics Laboratory	F	1
SOCR 478	Environmental Soil Sciences	S	3
SOCR 479	Environmental Soil Science Laboratory	S	1
STAT 305	Sampling Techniques	F	3
STAT 340	Multiple Regression Analysis	S,SS	3
STAT 350	Design of Experiments	F,SS	3
STAT 372	Data Analysis Tools	F	3
STAT 420	Probability and Mathematical Statistics I	F	3
STAT 430	Probability and Mathematical Statistics II	S	3
STAT 511 A or B	Design and Data Analysis for Researchers I: R Software or SAS Software	F	4
STAT 512	Design and Data Analysis for Researchers II	S	4

NOTE: Other courses may be available as CBE Technical electives; contact the CBE department for further information.

To Request Overrides - Include your CSU ID and verification that you meet prerequisites; if you do not meet prerequisites, request permission from the prof and indicate why you think you would be successful in the course. If granted permission, forward as indicated below.

- ◆ For 500-level BIOM courses, forward permission to Sara.Mattern@colostate.edu (BME grad adviser) to request override
- ◆ For 500-level CBE courses, you should be able to register if you meet the pre-requisites. If you need an override, forward permission to Claire.Lavelle@colostate.edu.
- ◆ For 500-level ECE courses, you should be able to register if you meet the pre-requisites. If you need an override, forward permission to Courtney.Johnsrud@colostate.edu
- ◆ For CIVE courses, email your BME adviser with the reason you want the override (e.g. meet pre-reqs but are not in the major) and she will forward request to the department on your behalf.
- ◆ For MECH courses, request approval via your BME adviser, who will forward to MECH on your behalf. If you do not meet prerequisites for 500-level courses (cum 3.0+ gpa or coursework), request permission from the prof and forward permission to your BME adviser.
- ◆ To request overrides for other courses (e.g. 500-level or prereq override), email the course professor or the department teaching the course.



Biomedical engineering (BME) degree combined with chemical and biological engineering (BME+CBE) typically draws students interested in using biology and chemistry in engineering to solve problems in human and animal health. Our BME+CBE program has an emphasis on process engineering and also prepares students in diagnosing and/or treating diseases (such as cancer or tuberculosis), using medical devices that incorporate biology or chemistry (e.g., blood oxygenators or advanced wound-healing techniques), or working with advanced technologies such as artificial organs.

Learn more about [biomedical engineers](http://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm) - <http://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm> in the Bureau of Labor Statistics Occupational Outlook Handbook or at the Biomedical Engineering Society: [BMES.org](http://www.bmes.org).

Learn more about [chemical engineers](http://www.bls.gov/ooh/architecture-and-engineering/chemical-engineers.htm) - <http://www.bls.gov/ooh/architecture-and-engineering/chemical-engineers.htm> in the Bureau of Labor Statistics Occupational Outlook Handbook.

Additional Resources: American Institute of Chemical Engineers (AIChE) <http://www.aiche.org/>; Materials Research Society <http://www.asb-biomech.org/>; American Peptide Society (www.americanpeptidesociety.org); American Protein Society www.proteinsociety.org; American Society for Gene and Cell Therapy (www.asgct.org).

Our alumni are working at places like Astra Zeneca, Beckman Coulter, Epic Healthcare, Genetech, Hyde Engineering, Juno Therapeutics, Kromatid, Los Alamos National Lab, Med Immune, Medsource, Medtronic, Penumbra, Raytheon, Symbios Technology, and Terumo BCT. Many are also in graduate schools (Stanford, MIT, CSU, New Zealand, Europe, USC, CU, and others).

Finding BME Internships/Jobs

Take advantage of CSU resources

- **Career Fairs** – fall and spring. Many biotech companies don't go to these, but some do. Check with companies for your partner majors, also.
- **Biotech Connect** – held in early March – networking event for biotech companies
- **Handshake** – internship/job posting database (<https://career.colostate.edu/experience/handshake>)
- **Engineering Success Center** – help with resumes, interviewing, job/internship search, co-ops

Attend events, look at job posting and company websites (sign up to have updated jobs sent to you)

- **Biomedical Engineering Society** – www.BMES.org
 - Active student chapter @CSU - <https://www.engr.colostate.edu/organizations/bmes;>
 - Email for further information/membership: csu.bmesociety@gmail.com
 - Job Postings - <http://jobboard.bmes.org/search.cfm>; especially good for academic positions.
- **Colorado Bioscience Association** (THE organization for biotech in CO): www.cobioscience.com
 - **Job postings** -- www.cobioscience.com/careers.php; www.aftercollege.com; www.glassdoor.com; www.biospace.com
 - **Local information and opportunities** -- find industry updates and a company directory in the back! <http://www.cobioscience.com/sponsorship/marketing-magazine>
- **General Biotech** - www.Biospace.com – wordsearch specific terms (i.e. medical devices, tissue engineering)
- **Pharmaceuticals** – www.ispe.org
- **Medical Device** - <http://www.devicespace.com>
- **Clinical Research** - <http://www.biospace.com/clinicaspacejobs/home>