

BME Broad Technical Electives

BME Broad Technical Electives (TEs) are designed to provide additional breadth in the undergraduate Biomedical Engineering (BME+) program

BME+ students are required to take 3 credits from classes on the following list.

This proposal is expected to be effective FA20; it is currently moving through the university curricular approval system

Key:	
F - Fall	* Available Every Other Year (Even)
S - Spring	** Available Every Other Year (Odd)
SS - Summer	See notes below about courses restricted by BME pathway
<i>NOTE: Course availability changes; check with Department about term offerings</i>	

- NOTE:**
1. Classes otherwise required for (or equivalent to) the degree not allowed for BME BE credit.
 2. Course availability changes frequently. Please check with individual departments regarding course availability.
 3. Courses will show in DARS beginning FA20
 4. See last page of this document for information on how to obtain course overrides

COURSE	NAME	TERM	CR
ATS 555	Air Pollution	S**	3
ATS 560	Air Pollution Measurement	F	2
BC 351*	Principles of Biochemistry (not allowed for BME+CBE)	F, S, SS	4
BC 401	Comprehensive Biochemistry I	F	3
BC 403	Comprehensive Biochemistry II	S	3
BC 404	Comprehensive Biochemistry Lab	F,S	2
BC 411	Physical Biochemistry	F	4
BC 441	3D Molecular Models for Biochemistry	F	1
BC 463	Molecular Genetics	F	3
BC 464	Molecular Genetics Recitation	F	1
BC 465	Molecular Regulation of Cell Function	S	3
BC 517	Metabolism	F/S	2
BC 521	Principles of Chemical Biology	F	3
BIOM 350A	Study Abroad -- Ecuador: Prosthetics	SS	1 or 2
BIOM 421x	Transp Phenomena in BME (allowed for BME+EE, BME+EE-L&O, BME+MECH)	F	3
BIOM 422x	Quant. Systems in Synth. Bio (allowed for BME+EE, BME+EE-L&O, BME+MECH)	S	3
BIOM 431*	Biomed Signal/Image Proc'g (allowed for BME+CBE, BME+MECH)	S	3
BIOM 441xx	Biomechanicals and Biomaterials (allowed for BME+CBE, BME+EE, BME+EE-L&O)	F	3
BIOM/CBE 504	Fundamentals of Biochemical Engineering	S	3
BIOM/ECE 517	Advanced Optical Imaging	F*	3
BIOM/ECE 518	Biophotonics	F	3
BIOM/CBE 522	Bioseparation Processes	F	3
BIOM/MECH 525	Cell and Tissue Engineering	S	3
BIOM/ECE 526	Biological Physics	F**	3
BIOM/ECE 527 (A-F)	Biosensors	F, S, SS	1
BIOM/MECH 531	Materials Engineering	S	3
BIOM/CIVE 533	Biomolecular Tools for Engineers	F	3
BIOM/ECE 537	Biomedical Signal Processing	S	3
BIOM/MECH 570	Bioengineering	F	3
BIOM/MECH 573	Structure and Function of Biomaterials	S	3
BIOM/MECH 574	Bio-Inspired Surfaces	S	3
BIOM/MECH 576	Quantitative Systems Physiology	S	4
BIOM/MECH 578	Musculoskeletal Biosolid Mechanics	F	3
BIOM/MECH 579	Cardiovascular Biomechanics	F**	3
BMS 301	Human Gross Anatomy	F,S,SS	5
BMS 302	Laboratory in Principles in Physiology	F,S	2
BMS 305	Domestic Animal Gross Anatomy	S	4
BMS 310	Anatomy for the Health Professions (online)	F, S, SS	4
BMS 325	Cellular Neurobiology	F	3
BMS 330	Microscopic Anatomy	S	4
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

COURSE	NAME	TERM	CR
BMS 430	Endocrinology	F	3
BMS 450	Pharmacology	S	3
BMS 460	Essentials of Pathophysiology	S	3
BMS 500	Mammalian Physiology I	F	4
BMS 501	Mammalian Physiology II	S	4
BMS/NB 503	Developmental Neurobiology	S	3
BMS/NB 505	Neuronal Circuits, Systems and Behavior	S	3
BMS 545	Neuroanatomy	S	5
BMS 575	Human Anatomy Dissection	F	4
BSPM 302	Applied and General Entomology	F	2
BSPM 310 ++	Understanding Pesticides	S*	3
BSPM 361	Elements of Plant Pathology	S	3
BSPM/MIP 576*	Bioinformatics	F,S	3
BZ 310	Cell Biology	F,S,SS	4
BZ 311	Developmental Biology	S,SS	4
BZ 348	Theory of Population and Evolutionary Ecology	F	4
BZ 350	Molecular and General Genetics	F,S,SS	4
BZ 360	Bioinformatics and Genomics	S	3
BZ 420	Evolutionary Medicine	S	3
BZ 476/BZ 576	Genetics of Model Organisms	F	3
CBE 330x	Process Simulation (allowed for BME+EE, BME+EE-L&O, BME+MECH)	F	3
CBE 406	Introduction to Transport Phenomena	F	3
CBE 439	Environmental Engineering Chemical Concepts	F	3
CBE 501	Chemical Engineering Thermodynamics	F	3
CBE 502	Advanced Reactor Design	F	3
CBE 503	Transport Phenomena Fundamentals	S	3
CBE 505	Biochemical Engineering Laboratory	F**	1
CBE 514	Polymer Science and Engineering	S	3
CBE 521	Mathematical Modeling for Chemical Engineers	F	3
CBE 522	Bioseparation Processes	F	3
CBE 524	Bioremediation	F**	1
CBE/CIVE 540	Advanced Biological Wastewater Processing	F	3
CBE 570	Biomechular Engineering/Synthetic Biology	S	3
CHEM 246	Fundamentals of Organic Chemistry Lab	F,S,SS	1
CHEM 261	Fundamentals of Inorganic Chemistry	S	3
CHEM 311	Introduction to Nanoscale Science	S*	3
CHEM 334	Quantitative Analysis Laboratory	F,S	1
CHEM 335	Introduction to Analytical Chemistry	F,S	3
CHEM 338	Environmental Chemistry	S**	3
CHEM 343x	Modern Org Chem II (allowed for BME+EE, BME+EE-L&O, BME+MECH)	F, S, SS	3
CHEM 344x	Modern Org Chem II Lab (allowed for BME+EE, BME+EE-L&O, BME+MECH)	F, S, SS	2
CHEM 346x	Organic Chem II (allowed for BME+EE, BME+EE-L&O, BME+MECH)	S	4
CHEM 431	Instrumental Analysis	F	4
CHEM 433	Clinical Chemistry	S**	3

COURSE	NAME	TERM	CR
CHEM 440	Advanced Organic Chemistry Laboratory	F	2
CHEM 461	Inorganic Chemistry	S	3
CHEM 522	Methods of Chemical Biology	S	2
CHEM 532	Advanced Chemical Analysis II	F, S, SS	3
CHEM 537	Electrochemical Methods	S**	3
CHEM 539 (A,B,C)	Principles of NMR and MRI	S	1
CHEM 541	Organic Molecular Structure Determination	S	2
CHEM 543	Structure/Mechanisms in Organic Chemistry	F	2
CHEM 545	Synthetic Organic Chemistry I	S	3
CHEM 547	Physical Organic Chemistry	S	3
CHEM 555	Chemistry of Sustainability	F	3
CHEM 569	Chemical Crystallography	S*	3
CHEM 570	Chemical Bonding	F*	3
CHEM 575	Chemical Thermodynamics	F	1
CHEM 576	Statistical Mechanics	F	2
CHEM 577	Surface Chemistry	S	3
CHEM 579	Chemical Kinetics	F**	3
CIVE 322	Basic Hydrology	F,S	3
CIVE 330	Ecological Engineering	S	3
CIVE 360**	Mechanics of Solids (not allowed for BME+MECH)	F,S,SS	3
CIVE 367	Structural Analysis	F,S	3
CIVE 401	Hydraulic Engineering	S	3
CIVE 413	Environmental River Mechanics	F	3
CIVE 423	Groundwater Engineering	S	3
CIVE 425	Soil and Water Engineering	S	3
CIVE 438	Environmental Engineering Concepts	F,S	3
CIVE 440	Nonpoint Source Pollution	F	3
CIVE 442	Air Quality Engineering	S	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
CIVE 562	Fundamentals of Vibrations	S	3
CM 501	Advanced Cell Biology	F	4
CM/NB 502	Techniques in Molecular & Cellular Biology	F	2
CS 152	Intro to Programming- Python (not allowed for BME+EE or BME+EL)	F,S	2
CS 163/164 ++	Java No Prior Programming/Java Prior Programming	F,S,SS	4
CS 165	AVA (CS2) Data Structures and Algorithms	F,S	4
CS 220	Discrete Structures and their Applications	F, S, SS	4
CS 253	Software Development with C++	F,S	4
CS 270	Computer Organization	F,S	4
CS 314	Software Engineering	F, S	3
CS 320 ++	Algorithms-Theory and Practice	F,S	3
CS 356	Systems Security	F, S	3
CS 370	Operating Systems	F, S	3
CS 410	Introduction to Computer Graphics	F	4
CS 414	Object-Oriented Design	F	4
CS 420	Introduction to Analysis of Algorithms	F	4
CS 430	Database Systems	S	4
CS 440 ++	Introduction to Artificial Intelligence	F	4
CS 445	Introduction to Machine Learning	S	4
CS 453	Introduction to Compiler Construction	S	4
CS 455	Introduction to Distributed Systems	S	4
CS 475	Parallel Programming	F	4
CS 510	Image Computation	S	4

COURSE	NAME	TERM	CR
CS 520	Analysis of Algorithms	S	4
CS 530	Fault-Tolerant Computing	S	4
CS 540	Artificial Intelligence	S	4
CS 545	Machine Learning	F	4
CS/STAT 548 ++	Bioinformatics Algorithms	F	4
CS 553	Algorithmic Language Compilers	F	4
CS 555	Distributed Systems	F	4
CS 556	Computer Security	F	4
CS 557	Advanced Networking	S	4
CS 575	Parallel Processing	F	4
ECE 204 **	Introduction to Electrical Engineering (allowed for BME+CBE)	F,S	3
ECE 312	Linear System Analysis II	S	3
ECE/MATH 430	Fourier and Wavelet Analysis with Apps	S	3
ECE4XX	Any ECE course at the 400 level except ECE 495 (Ind. Study)	F, S	Varies
ECE5XX	Any ECE course at the 500 level	F,S	Varies
ECE/MECH 569	Micro-Electro-Mechanical Devices	S	3
ENGR 300	3D Printing Lab for Engineers	F,S,SS	1
ENGR 422	Technology Entrepreneurship	S	3
ENGR 502	Engineering Project and Program Management	F, S	3
ENGR 510	Engineering Optimization	F	3
ENGR 525	Intellectual Property and Invention Systems	S	3
ENGR 531	Engineering Risk Analysis	F, S	3
MATH/ENGR 550	Numerical Methods in Science and Engineerign	F,S	3
ERHS 320 ++	Environmental Health- Water and Food Safety	F	3
ERHS 332 ++	Principles of Epidemiology	S	3
ERHS 410 ++	Environmental Health and Waste Management	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,S	3
ERHS 503 ++	Toxicology Principles	S	1
ERHS 510	Cancer Biology	S	3
ERHS 530 ++	Radiological Physics and Dosimetry I	F	3
ERHS 540	Principles of Ergonomics	F	3
ERHS 542 ++	Biostatistical Methods for Qualitative Data	F	3
ERHS 547	Equipment and Instrumentation	S	3
F 311	Forest Ecology	F,S	3
FIN 305	Fundamentals of Finance	F,S,SS	3
FSHN 470	Integrated Nutrition & Metabolism	F,S	3
FTEC 447	Food Chemistry	S**	2
GEOL 150	Physical Geology for Scientists and Engineers	F	4
GEOL 452	Hydrogeology	F	4
GEOL 454	Geomorphology	S	4
GES 441	Analysis of Sustainable Energy Solutions	S	3
GES 542	Biobased Fuels, Energy, and Chemicals	S	3
HES 207	Anatomical Kinesiology	F,S,SS	3
HES 307	Biomechanical Principles of Human Movement	F,S,SS	4
HES 319	Neuromuscular Aspects of Human Movement	F,S	4
HES 403	Physiology of Exercise	F,S,SS	4
HES 420 ++	Electrocardiography and Exercise Management	F,S	3
HES 476	Exercise and Chronic Disease	F,S,SS	3
HORT 579	Professional Landscape Practices	S	2
IDEA 310B	Design Thinking Toolbox: 3D Modeling	OAN	2
IDEA 310D	Design Thinking Toolbox: Digital Imaging	OAN	1
LIFE 201B	Introductory Genetics	F,S	3
LIFE 202B	Introductory Genetics Recitation	F,S	1

COURSE	NAME	TERM	CR
LIFE 203	Introductory Genetics Laboratory	S	2
LIFE 210	Introductory Cell Biology	F	3
LIFE 211	Introductory Cell Biology Honors Recitation	F, S	1
LIFE 212	Introductory Cell Biology Laboratory	F,S	2
LIFE 320	Ecology	F,S	3
MATH 151x	Math Algorithms in Matlab I (allowed for BME+EE, BME+EE-L&O, BME+MECH)	S	1
MATH 229	Matrices & Linear Equations	F,S	2
MATH 235	Intro to Mathematical Reasoning	F,S	2
MATH 301	Introduction to Combinatorial Theory	F	3
MATH 317	Advanced Calculus of One Variable	F,S,SS	3
MATH 331	Introduction to Mathematical Modeling	F	3
MATH 332	Partial Differential Equations	S	3
MATH/BZ 348	Theory of Population and Evolutionary Ecology	F	4
MATH 360	Mathematics of Information Security	F	3
MATH 366	Introduction to Abstract Algebra	F,S,SS	3
MATH 369	Linear Algebra I	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 450	Introduction to Numerical Analysis I	F	3
MATH 451	Introduction to Numerical Analysis II	S	3
MATH 455	Mathematics in Biology and Medicine	F**	3
MATH 460	Information and Coding Theory	S	3
MATH 466	Abstract Algebra I	F	3
MATH 467	Abstract Algebra II	S**	3
MATH 469	Linear Algebra II	S	3
MATH 470	Euclidean and Non-Euclidean Geometry	S	3
MATH 474	Introduction to Differential Geometry	F**	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 535	Foundations of Applied Mathematics	F	3
MATH 546	Partial Differential Equations II	S	3
MATH 560	Linear Algebra	F	3
MECH 200	Intro to Manufacturing Processes	F,S	3
MECH 303	Energy Engineering	F	3
MECH 307 xx	Mechatronics & Meas'mt Syst (allowed for BME+EE, BME+E-L&O, BME+CBE)	F,S	4
MECH 324xx	Dynamics of Machines (allowed for BME+EE, BME+E-L&O, BME+CBE)	F,S	4
MECH 325xx	Machine Design (allowed for BME+EE, BME+E-L&O, BME+CBE)	F,S	3
MECH 331xx	Intro to Engineering Materials (allowed for BME+EE, BME+E-L&O, BME+CBE)	F,S	4
MECH 407	Laser Applications in Mechanical Engineering	F	3
MECH 411	Manufacturing Engineering	S	3
MECH 424	Advanced Dynamics	S	3
MECH 425	Mechanical Engineering Vibrations	F	4
MECH 431	Metals and Alloys	F	3
MECH 432	Engineering of Nanomaterials	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 502	Advances/Additive Manufacturing Engineering	S	3
MECH 507	Laser Diagnostics for Thermosciences	S**	3
MECH 509	Design and Analysis in Engineering Research	S	3
MECH 513	Simulation Modeling and Experimentation	S	3
MECH 524	Principles of Dynamics	F	3

COURSE	NAME	TERM	CR
MECH 527	Hybrid Electric Vehicle Powertrains	F	3
MECH 529	Advanced Mechanical Systems	F	3
MECH 530	Advanced Composite Materials	F	3
MECH 543	Biofluid Mechanics	S**	3
MECH 552	Applied Computational Fluid Dynamics	F**	3
MECH 558	Combustion	F*	3
MECH564	Fundamentals of Robot Mechanisms and Controls	S	3
MECH 575	Solar and Alternative Energies	S	3
MGT 305	Fundamentals of Management	F,S,SS	3
MGT 340	Fundamentals of Entrepreneurship	F,S,SS	3
MIP 300	General Microbiology	F,S,SS	3
MIP 302	General Microbiology Laboratory	F,S,SS	2
MIP 315	Pathology of Human and Animal Disease	F,S	3
MIP 334	Food Microbiology	F	3
MIP 335	Food Microbiology Laboratory	F**	2
MIP 342	Immunology	F,S	4
MIP 343	Immunology Laboratory	S	2
MIP 350	Microbial Diversity	S**	3
MIP 351	Medical Bacteriology	S	3
MIP 352	Medical Bacteriology Laboratory	S	3
MIP 420	Medical and Molecular Virology	F	4
MIP 425	Virology and Cell Culture Laboratory	F	2
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 530	Advanced Molecular Virology	S*	4
MIP 543	RNA Biology	F**	3
MIP 550	Microbial and Molecular Genetics Laboratory	S	4
MIP 555	Principles and Mechanisms of Disease	F	3
MIP/BSPM 576	Bioinformatics	F,S	3
MIP 578	Genetics of Natural Populations	F	4
MKT 305	Fundamentals of Marketing	F,S,SS	3
MSE 501	Materials Technology Transfer	F	1
MSE 502 (A-F)	Materials Science & Engineering Methods	F,S	1
MSE 503	Mechanical Behaviors of Materials	S	3
MSE 504	Thermodynamics of Materials	F	3
MSE 505	Kinetics of Materials	S	3
NR 319	Geospatial Applications in Natural Resources	F,S	4
NR/GR 323	Remote Sensing and Image Interpretation	F	3
NR/ESS 353	Global Change Ecology, Impacts and Mitigation	S	3
NR 505	Concepts in GIS	F	4
PH 314***	Intro to Modern Physics (allowed for BME+CBE, BME+EE, BME+MECH)	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 (allowed for BME+CBE, BME+EE, BME+MECH)	F	4
PH 361	Physical Thermodynamics	S	3
PH 425	Advanced Physics Lab	S	2
PH 451 ***	Intro Quantum Mech'cs I (allowed for BME+CBE, BME+EE, BME+MECH)	F	3
PH 452	Intro Quantum Mech'cs II	S	3
PH 462	Statistical Physics	F	3
PH 517	Chaos, Fractals, and Non-linear Dynamics	S	3
PH 521	Introduction to Lasers	S	3
PH 522	Introductory Laser Laboratory	S	1

COURSE	NAME	TERM	CR
PH 531	Introductory Condensed Matter Physics	S	3
PH 561	Elementary Particle Physics	S	3
PH 571	Mathematical Methods for Physics I	F	3
PH 572	Mathematical Methods for Physics II	S	3
PHIL 410	Formal Logic	F,S	3
PSY 253	Human Factors in Engineering	S,SS	3
SOCR 330	Principles of Genetics	F,S,SS	3
SOCR 400	Soils and Global Change: Science and Impacts	F	3
SOCR 430	Applications of Plant Biotechnology	F*	3
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 567	Environmental Soil Chemistry	S	4
STAT 158	Introduction to R Programming	S, SS	1
STAT 305	Sampling Techniques	F	3
STAT 340	Multiple Regression Analysis	S,SS	3
STAT 341	Statistical Data Analysis I	F	3
STAT 342	Statistical Data Analysis II	S	3
STAT 350	Design of Experiments	F,SS	3
STAT 400	Statistical Computing	F	3
STAT 420	Probability and Mathematical Statistics I	F	3
STAT 421	Introduction to Stochastic Processes	S	3
STAT 430	Probability and Mathematical Statistics II	S	3
STAT 460	Applied Multivariate Analysis	F,S,SS	3
STAT 512	Design and Data Analysis for Researchers II	S	4
SYSE 501	Foundations of Systems Engineering	F, S	3

KEY to courses allowed by individual BME Pathways

- x - Approved for BME+EE, BME+EE+L&O, BME+MECH; Not approved for BME+CBE
- xx- Approved for BME+EE, BME+EE+L&O, BME+CBE; Not approved for BME+MECH
- - Approved for BME+CBE, BME+MECH; Not approved for BME+EE, BME+EE+L&O
- - Approved for BME+CBE; Not approved for BME+MECH, BME+EE, BME EE+L&O
- - Approved for BME+CBE, BME+EE, BME+MECH; not approved for BME+EE+L&O

- ◆ OVERRIDES For 500-level BIOM courses, forward permission to Sara.Mattern@colostate.edu to request override
- ◆ OVERRIDES For 500-level CBE courses, forward prof permission permission to Claire.Lavelle@colostate.edu for override.
- OVERRIDES For 500-level ECE courses forward prof permission to Courtney.Johnsrud@colostate.edu
- OVERRIDES For MECH courses, forward request to your BME adviser (w/prof permission if you don't have 3.0+ GPA or prereqs)
- OVERRIDES For other courses - contact department teaching the course.