

BIOMEDICAL ENGINEERING - BACHELOR OF SCIENCE (BSBM)

Biomedical engineering is an exciting, multidisciplinary field that lies at the interface of medicine, biology and engineering. Biomedical engineers use engineering principles to analyze and solve problems in biology and medicine, providing an overall enhancement to healthcare. Biomedical engineers create technology to save lives and improve the quality of life. Much of the equipment in hospitals and clinics across the globe was designed, built and tested by biomedical engineers. At the same time, biomedical engineers employ concepts learned from biology and medicine to generate new (biomimetic) engineering designs in fields such as robotics and artificial intelligence.

Course code for this program is BMEN.

Requirements

Prerequisites and Passing Grades

The minimum passing grade for a course that is a prerequisite or corequisite for another required course is C-. If a grade of D+ or lower is received in a course that is a prerequisite to another, the student may not register for the subsequent course and must repeat the prerequisite course until a grade of C- or higher is achieved.

The minimum passing grade for a course that is not specifically a prerequisite or corequisite for another required course is D-.

The biomedical engineering program reserves the right to drop students enrolled in BMEN courses who have not met the minimum prerequisite requirements. It is the student's responsibility to communicate with the program if summer coursework and/or transfer credit will be used to meet the prerequisite requirement.

Required Courses and Credits

Required courses in engineering, physical science, and mathematics are interwoven throughout the curriculum to provide a balanced education in the fundamentals of the biomedical engineering profession. The core courses are complemented by technical electives, humanities and social sciences electives (<https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/>), free electives, and a writing course (<https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/>), for a total of 128 credits required for the degree.

Code	Title	Credit Hours
Required Biomedical Courses		
BMEN 1000	Exploring Biomedical Engineering	1
or AREN 1316	Introduction to Architectural Engineering	
or ASEN 1000	Introduction to Aerospace Engineering Sciences	
or CHEN 1300	Introduction to Chemical and Biological Engineering	
or CSCI 1000	Computer Science as a Field of Work and Study	
or CVEN 1317	Introduction to Civil and Environmental Engineering	

or ECEN 1100	Exploring ECE	
or EVEN 1000	Introduction to Environmental Engineering	
or MCEN 2000	Mechanical Engineering as a Profession	
BMEN 1025	Computer-Aided Design & Fabrication	4
or MCEN 1025	Computer-Aided Design and Fabrication	
or GEEN 1017 & BMEN 1035	Engineering Drawing and Introduction to Fabrication for Biomedical Engineering	
BMEN 2100	Biomedical Engineering Principles and Methods	3
BMEN 2010	Biomaterials	3
BMEN 3010	Biotransport	3
BMEN 3030	Bioinstrumentation	3
BMEN 4010	Biomedical Engineering Capstone Design I	3
BMEN 4020	Biomedical Engineering Capstone Design II	3
BMEN 4117	Anatomy and Physiology for Biomedical Engineering	3
or MCEN 4117	Anatomy and Physiology for Engineers	
or MCEN 5117	Anatomy and Physiology for Engineers	
or BMEN 5117	Anatomy and Physiology for Biomedical Engineering	

Required Mechanics Courses

MCEN 2023	Statics and Structures	3
or GEEN 2851	Statics for Engineers	
or CVEN 2121	Analytical Mechanics 1	
MCEN 2063	Mechanics of Solids	3
or CVEN 3161	Mechanics of Materials 1	
MCEN 4133	Intro to Tissue Biomechanics	3

Required Electrical Courses

ECEN 2250	Introduction to Circuits and Electronics	3
or ECEN 3010	Circuits and Electronics for Mechanical Engineers	
or GEEN 3010	Circuits for Engineers	
or MCEN 3017	Circuits and Electronics for Mechanical Engineers	
ECEN 2260	Circuits as Systems	3
ECEN 2270	Electronics Design Lab	3
ECEN 3301	Biomedical Signals and Systems	3
or ECEN 3300	Linear Systems	

Technical Electives

Choose 15 credit hours of technical elective coursework. At least 12 of 15 must be 3000 level or above, and at least 6 of 15 must be BME-Approved Engineering technical electives, including 3 credits from focused electives.¹

Required Mathematics Courses

APPM 1350	Calculus 1 for Engineers	4
or MATH 1300	Calculus 1	
or APPM 1345	Calculus 1 with Algebra, Part B	
APPM 1360	Calculus 2 for Engineers	4
or MATH 2300	Calculus 2	
APPM 2350	Calculus 3 for Engineers	4
or MATH 2400	Calculus 3	
APPM 2360	Introduction to Differential Equations with Linear Algebra	4

or MATH 2130 & MATH 3430	Introduction to Linear Algebra for Non-Mathematics Majors and Ordinary Differential Equations	
or MATH 2135 & MATH 3430	Introduction to Linear Algebra for Mathematics Majors and Ordinary Differential Equations	
Required Physics Course		
PHYS 1110	General Physics 1	4
or PHYS 1115	General Physics 1 for Majors	
PHYS 1120	General Physics 2	4
or PHYS 1125	General Physics 2 for Majors	
PHYS 1140	Experimental Physics 1	1
Required Chemistry Courses		
<i>Select one of the following chemistry sequence options:</i> 7		
<i>Option 1:</i>		
CHEN 1201	General Chemistry for Engineers 1 ³	
or CHEN 1211	Accelerated Chemistry for Engineers	
or CHEM 1113	General Chemistry 1	
or CHEM 1400	Foundations of Chemistry	
CHEN 1203	General Chemistry for Engineers 2 ³	
or CHEN 1211	Accelerated Chemistry for Engineers	
or CHEM 1133	General Chemistry 2	
or CHEM 2100	Foundations of Chemistry 2	
CHEN 1221	Engineering General Chemistry Lab	
or CHEM 1134	Laboratory in General Chemistry 2	
or CHEM 1114	Laboratory in General Chemistry 1	
or CHEM 2101	Laboratory in Foundations of Chemistry 2	
<i>Option 2: (Students who take Option 2 must take two extra Free Electives)</i>		
CHEN 1211	Accelerated Chemistry for Engineers	
CHEM 1221	Engineering General Chemistry Lab	
or CHEM 1134	Laboratory in General Chemistry 2	
or CHEM 1114	Laboratory in General Chemistry 1	
or CHEM 1401	Foundations of Chemistry Lab	
Required Biology Course		
BIEN 2810	Biology for Engineers	3
or MCDB 1150	Introduction to Cellular and Molecular Biology	
or EBIO 1210 & EBIO 1220	General Biology 1 and General Biology 2	
Required Computing Courses		
CHEN 1310	Introduction to Engineering Computing ⁴	3
or CSCI 1300	Computer Science 1: Starting Computing	
CHEN 3010	Applied Data Analysis ⁴	3
or STAT 4000	Statistical Methods and Application I	
Humanities, Social Sciences and Writing		
Complete the college's humanities, social sciences and writing requirement as specified ²		18
Free Electives		
Choose at least 7 credit hours of free electives to meet the minimum 128 credit hours required for the bachelor's degree.		7
Total Credit Hours		128

¹ Choose from the course options listed on the program's Advising & Curriculum webpage.

² For more information, see the College of Engineering & Applied Science (<https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/>) website.

³ For CHEN 1201–CHEM 1113 and CHEM 1400 substitutions and for CHEN 1203–CHEM 1133 substitution are restricted to transfer students only.

⁴ For CHEN 1310–CSCI 1300 and for CHEN 3010–STAT 4000 substitutions are restricted to CS minors only.

Optional Program Tracks

Two distinct tracks are offered for students preparing for medical school:

- Pre-medical track biomechanics option (https://www.colorado.edu/bme/academics/bachelors-program/advising-curriculum/#pre_med_biomechanics_track_sample_curriculum-287): For students interested in going to medical school and are interested in human motion, performance, disabilities, prosthetics or orthopedics.
- Pre-medical track bioinstrumentation option (https://www.colorado.edu/bme/academics/bachelors-program/advising-curriculum/#pre_med_bioinstrumentation_track_sample_curriculum-287): For students interested in going to medical school and are interested in medical devices, such as biosensors and imaging systems, or robotic surgical tools.

Premedical Biomechanics Track

For more information, including curriculum requirements, visit the program's Advising & Curriculum (<https://www.colorado.edu/bme/academics/bachelors-program/advising-curriculum/>) webpage.

Code	Title	Credit Hours
Required Biomedical Courses		
BMEN 1000	Exploring Biomedical Engineering	1
or AREN 1316	Introduction to Architectural Engineering	
or ASEN 1000	Introduction to Aerospace Engineering Sciences	
or CHEN 1300	Introduction to Chemical and Biological Engineering	
or CSCI 1000	Computer Science as a Field of Work and Study	
or CVEN 1317	Introduction to Civil and Environmental Engineering	
or ECEN 1100	Exploring ECE	
or EVEN 1000	Introduction to Environmental Engineering	
or MCEN 2000	Mechanical Engineering as a Profession	
BMEN 1025	Computer-Aided Design & Fabrication	4
or MCEN 1025	Computer-Aided Design and Fabrication	
or GEEN 1017 & BMEN 1035	Engineering Drawing and Introduction to Fabrication for Biomedical Engineering	
BMEN 2100	Biomedical Engineering Principles and Methods	3
BMEN 2010	Biomaterials	3
BMEN 3010	Biotransport	3
BMEN 4010	Biomedical Engineering Capstone Design I	3
BMEN 4020	Biomedical Engineering Capstone Design II	3

BMEN 4117	Anatomy and Physiology for Biomedical Engineering	3
or MCEN 4117	Anatomy and Physiology for Engineers	
or MCEN 5117	Anatomy and Physiology for Engineers	
or BMEN 5117	Anatomy and Physiology for Biomedical Engineering	
or IPHY 3410 & IPHY 3430	Human Anatomy and Human Physiology	

Required Mechanics Courses

MCEN 2023	Statics and Structures	3
or GEEN 2851	Statics for Engineers	
or CVEN 2121	Analytical Mechanics 1	
MCEN 2063	Mechanics of Solids	3
or CVEN 3161	Mechanics of Materials 1	
MCEN 3017	Circuits and Electronics for Mechanical Engineers	3
or ECEN 2250	Introduction to Circuits and Electronics	
MCEN 4133	Intro to Tissue Biomechanics	3

Technical Electives

Choose 12 credit hours of technical elective coursework. At least 9 of 12 must be 3000 level or above, and 12 must be BME-Approved Engineering technical electives, including 3 credits from focused electives. ¹	12
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Required Mathematics Courses

APPM 1350	Calculus 1 for Engineers	4
or MATH 1300	Calculus 1	
or APPM 1345	Calculus 1 with Algebra, Part B	
APPM 1360	Calculus 2 for Engineers	4
or MATH 2300	Calculus 2	
APPM 2350	Calculus 3 for Engineers	4
or MATH 2400	Calculus 3	
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
or MATH 2130 & MATH 3430	Introduction to Linear Algebra for Non-Mathematics Majors and Ordinary Differential Equations	
or MATH 2135 & MATH 3430	Introduction to Linear Algebra for Mathematics Majors and Ordinary Differential Equations	

Required Physics Course

PHYS 1110	General Physics 1	4
or PHYS 1115	General Physics 1 for Majors	
PHYS 1120	General Physics 2	4
or PHYS 1125	General Physics 2 for Majors	
PHYS 1140	Experimental Physics 1	1

Required Chemistry Courses

CHEN 1201	General Chemistry for Engineers 1 ³	4
or CHEN 1211	Accelerated Chemistry for Engineers	
or CHEM 1113	General Chemistry 1	
or CHEM 1400	Foundations of Chemistry	
CHEN 1114	Laboratory in General Chemistry 1	1
or CHEM 1221	Engineering General Chemistry Lab	
or CHEM 1401	Foundations of Chemistry Lab	
CHEM 1133	General Chemistry 2	4

or CHEM 2100	Foundations of Chemistry 2	
CHEM 1134	Laboratory in General Chemistry 2	1
or CHEM 2101	Laboratory in Foundations of Chemistry 2	
CHEM 3311	Organic Chemistry 1	4
CHEM 3321	Laboratory in Organic Chemistry 1	1
CHEM 3331	Organic Chemistry 2	4
CHEM 3341	Laboratory in Organic Chemistry 2	1

Required Biochemistry Course

BCHM 4611	Principles of Biochemistry	3
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Required Biology Courses

MCDB 1150	Introduction to Cellular and Molecular Biology	3
or BIEN 2810	Biology for Engineers	
or EBIO 1210 & EBIO 1220	General Biology 1 and General Biology 2	
MCDB 1161	From Dirt to DNA: Phage Genomics Laboratory I	2
or MCDB 1171	Antibiotics Discovery Through Hands-on Screens I	
or MCDB 1181	Biological Probiotic/Drug Discovery Through Hands-on Screens	
or MCDB 2171	Chemotherapeutic Discovery Through Hands-On Screens 2	
MCDB 2150	Principles of Genetics	3

Required Computing Courses

CHEN 1310	Introduction to Engineering Computing ⁴	3
or CSCI 1300	Computer Science 1: Starting Computing	
CHEN 3010	Applied Data Analysis ⁴	3
or STAT 4000	Statistical Methods and Application I	

Humanities, Social Sciences and Writing

Complete the college's humanities, social sciences and writing requirement as specified ²	18
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Free Electives

Choose at least 1 credit hours of free electives to meet the minimum 128 credit hours required for the bachelor's degree.	1
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Total Credit Hours **128**

¹ Visit the program's Advising & Curriculum webpage for options.

² For more information, see the College of Engineering & Applied Science website.

³ For CHEN 1201–CHEM 1113 and CHEM 1400 substitutions are restricted to transfer students.

⁴ For CHEN 1310–CSCI 1300 and for CHEN 3010–STAT 4000 substitutions are restricted to CS minors only.

Premedical Bioinstrumentation Track

For more information, including curriculum requirements, visit the program's Advising & Curriculum (<https://www.colorado.edu/bme/academics/bachelors-program/advising-curriculum/>) webpage.

Code	Title	Credit Hours
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Required Biomedical Courses

BMEN 1000	Exploring Biomedical Engineering	1
or AREN 1316	Introduction to Architectural Engineering	
or ASEN 1000	Introduction to Aerospace Engineering Sciences	

or CHEN 1300	Introduction to Chemical and Biological Engineering	
or CSCI 1000	Computer Science as a Field of Work and Study	
or CVEN 1317	Introduction to Civil and Environmental Engineering	
or ECEN 1100	Exploring ECE	
or EVEN 1000	Introduction to Environmental Engineering	
or MCEN 2000	Mechanical Engineering as a Profession	
BMEN 1025	Computer-Aided Design & Fabrication	4
or MCEN 1025	Computer-Aided Design and Fabrication	
or GEEN 1017 & BMEN 1035	Engineering Drawing and Introduction to Fabrication for Biomedical Engineering	
BMEN 2100	Biomedical Engineering Principles and Methods	3
BMEN 2010	Biomaterials	3
BMEN 3010	Biotransport	3
BMEN 3030	Bioinstrumentation	3
BMEN 4010	Biomedical Engineering Capstone Design I	3
BMEN 4020	Biomedical Engineering Capstone Design II	3
Required Electrical Courses		
ECEN 2250	Introduction to Circuits and Electronics	3
or ECEN 3010	Circuits and Electronics for Mechanical Engineers	
or GEEN 3010	Circuits for Engineers	
or MCEN 3017	Circuits and Electronics for Mechanical Engineers	
ECEN 2260	Circuits as Systems	3
ECEN 2270	Electronics Design Lab	3
ECEN 3301	Biomedical Signals and Systems	3
or ECEN 3300	Linear Systems	
Technical Electives		
Choose 9 credit hours of technical elective coursework. At least 6 of 9 must be 3000 level or above, and at least 6 of 9 must be BME-approved engineering technical electives, including 3 credits from focused electives. ¹		9
Required Mathematics Courses		
APPM 1350	Calculus 1 for Engineers	4
or MATH 1300	Calculus 1	
or APPM 1345	Calculus 1 with Algebra, Part B	
APPM 1360	Calculus 2 for Engineers	4
or MATH 2300	Calculus 2	
APPM 2350	Calculus 3 for Engineers	4
or MATH 2400	Calculus 3	
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
or MATH 2130 & MATH 3430	Introduction to Linear Algebra for Non-Mathematics Majors and Ordinary Differential Equations	
or MATH 2135 & MATH 3430	Introduction to Linear Algebra for Mathematics Majors and Ordinary Differential Equations	
Required Physics Courses		
PHYS 1110	General Physics 1	4

or PHYS 1115	General Physics 1 for Majors	
PHYS 1120	General Physics 2	4
or PHYS 1125	General Physics 2 for Majors	
PHYS 1140	Experimental Physics 1	1
Required Chemistry Courses		
CHEN 1201	General Chemistry for Engineers 1 ³	4
or CHEN 1211	Accelerated Chemistry for Engineers	
or CHEM 1113	General Chemistry 1	
or CHEM 1400	Foundations of Chemistry	
CHEM 1114	Laboratory in General Chemistry 1	1
or CHEM 1221	Engineering General Chemistry Lab	
or CHEM 1401	Foundations of Chemistry Lab	
CHEM 1133	General Chemistry 2	4
or CHEM 2100	Foundations of Chemistry 2	
CHEM 1134	Laboratory in General Chemistry 2	1
or CHEM 2101	Laboratory in Foundations of Chemistry 2	
CHEM 3311	Organic Chemistry 1	4
CHEM 3321	Laboratory in Organic Chemistry 1	1
CHEM 3331	Organic Chemistry 2	4
CHEM 3341	Laboratory in Organic Chemistry 2	1
Required Biochemistry Course		
BCHM 4611	Principles of Biochemistry	3
Required Biology Courses		
MCDB 1150	Introduction to Cellular and Molecular Biology	3
or BIEN 2810	Biology for Engineers	
or EBIO 1210 & EBIO 1220	General Biology 1 and General Biology 2	
MCDB 1161	From Dirt to DNA: Phage Genomics Laboratory I	2
or MCDB 1171	Antibiotics Discovery Through Hands-on Screens I	
or MCDB 1181	Biological Probiotic/Drug Discovery Through Hands-on Screens	
or MCDB 2171	Chemotherapeutic Discovery Through Hands-On Screens 2	
MCDB 2150	Principles of Genetics	3
Required Computing Courses		
CHEN 1310	Introduction to Engineering Computing ⁴	3
or CSCI 1300	Computer Science 1: Starting Computing	
CHEN 3010	Applied Data Analysis ⁴	3
or STAT 4000	Statistical Methods and Application I	
Humanities, Social Sciences and Writing		
Complete the college's humanities, social sciences and writing requirement as specified ²		18
Free Electives		
Choose at least 4 credit hours of free electives to meet the minimum 128 credit hours required for the bachelor's degree.		4
Total Credit Hours		128

¹ Choose from the course options listed on the program's Advising & Curriculum webpage.

² For more information, see the College of Engineering & Applied Science website.

³ For CHEN 1201–CHEM 1113 and CHEM 1400 substitutions are restricted to transfer students only.

⁴ For CHEN 1310–CSCI 1300 and for CHEN 3010–STAT 4000 substitutions are restricted to CS minors only.

Plan(s) of Study

Year One

Fall Semester		Credit Hours
BMEN 1025	Computer-Aided Design & Fabrication	4
APPM 1350	Calculus 1 for Engineers	4
CHEN 1201	General Chemistry for Engineers 1	4
BIEN 2810	Biology for Engineers	3

Credit Hours 15

Spring Semester

BMEN 1000	Exploring Biomedical Engineering	1
APPM 1360	Calculus 2 for Engineers	4
CHEN 1203	General Chemistry for Engineers 2	2
CHEM 1221	Engineering General Chemistry Lab	1
CHEN 1310	Introduction to Engineering Computing	3
PHYS 1110	General Physics 1	4

Credit Hours 15

Year Two

Fall Semester		Credit Hours
BMEN 2100	Biomedical Engineering Principles and Methods	3
APPM 2350	Calculus 3 for Engineers	4
PHYS 1120	General Physics 2	4
Humanities or Social Science Elective ¹		6

Credit Hours 17

Spring Semester

BMEN 2010	Biomaterials	3
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
ECEN 2250	Introduction to Circuits and Electronics	3
MCEN 2023	Statics and Structures	3
PHYS 1140	Experimental Physics 1	1
Humanities or Social Science Elective ¹		3

Credit Hours 17

Year Three

Fall Semester		Credit Hours
BMEN 3010	Biotransport	3
ECEN 2260	Circuits as Systems	3
ECEN 2270	Electronics Design Lab	3
MCEN 2063	Mechanics of Solids	3
Technical Elective ³		3

Credit Hours 15

Spring Semester

BMEN 3030	Bioinstrumentation	3
MCEN 4133	Intro to Tissue Biomechanics	3
ECEN 3301	Biomedical Signals and Systems	3
Technical Elective ³		3
Humanities or Social Sciences Elective ¹		3

Free Elective		3
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Credit Hours 18

Year Four

Fall Semester		Credit Hours
BMEN 4010	Biomedical Engineering Capstone Design I	3
BMEN 4117	Anatomy and Physiology for Biomedical Engineering	3
CHEN 3010	Applied Data Analysis	3
Technical Elective ³		3
College-Approved Writing Course ²		3

Credit Hours 15

Spring Semester

BMEN 4020	Biomedical Engineering Capstone Design II	3
Focus Technical Elective ³		3
Technical Elective ³		3
Humanities or Social Sciences Elective ¹		3
Free Elective		4

Credit Hours 16

Total Credit Hours 128

¹ Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives. (<http://www.colorado.edu/engineering/academics/policies/hss/>)

² Students may choose a course from the list of college-approved writing courses (<http://www.colorado.edu/engineering/academics/policies/hss/>). (<https://www.colorado.edu/engineering-advising/get-your-degree/degree-requirements/humanities-social-sciences-and-writing-requirements/>)

³ Standard curriculum requires a total of 15 credit hours of technical elective coursework. At least 12 of 15 must be 3000 level or above, and at least 6 of 15 must be BME- Approved Engineering technical electives with 3 credits from the approved focus technical elective list. Visit the program's Advising & Curriculum webpage for options.

Premedical Biomechanics Track

Year One

Fall Semester		Credit Hours
BMEN 1025	Computer-Aided Design & Fabrication	4
APPM 1350	Calculus 1 for Engineers	4
CHEN 1201	General Chemistry for Engineers 1	4
CHEM 1114	Laboratory in General Chemistry 1	1
MCDB 1150	Introduction to Cellular and Molecular Biology	3

Credit Hours 16

Spring Semester

BMEN 1000	Exploring Biomedical Engineering	1
APPM 1360	Calculus 2 for Engineers	4
CHEM 1133	General Chemistry 2	4
CHEM 1134	Laboratory in General Chemistry 2	1
CHEN 1310	Introduction to Engineering Computing	3
PHYS 1110	General Physics 1	4

Credit Hours 17

Year Two**Fall Semester**

BMEN 2100	Biomedical Engineering Principles and Methods	3
APPM 2350	Calculus 3 for Engineers	4
PHYS 1120	General Physics 2	4
PHYS 1140	Experimental Physics 1	1
Humanities or Social Science Elective ¹		3
Credit Hours		15

Spring Semester

BMEN 2010	Biomaterials	3
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
CHEM 3311	Organic Chemistry 1	4
CHEM 3321	Laboratory in Organic Chemistry 1	1
MCDB 1161	From Dirt to DNA: Phage Genomics Laboratory I	2
MCEN 2023	Statics and Structures	3
Credit Hours		17

Year Three**Fall Semester**

BMEN 3010	Biotransport	3
CHEM 3331	Organic Chemistry 2	4
CHEM 3341	Laboratory in Organic Chemistry 2	1
MCEN 2063	Mechanics of Solids	3
Technical Elective ³		3
Humanities or Social Sciences Elective ¹		3
Credit Hours		17

Spring Semester

MCEN 3017	Circuits and Electronics for Mechanical Engineers	3
MCEN 4133	Intro to Tissue Biomechanics	3
BCHM 4611	Principles of Biochemistry	3
Humanities or Social Sciences Elective ¹		6
Free Elective		1
Credit Hours		16

Year Four**Fall Semester**

BMEN 4010	Biomedical Engineering Capstone Design I	3
BMEN 4117	Anatomy and Physiology for Biomedical Engineering	3
CHEM 3010	Applied Data Analysis	3
Technical Elective ³		3
College-Approved Writing Course ²		3
Credit Hours		15

Spring Semester

BMEN 4020	Biomedical Engineering Capstone Design II	3
MCDB 2150	Principles of Genetics	3
Focus Technical Elective ³		3
Technical Elective ³		3

Humanities or Social Sciences Elective ¹	3
Credit Hours	15
Total Credit Hours	128

¹ Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives.

² Students may choose a course from the list of college-approved writing courses.

³ Pre-Med Biomechanics requires a total of 12 credit hours of engineering technical elective coursework. At least 9 of 12 must be 3000 level or above, and 12 must be BME- Approved Engineering technical electives with 3 credits from the approved focus technical elective list. Visit the program's Advising & Curriculum webpage for options.

Premedical Bioinstrumentation Track**Year One****Fall Semester**

		Credit Hours
BMEN 1025	Computer-Aided Design & Fabrication	4
APPM 1350	Calculus 1 for Engineers	4
CHEM 1201	General Chemistry for Engineers 1	4
CHEM 1114	Laboratory in General Chemistry 1	1
MCDB 1150	Introduction to Cellular and Molecular Biology	3
Credit Hours		16

Spring Semester

BMEN 1000	Exploring Biomedical Engineering	1
APPM 1360	Calculus 2 for Engineers	4
CHEM 1133	General Chemistry 2	4
CHEM 1134	Laboratory in General Chemistry 2	1
CHEM 1310	Introduction to Engineering Computing	3
PHYS 1110	General Physics 1	4
Credit Hours		17

Year Two**Fall Semester**

BMEN 2100	Biomedical Engineering Principles and Methods	3
APPM 2350	Calculus 3 for Engineers	4
PHYS 1120	General Physics 2	4
PHYS 1140	Experimental Physics 1	1
Humanities or Social Science Elective ¹		6
Credit Hours		18

Spring Semester

BMEN 2010	Biomaterials	3
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
CHEM 3311	Organic Chemistry 1	4
CHEM 3321	Laboratory in Organic Chemistry 1	1
ECEN 2250	Introduction to Circuits and Electronics	3
MCDB 1161	From Dirt to DNA: Phage Genomics Laboratory I	2
Credit Hours		17

Year Three**Fall Semester**

BMEN 3010	Biotransport	3
CHEM 3331	Organic Chemistry 2	4
CHEM 3341	Laboratory in Organic Chemistry 2	1
ECEN 2260	Circuits as Systems	3
ECEN 2270	Electronics Design Lab	3
Free Elective		1
Credit Hours		15

Spring Semester

BMEN 3030	Bioinstrumentation	3
ECEN 3301	Biomedical Signals and Systems	3
BCHM 4611	Principles of Biochemistry	3
Humanities and Social Sciences Elective ¹		3
Writing Requirement ²		3
Credit Hours		15

Year Four**Fall Semester**

BMEN 4010	Biomedical Engineering Capstone Design I	3
CHEN 3010	Applied Data Analysis	3
Technical Elective ³		3
Humanities or Social Science Elective ¹		3
Eng Technical Elective ³		3
Credit Hours		15

Spring Semester

BMEN 4020	Biomedical Engineering Capstone Design II	3
Focus Technical Elective ³		3
MCDB 2150	Principles of Genetics	3
Humanities or Social Science Elective ¹		3
Free Electives		3
Credit Hours		15
Total Credit Hours		128

¹ Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives.

² Students may choose a course from the list of college-approved writing courses.

³ Pre-Med Bioinstrumentation requires a total of 9 credit hours of technical elective coursework. At least 6 of 9 must be 3000 level or above, and at least 6 of 9 must be BME-approved engineering technical electives with 3 credits from the approved focus technical elective list. Visit the program's Advising & Curriculum webpage for options.

Learning Outcomes

Program Educational Objectives

The biomedical engineering program at CU Boulder is dedicated to preparing each of our graduating students for one or more the following achievements within 5-10 years of receiving their undergraduate degrees:

- Professional engineering employment in life sciences and healthcare industries, in interdisciplinary areas including but not limited to the medical device industry, engineering consulting,

biomechanics, digital health and biotechnology, with promotions and increasing levels of leadership and responsibility over time.

- Completion of graduate degree in biomedical engineering or related fields, with subsequent employment in academy, industry or related professions.
- Completion of medical or other professional school, with subsequent placement in residency, clinical practice and/or other professional employment.

General Learning Outcomes

Upon graduation, students will be able to:

- Identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics.
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors.
- Communicate effectively with a range of audiences.
- Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts.
- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
- Develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions.
- Acquire and apply new knowledge as needed, using appropriate learning strategies.

Biomedical Engineering Specific Outcomes

Upon graduation, students will be able to:

- Apply principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics.
- Solve biomedical engineering problems, including those associated with the interaction between living and non-living systems.
- Analyze, model, design and realize biomedical engineering devices, systems, components or processes.
- Make measurements on and interpret data from living systems.

Bachelor's–Accelerated Master's Degree Program(s)

The bachelor's–accelerated master's (BAM) degree program options offer currently enrolled CU Boulder undergraduate students the opportunity to receive a bachelor's and master's degree in a shorter period of time. Students receive the bachelor's degree first but begin taking graduate coursework as undergraduates (typically in their senior year).

Because some courses are allowed to double count for both the bachelor's and the master's degrees, students receive a master's degree in less time and at a lower cost than if they were to enroll in a stand-alone master's degree program after completion of their baccalaureate degree. In addition, staying at CU Boulder to pursue a bachelor's–accelerated master's program enables students to continue working with their established faculty mentors.

BS and MS in Biomedical Engineering

Admission Requirements

In order to gain admission to the BAM program named above, a student must meet the following criteria:

- Have a cumulative GPA of 3.000 or higher.
- Have no MAPS deficiencies (students admitted to CU Boulder prior to Summer 2023 only).
- Have at least junior class standing.
- Have completed all prerequisite courses with a passing grade at the time of admission: BMEN 2000, BMEN 2010 and BMEN 3010.

Program Requirements

Students may take up to and including 12 hours while in the undergraduate program which can later be used toward the master's degree. However, only 6 credits may be double-counted toward the bachelor's degree and the master's degree. Students must maintain a 3.000 GPA while in the BAM program.

Students must apply to graduate with the bachelor's degree and apply to continue with the master's degree early in the semester in which the undergraduate requirements will be completed.