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# **BIOMEDICAL ENGINEERING UNDERGRADUATE PROGRAM HANDBOOK**

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UNIVERSITY OF COLORADO, BOULDER

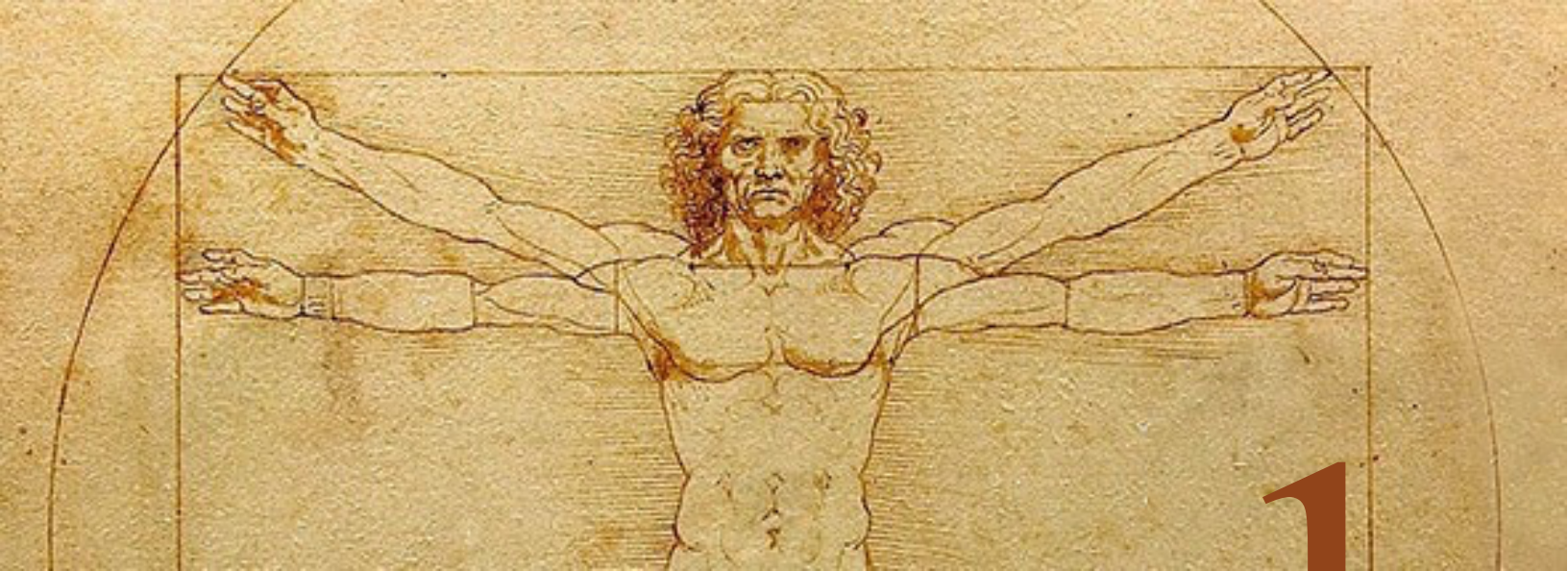
2024 - 2025 ACADEMIC YEAR

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## CONTENTS

<b>1</b>	<b>UNDERGRADUATE PROGRAM OVERVIEW.....</b>	<b>4</b>
1.1	Program Mission Statement .....	4
1.2	What is Biomedical Engineering? .....	4
1.3	Program Outcomes and Objectives .....	4
1.4	Differences Between Engineering Fields .....	4
1.5	Using this Handbook .....	5
1.6	Contact Information .....	5
<b>2</b>	<b>ACADEMIC ADVISING .....</b>	<b>6</b>
2.1	Overview .....	6
2.2	Student Responsibilities .....	6
2.3	Academic Advisor Responsibilities .....	6
2.4	Degree Planning Considerations .....	7
2.5	Change of Major.....	7
2.6	Intra-University Transfer.....	7
<b>3</b>	<b>CURRICULUM .....</b>	<b>8</b>
3.1	Overview and Learning Objectives.....	8
3.2	Tracks .....	8
3.3	Degree Plans.....	9
3.4	Curriculum Flowcharts.....	12
<b>4</b>	<b>CAREER PLANNING RESOURCES .....</b>	<b>15</b>
4.1	ProReady .....	15
4.2	Career Services.....	15
4.3	Internships .....	15
4.4	Co-ops .....	15
<b>5</b>	<b>ACADEMIC EXPECTATIONS.....</b>	<b>16</b>
5.1	Course Catalog .....	16
5.2	Pre-requisites, Co-requisites, and Passing Grades .....	16
5.3	Course Repetition .....	16
5.4	Grade Replacement .....	16
5.5	Incomplete Grades.....	17
5.6	Graduation Requirements.....	17
5.7	Technical Electives.....	17
5.8	Independent Study .....	17

5.8.1	Guidelines for Independent Study.....	18
5.8.2	Requirements .....	18
5.8.3	Enrollment Procedure .....	18
5.9	General Education Requirements .....	18
5.10	MAPS Requirements .....	19
5.11	Minors .....	19
5.12	Course Substitutions .....	20
5.13	AP & IB Credit.....	21
5.14	Math Placement .....	21
5.15	Chemistry Placement.....	21
5.16	Transfer Credit .....	21
5.17	Petitions .....	22
<b>6</b>	<b>STUDENT EXPERIENCE .....</b>	<b>23</b>
6.1	Student Organizations .....	23
6.2	Center for Student Involvement .....	23
6.3	Undergraduate Research.....	23
6.4	Discovery Learning Apprenticeships .....	24
6.5	Summer Program for Undergraduate Research .....	24
6.6	Double Degrees .....	24
6.7	Bachelor's-Accelerated Master's .....	24
6.8	Education Abroad.....	24
<b>7</b>	<b>POLICIES &amp; RESOURCES .....</b>	<b>25</b>
7.1	Student Expectations and Policies.....	25
7.2	Mental Health and Other Campus Resources.....	25
7.3	Problematic Language, Behavior, and Discrimination .....	26
7.4	Discrimination and Harassment Policy .....	26
7.5	Discrimination and Harassment Policy .....	26
7.6	Student Conduct .....	26
7.7	Classroom Behavior Policy .....	27
7.8	Academic Calendar and Registration Deadlines .....	27
7.9	Deadlines.....	27
7.10	Adding and Dropping Courses .....	27
7.11	Helpful Links.....	28



# 1 UNDERGRADUATE PROGRAM OVERVIEW

## 1.1 Program Mission Statement

The Biomedical Engineering Program at CU Boulder is building on strengths in biomechanics and mechanobiology; medical devices; imaging and diagnostics; and therapeutics to create a nationally recognized educational and research program that attracts top students and faculty to the growing Colorado biomedical technology ecosystem.

## 1.2 What is Biomedical Engineering?

Biomedical engineering is an interdisciplinary program that integrates skills and expertise in biomedicine, mechanics, electronics, materials and engineering design. Our graduates will be versatile problem-solvers who succeed as researchers, consultants, entrepreneurs, medical doctors and engineers in the med-tech field and beyond.

## 1.3 Program Outcomes and Objectives

The program provides both breadth and depth across the range of engineering and science topics consistent with standard biomedical engineering educational objectives and student outcomes, including the following experiences:

- Applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics
- Solving biomedical engineering problems, including those associated with the interaction between living and non-living systems
- Analyzing, modeling, designing, and realizing biomedical engineering devices, systems, components, or processes
- Making measurements on and interpreting data from living systems.

## 1.4 Differences Between Engineering Fields

At CU Boulder, we have majors in Biomedical Engineering (BME) and Chemical and Biological Engineering (ChBE). So, what's the difference? BME is a broader discipline that focuses more narrowly on medical technology. The BME curriculum draws from courses in chemical engineering, electrical engineering and mechanical engineering for a truly interdisciplinary degree. Thus, BME students learn to make chemical



measurements and solutions, to rapid prototype mechanical components with computer-aided design and fabrication, and to build electrical circuits. BME focuses on technologies that are employed in the hospital setting, such as the prosthetic hand, artificial heart, magnetic resonance imaging scanner or focused ultrasound therapy system. On the other hand, ChBE is a more narrowly focused discipline that applies more broadly to the field of biological engineering. The ChBE curriculum draws heavily from chemical engineering and does not require courses from electrical or mechanical engineering. ChBE applies not only to biomedicine, but also to biofuels, bioremediation and other biotechnologies. Within biomedicine, BME tends to focus more on medical devices, whereas ChBE tends to focus more on pharmaceuticals. However, there is quite a bit of crossover, especially in overlapping areas such as drug delivery, biomaterials, tissue engineering and gene and cell therapy.

## **1.5 Using this Handbook**

This handbook is intended to provide information, policies, and procedures for students enrolled in the Biomedical Engineering (BME) Undergraduate Program at The University of Colorado Boulder. Students will use this handbook in conjunction with Program and University communications to build a plan towards graduation with their academic advisor.

The purpose of this handbook is to assist undergraduate students majoring in Biomedical Engineering (BMEN) to fulfill the curriculum requirements for the Bachelor of Science (BS) degree. These requirements are structured to comply with College of Engineering and Applied Science rules and in alignment with the requirements and rules of the Engineering Accreditation Commission of ABET ([www.abet.org](http://www.abet.org)).

The Undergraduate Program Handbook is available online through the BME website. Students are responsible for reading, understanding, and complying with the policies included in this guide. Student questions or concerns regarding policies and information in the handbook should be brought to their academic advisor for further clarification.

Students are responsible for adherence to the Biomedical engineering (BMEN) curriculum rules and requirements. Students can access the curriculum list and a graphical curriculum plan [here](#). Alternatively, students may elect to follow a personalized revision to the curriculum. When creating a revised or customized degree plan, students are encouraged to work with their academic advisor and should be aware deviation from the planned sequence of courses may result in delayed graduation.

The University of Colorado Boulder, the College of Engineering and Applied Science, and the Biomedical Engineering Program reserve the right to revise information, requirements, policies, rules, and regulations at any time. Whenever changes occur, every effort will be made to notify students who may be impacted.

## **1.6 Contact Information**

The Biomedical Engineering Program is located in the Engineering Center ECNT 116 at CU Boulder, with the following physical, mailing and electronic mailing addresses:

Physical address (map):	Mailing Address:	Email Address:
1095 Regent Drive	521 UCB	<a href="mailto:BMEUndergraduate@Colorado.edu">BMEUndergraduate@Colorado.edu</a>
Boulder, CO 80309	Boulder, CO 80309	

Corey Neu, Program Director: [Corey.Neu@Colorado.edu](mailto:Corey.Neu@Colorado.edu)



## 2 ACADEMIC ADVISING

### 2.1 Overview

Academic advisors work with students to help them navigate their academic journey at the University. Academic advising is a process in which an academic advisor collaborates with students to set goals for their academic, professional, and personal life. Students in the College of Engineering and Applied Science are required to meet with their academic advisor once a semester. Students can schedule an individual appointment with their advisor through [Buff Portal Advising](#), including in the summer semester.

Advisors within the college as well as across the University, will be available for drop-in advising on Mondays from 1:00-3:00pm MT while school is in session. Additional drop-in hours as well as standard individual appointment availability are also available through [Buff Portal Advising](#).

### 2.2 Student Responsibilities

Academic advising is a collaborative process and ultimately students are responsible for their educational experience. Academic advisors want to help students set meaningful goals and provide the support, resources, and guidance to meet them. Students are expected to:

- Check their Colorado.edu email regularly. All official university communication, including contact from academic advising, will be sent to Colorado.edu accounts.
- Be familiar with the course sequencing and requirements in the academic program.
- Familiarize themselves with the academic calendar and deadlines.
- Keep record of their academic progress and goals.
- Bring a list of courses for the upcoming semester to your advising appointment each semester.
- Arrive on time for advising appointments. If students can no longer attend, they are expected to cancel their appointment in a timely manner.
- Understand accuracy for academic plans as this is ultimately their responsibility.

### 2.3 Academic Advisor Responsibilities

Students meet at least once a semester with their academic advisor to discuss academic progress, general well-being, and to remove their academic advising hold. The hold may be one of multiple holds which would prevent students from registering for classes in the upcoming semester. Therefore, it is important for students to be aware of additional holds and work to manage and resolve them before their enrollment date.

The academic advisor will:

- Understand and communicate curriculum, requirements, policies, and procedures.
- Assist students in making course decisions.

- Assist students in creating an educational plan consistent with their goals.
- Be accessible during posted appointment times and by email and/or phone.
- Provide a safe place where students can share thoughts, aspirations, concerns, and interests.
- Provide resources, referrals, and strategies to help students.
- Listen to student concerns and respect a student's individual values and choices.
- Encourage and support students as they gain the skills and knowledge necessary for success.
- Help students find balance with academic, social, and personal activities.

The College of Engineering and Applied Science publishes academic advising expectations [here](#).

## 2.4 Degree Planning Considerations

Many Biomedical engineering courses are offered every semester. Courses offered once per year are indicated as either *Fall only* or *Spring only* on the [curriculum plans](#).

The minimum course load for full-time enrollment is 12 credit hours during the fall and spring semesters and 6 credit hours during the summer semester. The maximum course load is 19 credit hours. Students planning to enroll part-time or exceed the maximum credit hours per semester must submit a [petition](#) to the College. After 18 credit hours, a tuition surcharge is applied.

Students need to be familiar with the pre-requisites and co-requisites within the biomedical engineering program. The [degree audit](#) as well as the [curriculum plans](#) can help students learn about the academic requirements of the program and make plans for future semester. Academic advisors will work with students to help them plan pathways towards graduation taking into account students' individual goals and priorities for their educational experience.

Students interested in a minor, certificate, option, or studying abroad should discuss this with their academic advisors early in the program, when possible. Students may have more flexibility in meeting these academic goals if they start planning early in their undergraduate career.

## 2.5 Change of Major

Degree seeking BS students within the College of Engineering and Applied Science can change majors within the College if they are in good academic standing. Students considering a change of major should first meet with their current academic advisor, and then schedule another meeting with an academic advisor in their desired major. The student will complete the [Change of Major Form](#) which requires signature from both academic advisors. The change can be initiated at any time throughout the semester, though students are encouraged to keep enrollment and registration dates in mind. Many courses within the College of Engineering and Applied Science will have enrollment restriction subject to major, so it benefits the students to change majors as soon as they have made the decision.

## 2.6 Intra-University Transfer

Students outside of the College of Engineering and Applied Science interested in studying engineering can transfer into the College via the Intra-University Transfer (IUT) process. Students meeting all IUT requirements are guaranteed transfer into CEAS.

The online IUT application, current application deadlines and more information, can be found [here](#).





## 3 CURRICULUM

### 7.1 Overview and Learning Objectives

Biomedical Engineering is an interdisciplinary program that integrates skills and expertise in biomedicine, mechanics, electronics, materials and engineering design. Our graduates will be versatile problem-solvers who succeed as researchers, consultants, entrepreneurs, medical doctors and engineers in the med-tech field and beyond.

### 3.2 Tracks

Students follow one of three paths:

- **Industry/graduate track:** For students who are interested in pursuing a career in industry or graduate school (research or academia).
- **Pre-medical track, biomechanics option:** Biomechanics is the study of the structure, function and motion of the mechanical aspects of biological systems, at any level from whole organisms to organs, cells and molecules, using the methods of mechanics. Biomechanics draws from the traditional engineering discipline of mechanical engineering.
- **Pre-medical track, bioinstrumentations option:** Bioinstrumentation is an application of biomedical engineering, which focuses on devices used to measure, evaluate and treat biological systems. Examples include biosensors and imaging systems. Bioinstrumentation draws from the traditional engineering discipline of electrical engineering. You may wish to take the bioinstrumentation track if you are interested in medical devices, such as biosensors and imaging systems, or robotic surgical tools. You may find bioinstrumentation interesting if you want to learn more about the electrical interaction of surgical tools with tissue, methods to image the engineered tissues post-translation, or the rapidly developing field of neurobiology.



### 3.3 Degree Plans

All plans can be completed in 4 years and require the same number of credit hours. Plans can vary depending on program year.

#### Industry/Graduate Curriculum

For students who are interested in pursuing a career in industry or graduate school (research or academia).

<b>Freshman Year Fall</b>	<b>15</b>	<b>Freshman Year Spring</b>	<b>15</b>
APPM 1350: Calc 1 for Engineers	4	APPM 1360: Calc 2 for Engineers	4
BMEN 1025: CAD/Fab	4	BMEN 1000: Explore BME	1
CHEN 1201: Gen Chem 1 for Eng	4	CHEM 1221: Gen Chem Lab for Eng	1
BIEN 2810: Bio for Engineers	3	CHEN 1203: Gen Chem 2 for Eng	2
		PHYS 1110: Physics 1	4
		CHEN 1310: Intro to Eng Computing	3

<b>Sophomore Year Fall</b>	<b>17</b>	<b>Sophomore Year Spring</b>	<b>17</b>
APPM 2350 Calc 3 for Engineers	4	APPM 2360 Diff Eq w/Linear Alg	4
BMEN 2100: Biomed Prin. & Meth.	3	BMEN 2010: Biomaterials	3
**H&SS Elective	3	ECEN 2250: Circuits & Electronics	3
**H&SS Elective	3	MCEN 2023: Statics & Structures	3
PHYS 1120 Physics 2	4	PHYS 1140: Exp. Physics	1
		**H&SS Elective	3

<b>Junior Year Fall</b>	<b>15</b>	<b>Junior Year Spring</b>	<b>18</b>
BMEN 3010: Biotransport	3	BMEN 3030: Bioinstrumentation	3
ECEN 2260: Circuits as Systems	3	ECEN 3301: Biomed Signals & Sys.	3
ECEN 2270: Electronics Lab	3	MCEN 4133: Biomechanics	3
MCEN 2063: Mechanics of Solids	3	^^Technical Elective	3
^^Technical Elective	3	**H&SS Elective	3
		Free Elective	3

<b>Senior Year Fall</b>	<b>15</b>	<b>Senior Year Spring</b>	<b>16</b>
BMEN 4010: BME Design 1	3	BMEN 4020: BME Design 2	3
BMEN 4117: Anatomy & Physiology	3	^^Focus Technical Elective	3
CHEN 3010: Applied Data Analysis	3	^^Technical Elective	3
^^Technical Elective	3	**H&SS Elective	3
**College-Approved Writing	3	Free Elective	4

^^Choose 15 credit hours of technical elective coursework (at least 12 must be upper-division- 6 of which must be BME-Approved Engineering technical electives with 3 credits from the approved focus technical elective list). Approved Technical Electives can be found on the [BME Website](#).

\*\*When selecting H&SS electives and the College-Approved Writing Course, consult the [College's degree requirements](#).

## Pre-Med Biomechanics Track

For those who are interested in human motion, performance, disabilities, prosthetics or orthopedics. Students may find biomechanics interesting if they want to learn more about the mechanical interaction of surgical tools with tissue, the impact of mechanical stimulation on engineered tissues, or the rapidly developing field of mechanobiology.

Freshman Year Fall	16	Freshman Year Spring	17
APPM 1350: Calc 1 for Engineers	4	APPM 1360: Calc 2 for Engineers	4
BMEN 1025: CAD/Fab	4	BMEN 1000: Explore BME	1
CHEN 1201: Gen Chem 1 for Eng	4	CHEM 1133: Gen Chem 2	4
CHEM 1114: Gen Chem 1 Lab	1	CHEM 1134: Gen Chem 2 Lab	1
MCDB 1150: Intro to Cellular and	3	PHYS 1110: Physics 1	4
		CHEN 1310: Intro to Eng Computing	3

Sophomore Year Fall	15	Sophomore Year Spring	17
APPM 2350 Calc 3 for Engineers	4	APPM 2360 Diff Eq w/Linear Alg	4
BMEN 2100: Biomed Prin & Meth	3	BMEN 2010: Biomaterials	3
**H&SS Elective	3	CHEM 3311 Organic Chem 1	4
PHYS 1120 Physics 2	4	CHEM 3321 Organic Chem 1 Lab	1
PHYS 1140: Exp. Physics	1	MCDB 1161: Phage Genomics Lab 1	2
		MCEN 2023: Statics & Structures	3

Junior Year Fall	17	Junior Year Spring	16
BMEN 3010: Biotransport	3	MCEN 3017 Circuits & Electronics	3
CHEM 3331 Organic Chem 2	4	BCHM 4611: Biochemistry	3
CHEM 3341 Organic Chem 2 Lab	1	MCEN 4133: Tissue Biomechanics	3
MCEN 2063: Mechanics of Solids	3	**H&SS Elective	3
^^Technical Elective	3	**H&SS Elective	3
**H&SS Elective	3	Free Elective	1

Senior Year Fall	15	Senior Year Spring	15
BMEN 4010: BME Design 1	3	MCDB 2150: Principles of Genetics	3
BMEN 4117: Anatomy & Physiology	3	BMEN 4020: BME Design 2	3
CHEN 3010: Applied Data Analysis	3	^^Focus Technical Elective	3
^^Technical Elective	3	^^Technical Elective	3
**College-Approved Writing	3	**H&SS Elective	3

^^ The Pre-Med Biomechanics Track requires a total of 12 Technical Elective credits, 9 must be upper division, and 12 must be BME-Approved Engineering Technical Electives with 3 credits from the approved focus technical elective list. Approved Technical Electives can be found on the [BME Website](#).

\*\*When selecting H&SS electives and the College-Approved Writing Course, consult the [College's degree requirements](#).

## Pre-Med Bioinstrumentation Track

For those who are interested in medical devices, such as biosensors and imaging systems, or robotic surgical tools. They may find bioinstrumentation interesting if they want to learn more about the electrical interaction of surgical tools with tissue, methods to image the engineered tissues post-translation, or the rapidly developing field of neurobiology.

Freshman Year Fall	16	Freshman Year Spring	17
APPM 1350: Calc 1 for Engineers	4	APPM 1360: Calc 2 for Engineers	4
BMEN 1025: CAD/Fab	4	BMEN 1000: Explore BME	1
CHEN 1201: Gen Chem 1 for Eng	4	CHEM 1133: Gen Chem 2	4
CHEM 1114: Gen Chem 1 Lab	1	CHEM 1134: Gen Chem 2 Lab	1
MCDB 1150: Intro to Cellular and	3	PHYS 1110: Physics 1	4
		CHEN 1310: Intro to Eng Computing	3

Sophomore Year Fall	18	Sophomore Year Spring	17
APPM 2350 Calc 3 for Engineers	4	APPM 2360 Diff Eq w/Linear Alg	4
BMEN 2100: Biomed Prin & Meth	3	BMEN 2010: Biomaterials	3
**H&SS Elective	3	CHEM 3311 Organic Chem 1	4
**H&SS Elective	3	CHEM 3321 Organic Chem 1 Lab	1
PHYS 1120 Physics 2	4	ECEN 2250: Circuits & Electronics	3
PHYS 1140: Exp. Physics	1	MCDB 1161: Phage Genomics Lab 1	2

Junior Year Fall	15	Junior Year Spring	15
BMEN 3010: Biotransport	3	BMEN 3030: Bioinstrumentation	3
CHEM 3331 Organic Chem 2	4	ECEN 3301: Biomedical Signals and	3
CHEM 3341 Organic Chem 2 Lab	1	BCHM 4611: Biochemistry	3
ECEN 2260: Circuits as Systems	3	**H&SS Elective	3
ECEN 2270: Electronics Design Lab	3	**College-Approved Writing	3
Free Elective	1		

Senior Year Fall	15	Senior Year Spring	15
BMEN 4010: BME Design 1	3	MCDB 2150: Principles of Genetics	3
CHEN 3010: Applied Data Analysis	3	BMEN 4020: BME Design 2	3
^^Technical Elective	3	^^Focus Technical Elective	3
^^Technical Elective	3	**H&SS Elective	3
**H&SS Elective	3	Free Elective	3

^^ The Pre-Med Bioinstrumentation Track requires a total of 9 technical electives, of which at least 6 credits must be upper-division and 6 must be BME-Approved Engineering Technical Elective credits with 3 credits from the approved focus technical elective list.

Approved Technical Electives can be found on the [BME Website](#).

\*\*When selecting H&SS electives and the College-Approved Writing Course, consult the [College's degree requirements](#).

### 3.4 Curriculum Flowcharts

Flowcharts are provided to each student. Occasional changes to course numbers, requisites, etc. may occur after the flowchart has been published. The most updated flowchart is always available from the Undergraduate Academic Advisor or on the [BME website](#).

It is the student's responsibility for tracking their progress on the flowchart and making sure that their degree audit is up to date. Students should contact the Undergraduate Academic Advisor to address any discrepancies in their audit.

Not all classes are offered every semester. Those that are only offered once per year are noted on the flowcharts.

#### Industry/Graduate Curriculum (BMEN)

For students who are interested in pursuing a career in industry or graduate school (research or academia).

## BIOMEDICAL ENGINEERING *INDUSTRY/GRAD SCHOOL* CURRICULUM – FALL 2024

1	<b>BMEN 1025 (4)</b> Computer-Aided Design & Fabrication	<b>CHEN 1201 (4)</b> Gen Chem for Engineers			<b>APPM 1350 (4)</b> Calculus 1 For Engineers	<b>BIEN 2810 (3)</b> Biology for Engineers
2	<b>BMEN 1000 (1)</b> Explore BME Spring Only	<b>CHEN 1203 (2)</b> Gen Chem for Engineers 2 (PR: CHEN 1201 or CHEM 1113) (CR: CHEN 1221)	<b>CHEM 1221 (1)</b> Eng. Gen Chem Lab (PR: CHEN 1201 or CHEM 1113)(CR: CHEN 1201)	<b>PHYS 1110 (4)</b> General Physics 1 (CR: APPM 1350)	<b>APPM 1360 (4)</b> Calculus 2 For Engineers (PR: APPM 1350 or APPM 1345)	<b>CHEN 1310 (3)</b> Intro to Engineering Computing (CR: Calculus 1)
3	<b>BMEN 2100 (3)</b> Biomedical Principles and Methods (PR: BIEN 2810, CHEN 1201)	<b>Humanities &amp; Social Science (3)</b> Lower Division	<b>PHYS 1120 (4)</b> General Physics 2 (PR: PHYS 1110) (CR: APPM 1360)		<b>APPM 2350 (4)</b> Calculus 3 For Engineers (PR: APPM 1360)	<b>Humanities &amp; Social Science (3)</b> Lower Division
4	<b>BMEN 2010 (3)</b> Biomaterials (PR: CHEN 1201) (RPR: CHEN 1203, CHEM 1221) Spring Only	<b>MCEN 2023 (3)</b> Statics & Structures (PR: APPM 1360, PHYS 1110)	<b>PHYS 1140 (1)</b> Experimental Physics (CR: PHYS 1120)	<b>ECEN 2250 (3)</b> Intro to Circuits & Electronics (PR: APPM 1360, PHYS 1120) (CR: APPM 2360 or MATH 3430)	<b>APPM 2360 (4)</b> Linear Algebra & Differential Equations (PR: APPM 1360)	<b>Humanities &amp; Social Science (3)</b> Lower Division
5	<b>BMEN 3010 (3)</b> Biotransport (PR: BMEN 2100, CHEN 1310, PHYS 1110) (CR: APPM 2360) Fall Only	<b>MCEN 2063 (3)</b> Mechanics of Solids (PR: MCEN 2023, APPM 1360)		<b>ECEN 2260 (3)</b> Circuits as Systems (PR: ECEN 2250, APPM 2360)	<b>ECEN 2270 (3)</b> Electronics Design Lab (CR: ECEN 2260)	<b>General Technical Elective (3)</b> Lower or Upper Division
6	<b>BMEN 3030 (3)</b> Bioinstrumentation (PR: BMEN 2100, ECEN 2260, ECEN 2270) Spring Only	<b>MCEN 4133 (3)</b> Intro to Tissue Biomechanics (PR: BMEN 2010, MCEN 2063) Spring Only	<b>General Technical Elective (3)</b> Upper Division	<b>Free Elective (3)</b>	<b>ECEN 3301 (3)</b> Biomedical Signals/Systems (PR: ECEN 2260) Spring Only	<b>Humanities &amp; Social Science (3)</b> Upper Division
7	<b>BMEN 4010 (3)</b> BME Design 1 (PR: BMEN 1025, BMEN 2010, BMEN 3010) (CR: Writing) Fall Only	<b>BMEN 4117 (3)</b> Anatomy & Physiology for Biomedical Engineering (PR: BMEN 2100) (RPR: BMEN 2010, BMEN 3010)	<b>General Technical Elective (3)</b> Upper Division		<b>CHEN 3010 (3)</b> Applied Data Analysis (PR: APPM 2360, CHEN 1310)	<b>Writing Requirement(3)</b>
8	<b>BMEN 4020 (3)</b> BME Design 2 (PR: BMEN 4010) Spring Only	<b>Focus Technical Elective (3)</b> Upper Division	<b>Engineering Technical Elective (3)</b> Upper Division	<b>Free Elective (4)</b>	<b>Humanities &amp; Social Science (3)</b> Upper Division	<b>Example</b> <b>COURSE NUMBER (Cr.)</b> Course Name (PR: Pre-Requisites) (CR: Co-Requisites) (RPR: Recommended Pre-Requisite) (RCR: Recommended Co-Requisite)

Effective: Fall 2024



## Pre-Med Biomechanics Track (BMEN-BMC)

Students may wish to take the biomechanics track if they are interested in human motion, performance, disabilities, prosthetics or orthopedics. Students may find biomechanics interesting if they want to learn more about the mechanical interaction of surgical tools with tissue, the impact of mechanical stimulation on engineered tissues, or the rapidly developing field of mechanobiology.

## BIOMEDICAL ENGINEERING *PRE-MED BIOMECHANICS* CURRICULUM – FALL 2024

1	<b>BMEN 1025 (4)</b> Computer-Aided Design & Fabrication	<b>CHEM 1201 (4)</b> Gen Chem for Engineers (CR: CHEM 1114)	<b>CHEM 1114 (1)</b> Gen Chem 1 Lab (CR: CHEM 1201)		<b>MCDB 1150 (3)</b> Intro to Molecular and Cellular Biology	<b>APPM 1350 (4)</b> Calculus 1 For Engineers
2	<b>BMEN 1000 (1)</b> Explore BME Spring Only	<b>CHEM 1133 (4)</b> Gen Chem 2 (PR: CHEM 1201, CHEM 1114)	<b>CHEM 1134 (1)</b> Gen Chem 2 Lab (PR: CHEM 1201, CHEM 1114) (CR: CHEM 1133)	<b>PHYS 1110 (4)</b> General Physics 1 (CR: APPM 1350)	<b>CHEM 1310 (3)</b> Intro to Engineering Computing (CR: Calculus 1)	<b>APPM 1360 (4)</b> Calculus 2 For Engineers (PR: APPM 1350 or APPM 1345)
3	<b>BMEN 2100 (3)</b> Biomedical Principles and Methods (PR: MCDB 1150, CHEM 1201)	<b>Humanities &amp; Social Science (3)</b> Lower Division	<b>PHYS 1120 (4)</b> General Physics 2 (PR: PHYS 1110) (CR: APPM 1360)	<b>PHYS 1140 (1)</b> Experimental Physics (CR: PHYS 1120)		<b>APPM 2350 (4)</b> Calculus 3 For Engineers (PR: APPM 1360)
4	<b>BMEN 2010 (3)</b> Biomaterials (PR: CHEM 1201) Spring Only	<b>CHEM 3311 (4)</b> Organic Chem 1 (PR: CHEM 1133/1134) (CR: CHEM 3321)	<b>CHEM 3321 (1)</b> Organic Chem 1 Lab (PR: CHEM 1133/1134) (CR: CHEM 3311)	<b>MCDB 1161 (2)</b> Phage Genomics Lab I	<b>MCEN 2023 (3)</b> Statics & Structures (PR: APPM 1360, PHYS 1110)	<b>APPM 2360 (4)</b> Linear Algebra & Differential Equations (PR: APPM 1360)
5	<b>BMEN 3010 (3)</b> Biotransport (PR: BMEN 2100, CHEM 1310, PHYS 1110) (CR: APPM 2360) Fall Only	<b>CHEM 3331 (4)</b> Organic Chem 2 (PR: CHEM 3311/3321) (CR: CHEM 3341)	<b>CHEM 3341 (1)</b> Organic Chem 2 Lab (PR: CHEM 3311/3321) (CR: CHEM 3331)	<b>Engineering Technical Elective (3)</b> Lower or upper Division	<b>MCEN 2063 (3)</b> Mechanics of Solids (PR: MCEN 2023, APPM 1360)	<b>Humanities &amp; Social Science (3)</b> Lower Division
6	<b>Free Elective (1)</b>	<b>BCHM 4611 (3)</b> Principles of Biochemistry (PR: CHEM 3311)	<b>Humanities &amp; Social Science (3)</b> Upper Division	<b>Humanities &amp; Social Science (3)</b> Lower Division	<b>MCEN 4133 (3)</b> Intro to Tissue Biomechanics (PR: BMEN 2010, MCEN 2063) Spring Only	<b>MCEN 3017 (3)</b> Circuits and Electronics for Mech. Engineers (PR: APPM 2360 & PHYS 1120)
7	<b>BMEN 4010 (3)</b> BME Design 1 (PR: BMEN 1025, BMEN 2010, BMEN 3010) (CR: Writing) Fall Only	<b>BMEN 4117 (3)</b> Anatomy & Physiology for Biomedical Engineering (PR: BMEN 2100) (RPR: BMEN 2010, BMEN 3010)	<b>Engineering Technical Elective (3)</b> Upper Division	<b>Writing Requirement(3)</b>		<b>CHEM 3010 (3)</b> Applied Data Analysis (PR: APPM 2360, CHEM 1310)
8	<b>BMEN 4020 (3)</b> BME Design 2 (PR: BMEN 4010) Spring Only	<b>Focus Technical Elective (3)</b> Upper Division	<b>Engineering Technical Elective (3)</b> Upper Division	<b>MCDB 2150 (3)</b> Principles of Genetics (RPR: MCDB 1150)	<b>Humanities &amp; Social Science (3)</b> Upper Division	<b>Example</b> <b>COURSE NUMBER (Cr.)</b> Course Name (PR: Pre-Requisites) (CR: Co-Requisites)

Effective: Fall 2024

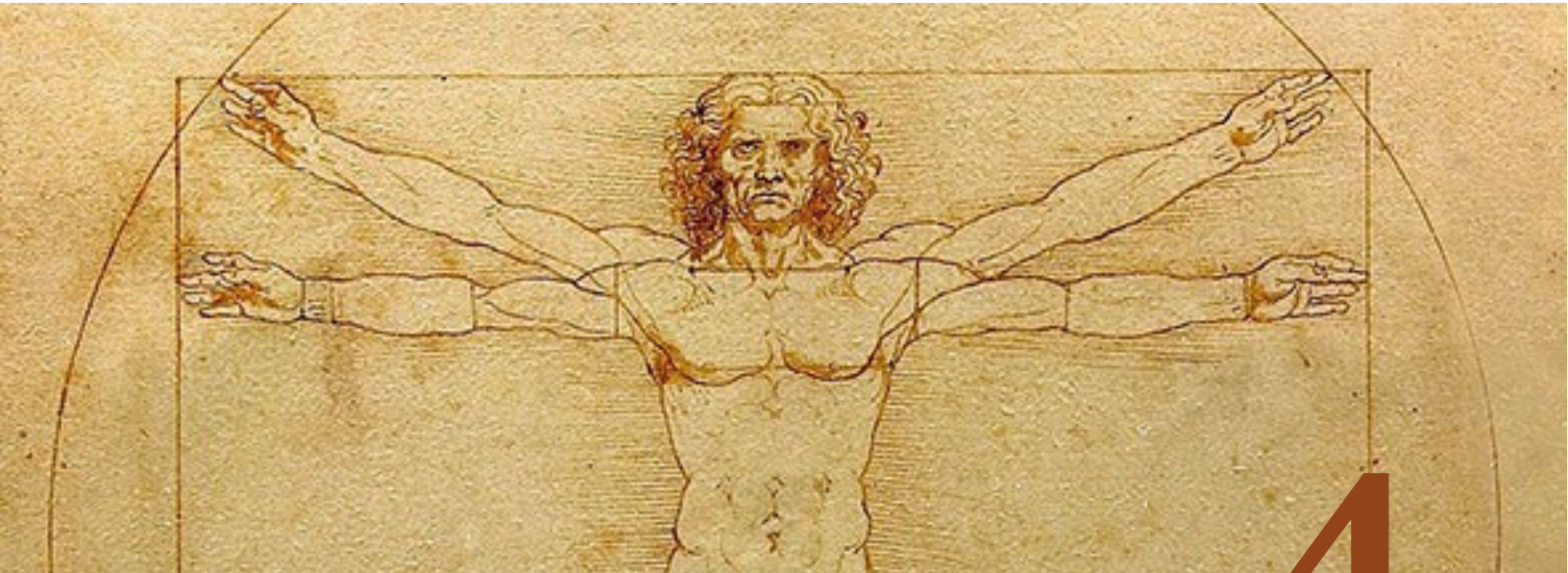
## Pre-Med Bioinstrumentation Track (BMEN-BIN)

Students may wish to take the bioinstrumentation track if they are interested in medical devices, such as biosensors and imaging systems, or robotic surgical tools. They may find bioinstrumentation interesting if they want to learn more about the electrical interaction of surgical tools with tissue, methods to image the engineered tissues post- translation, or the rapidly developing field of neurobiology.

## BIOMEDICAL ENGINEERING *PRE-MED BIOINSTRUMENTATION* CURRICULUM – FALL 2024

1	<b>BMEN 1025 (4)</b> Computer-Aided Design & Fabrication	<b>CHEN 1201 (4)</b> Gen Chem for Engineers (CR: CHEM 1114)	<b>CHEM 1114 (1)</b> Gen Chem 1 Lab (CR: CHEM 1201)		<b>MCDB 1150 (3)</b> Intro to Molecular and Cellular Biology	<b>APPM 1350 (4)</b> Calculus 1 For Engineers
2	<b>BMEN 1000 (1)</b> Explore BME Spring Only	<b>CHEM 1133 (4)</b> Gen Chem 2 (PR: CHEM 1201, CHEM 1114)	<b>CHEM 1134 (1)</b> Gen Chem 2 Lab (PR: CHEM 1201, CHEM 1114) (CR: CHEM 1133)	<b>PHYS 1110 (4)</b> General Physics 1 (CR: APPM 1350)	<b>CHEN 1310 (3)</b> Intro to Engineering Computing (CR: Calculus 1)	<b>APPM 1360 (4)</b> Calculus 2 For Engineers (PR: APPM 1350 or APPM 1345)
3	<b>BMEN 2100 (3)</b> Biomedical Principles and Methods (PR: MCDB 1150, CHEN 1201)	<b>Humanities &amp; Social Science (3)</b> Lower Division	<b>PHYS 1120 (4)</b> General Physics 2 (PR: PHYS 1110) (CR: APPM 1360)	<b>PHYS 1140 (1)</b> Experimental Physics (CR: PHYS 1120)	<b>Humanities &amp; Social Science (3)</b> Lower Division	<b>APPM 2350 (4)</b> Calculus 3 For Engineers (PR: APPM 1360)
4	<b>BMEN 2010 (3)</b> Biomaterials (PR: CHEN 1201) Spring Only	<b>CHEM 3311 (4)</b> Organic Chem 1 (PR: CHEM 1133/1134) (CR: CHEM 3321)	<b>CHEM 3321 (1)</b> Organic Chem 1 Lab (PR: CHEM 1133/1134) (CR: CHEM 3311)	<b>MCDB 1161 (2)</b> Phage Genomics Lab 1I	<b>ECEN 2250 (3)</b> Intro to Circuits & Electronics (PR: APPM 1360, PHYS 1120) (CR: APPM 2360 or MATH 3430)	<b>APPM 2360 (4)</b> Linear Algebra & Differential Equations (PR: APPM 1360)
5	<b>BMEN 3010 (3)</b> Biotransport (PR: BMEN 2100, CHEN 1310, PHYS 1110) (CR: APPM 2360) Fall Only	<b>CHEM 3331 (4)</b> Organic Chem 2 (PR: CHEM 3311/3321) (CR: CHEM 3341)	<b>CHEM 3341 (1)</b> Organic Chem 2 Lab (PR: CHEM 3311/3321) (CR: CHEM 3331)	<b>Free Elective (1)</b>	<b>ECEN 2260 (3)</b> Circuits as Systems (PR: ECEN 2250, APPM 2360)	<b>ECEN 2270 (3)</b> Electronics Design Lab (CR: ECEN 2260)
6	<b>BMEN 3030 (3)</b> Bioinstrumentation (PR: BMEN 2100, ECEN 2260, ECEN 2270) Spring Only	<b>BCHM 4611 (3)</b> Principles of Biochemistry (PR: CHEM 3311)		<b>Humanities &amp; Social Science (3)</b> Lower Division	<b>Writing Requirement (3)</b>	<b>ECEN 3301 (3)</b> Biomedical Signals/Systems (PR: ECEN 2260) Spring Only
7	<b>BMEN 4010 (3)</b> BME Design 1 (PR: BMEN 1025, BMEN 2010, BMEN 3010) (CR: Writing) Fall Only	<b>Engineering Technical Elective (3)</b> Upper Division	<b>General Technical Elective (3)</b> Lower or Upper Division	<b>Humanities &amp; Social Science (3)</b> Upper Division		<b>CHEN 3010 (3)</b> Applied Data Analysis (PR: APPM 2360, CHEN 1310)
8	<b>BMEN 4020 (3)</b> BME Design 2 (PR: BMEN 4010) Spring Only	<b>Focus Technical Elective (3)</b> Upper Division	<b>MCDB 2150 (3)</b> Principles of Genetics (RPR: MCDB 1150)	<b>Humanities &amp; Social Science (3)</b> Upper Division	<b>Free Elective (3)</b>	<b>Example</b> <b>COURSE NUMBER (Cr.)</b> Course Name (PR: Pre-Requisites) (CR: Co-Requisites) (RPR: Recommended Pre-Req)

Effective: Fall 2024



## 4 CAREER PLANNING RESOURCES

### 7.1 ProReady

The goal of the ProReady initiative is to provide CU Boulder engineering students with an easy and flexible formula for career success. The ProReady [website](#) connects students to resources, experiences, networks, and events from across the College. Students are encouraged to chart their career path, gain relevant experience, and grow their professional network.

### 4.2 Career Services

Students in the Department have access to career services at two different levels: university career services and CEAS career services. Career Services can help students and alumni clarify career interests, values and work-related skills; explore potential careers and employers; and refine job seeking, interviewing, and resume preparation skills. They host Career Fairs and Internship Fairs, sponsor resume writing workshops, and hold mock interview sessions. Career Services is located in the Center for Community (C4C). More information regarding access to Engineering Career Services can be found [here](#).

### 4.3 Internships

Internships play a significant role in linking students with prospective employers, with as many as half of the internships held by senior engineering students leading to job offers. Internships enhance academic studies and/or career interests. Internships are promoted throughout the year, with a specific push toward summer work experience. Internship fairs are usually held in mid-October and mid-March every year. BME students can earn [Internship for Credit](#) (six hours max) to be used as technical elective credit. When applying for credit, students must provide sufficient information about the engineering/technical nature of their position and duties.

### 4.4 Co-ops

The Engineering Cooperative Education (Co-op) Program at CU Boulder, a professional development program, allows undergraduates to have a year-round schedule that alternates professional work experiences with class-room coursework. The Co-op Program can provide as much as two years of direct professional development within a five-year bachelor's degree program. Students who participate in co-ops are better prepared to enter the work force and often continue their employment with their co-op employer after graduation. Co-op experiences are paid and result in academic credit. A maximum of 3 credits from a registered co-op experience can be applied to the degree as free elective credit. Co-op students receive an official entry on their transcript for each co-op experience.





## 5 Academic Expectations

### 5.1 Course Catalog

The [course catalog](#) is updated every academic year and provides a summary of campus offerings, policies and requirements; descriptions of colleges, schools and departments/programs; and degree requirements, course descriptions and faculty listings. Students should refer to the degree, major, minor and certificate requirements listed at the time they formally enter a program.

### 5.2 Pre-requisites, Co-requisites, and Passing Grades

The minimum passing grade for a prerequisite or co-requisite course within the biomedical engineering curriculum is a C-. This requirement includes courses completed in another program or department (APPM, PHYS, etc.). However, if a course taught in another program or department is a co-requisite/pre-requisite for a course in the biomedical curriculum that requires a minimum passing grade of C or higher its co-requisite/prerequisite courses, then this higher requirement applies to biomedical engineering students. The minimum passing grade for standalone classes is a D-. Pass/Fail is only permitted for BMEN 1000 and Free Elective credits.

If the minimum required grade in a prerequisite course is not achieved, the student is required to repeat the course until the minimum acceptable grade has been earned (maximum of 3 attempts total). If a student takes the advanced (post-requisite) course, it does not remove the obligation to meet the prerequisite course minimum grade requirement, even if the grade earned in the advanced course is acceptable.

### 5.3 Course Repetition

The BME Program permits three graded course attempts. Students who fail to complete a course with the minimum grade required after three attempts will be required to change their major from biomedical engineering. W grades from withdrawn courses do not account as an attempt.

### 5.4 Grade Replacement

A student who receives a grade of C- or lower can retake the course for grade replacement. Full details and requirements are available on the [registrar website](#). This does not impact program policy regarding the number of course attempts permitted.



## 5.5 Incomplete Grades

To receive an Incomplete (temporary grade of I), the student must receive the consent of the instructor and be able to demonstrate that for documented reasons beyond the student's control, the student was unable to complete course requirements during the semester enrolled. The student must submit a [CEAS Incomplete Grade Form](#). Students are given one academic year to complete the requirements for the course and receive a letter grade. After one academic year, the incomplete grade automatically changes to an F.

## 5.6 Graduation Requirements

Failure to complete the requirements listed below will postpone graduation. Any exceptions will require authorization from the Biomedical Engineering Program and the Dean's Office. Students should continue meeting with their advisor at least once a semester, including the semester they intend to graduate, to review their academic record and progress. It is the student's responsibility to be certain all degree requirements have been met, apply to graduate, complete the online diploma card, and to keep their advisor and the Dean's Office informed of any changes in graduation plans.

To be eligible to graduate, students must meet the following minimum requirements:

- The satisfactory completion of the prescribed and elective work in the BMEN BS curriculum. A student must complete a minimum number of 128 credit hours. The last 45 credit hours of the 128 credit hours required for the BS degree must be earned via CU Boulder coursework only and while rostered in the College of Engineering and Applied Science.
- Maintain minimum Cumulative GPA and Major GPA of 2.000 for all courses attempted and for all courses counting toward graduation requirements.
- Successful completion of all Minimum Academic Preparation Standards ([MAPS](#)) requirements.
- Submission of a completed online Application for Diploma Form.
- Complete the College of Engineering and Applied Sciences Senior Survey.

Double degree students must obtain approval of both designated departments and colleges. The University requires a minimum of 30 additional credit hours be earned for the second degree outside of engineering or 15 credits for a second degree within engineering. Both degree requirements must be completed.

## 5.7 Technical Electives

Technical electives allow students to explore advanced concepts within the engineering discipline as preparation for their future career. A technical elective is usually a course in engineering or science with technical content selected using the approved courses on the BME website as a guide. Pre-med students need to consult with their advisor before taking any courses outside of engineering. If students are interested in taking a course not already approved, they may submit a petition for the course to be reviewed by the Department's Undergraduate Committee.

The goal of the requirement is to allow students to expand their field of knowledge and complement their degree. Students are encouraged to be strategic when selecting technical electives. For example, a student might choose to satisfy their Gen Tech Electives with courses in a specific subject like applied math or computer science. Not every elective is offered every semester. Many courses are offered only in the fall or the spring.

## 5.8 Independent Study

Independent Study is an opportunity for students to earn academic credit for learning outside the formal class structure, under the individual direction of a faculty member. Independent Study is provided to fill an academic need of importance to the student that cannot be filled by the regular curriculum. An Independent Study requires a high level of self-directed learning.

Undergraduate students can apply up to 6 hours of Independent Study towards their degree. Student may use approved Independent Study credit towards Tech Electives or Free Electives. If an Independent Study is supervised by a faculty member outside of the Department, then the course would apply to the degree as a Gen Tech Elective.

To pursue an Independent Study, an [Independent Study Agreement Form](#) must be completed and signed by both the student and the sponsor of the Independent Study. Students should be familiar with the policies associated with the Independent Study Agreement.

### 5.8.1 Guidelines for Independent Study

A number of activities are specifically prohibited as Independent Study work. Included here are such activities as internships, volunteer or paid work in a university department, volunteer work of other kinds, work in a business, extra work in a class, and work completed elsewhere. Independent Study cannot substitute for a regular course offering. Independent Study will normally consist of directed research which leads to the preparation of a substantive presentation of findings, usually in the form of a written paper or report. Any variation on this format must be approved by the Department's Undergraduate Committee.

### 5.8.2 Requirements

The following minimum criteria must be met to ensure the overall outcomes of the educational experience, the success of the students, and compliance with accreditation standards. The Independent Study must:

- Include comprehensive objectives in a written form.
- Demonstrate the relevance and appropriateness to the program outcomes.
- Promote a high level of self-directed learning.
- Engage students to interact with the instructor throughout the course.

### 5.8.3 Enrollment Procedure

The student will develop a plan or idea for the Independent Study and will work with the supervising faculty member to determine the feasibility of the proposed course. The Independent Study may not be done retroactively. The agreement for Independent Study is to be completed, signed, and approved by all parties prior to the initiation of the project, and no later than one week prior to the end of the registration period.

The student and the faculty member will complete the [Independent Study Agreement Form](#) including, but not limited to, the following information:

- Course description and area of study, including the number of credits to be issued (1 credit hour is approximately equal to 40 clock hours of proposed independent study activity per semester).
- Learning objectives and outcomes.
- Approach to be used (directed reading, instructions and supervision, and/or lab experience, exercises and projects, etc.)
- Information on textbooks, references, and reading materials.
- Means of communication between student and faculty member throughout the course of independent study.
- Means of evaluation (one or more), typically consisting of a tangible product such as a project, presentation, written review of the literature, homework assignments or exams.
- Guidelines, schedules, benchmarks and/or milestones, or weekly task breakdowns throughout the semester

Upon approval of the Independent Study by the Department's Undergraduate Committee, the undergraduate advisor or administration support will help the student add the course to their schedule.

## 5.9 General Education Requirements

In addition to the math, physics, and engineering courses comprising the undergraduate degree in biomedical engineering, students must fulfill additional requirements intended to provide a holistic education. Students may benefit by creating a cohesive plan for these requirements combining both breadth and depth. Students are advised to consider their interests. They may decide to concentrate many of their general education requirements in one external department or decide to work towards a certificate or minor.

### Humanities & Social Science Requirements

Students are required to complete 18 hours of humanities, social science, and writing as part of the general education requirements within the College. Students require three lower-division humanities & social science courses (or 9 hours) in addition to two upper-division humanities & social science courses (or 6 hours). Students have multiple course options to fulfill these requirements. Details regarding qualifying classes and how to search for them when

enrolling can be found [here](#).

Students with AP/IB credit or community college transfer credit may satisfy lower-division requirements for humanities & social science credit but will need to fulfill the remaining upper-division credit.

### **Writing Requirement**

The College has the following options to fulfill writing requirements:

- ENES 1010 (freshmen only), ENES 3100
- WRTG 3030, WRTG 3035
- PHYS 3050
- ENLP 3100 (previous success in an ENLP course highly recommended)

### **Free Electives**

Free elective credit can be met a number of different ways to satisfy degree requirements. If a student has transfer credit not applied elsewhere in the degree, either from another institution or from AP/IB credit, these credit hours can meet requirements for free electives. A student may have additional hours which can be applied from course substitutions or seminars. Students can also enroll in any kind of course on campus to fulfill free elective requirements. Students should talk with their academic advisor to discuss the most efficient way to meet free elective requirements.

## **5.10 MAPS Requirements**

Minimum Academic Preparation Standards, or MAPS, are required for all domestic students and any international students who have completed more than four semesters of U.S. schooling. MAPS content areas are usually fulfilled by high school coursework, but sometimes students must address "MAPS deficiencies" with their college coursework. Typically, one unit equals one year of high school study or one semester of college coursework (see specifications for MAPS Foreign Language category, below).

For engineering students, those who experience a MAPS deficiency most often need to take additional foreign language courses and/or social science courses. These courses can do "double duty" by fulfilling MAPS as well as humanities & social sciences requirements. Students should talk with their academic advisor about MAPS and develop a plan early to remedy any deficiencies. Courses taken to fulfill a MAPS requirement may not be taken on a Pass/Fail basis per campus MAPS policies.

For foreign language MAPS requirements, students are required to have 2 units in a single foreign language. Students must demonstrate written and oral language proficiency through the second-level of a single foreign language which means two full years of high school or two semester college courses (e.g., SPAN 1010: Beginning Spanish 1 and SPAN 1020: Beginning Spanish 2).

For students working on a sequence of foreign language courses to satisfy MAPS, the courses must be taken for a letter grade. The minimum grade for pre-requisite courses is C-, but the terminal course (e.g., SPAN 1020, which is second semester Spanish at CU Boulder) can be a grade of D-. If a student petitions and is approved to complete their MAPS coursework elsewhere, the terminal course (e.g., SPA 112 at Front Range Community College) grade may be D-. The course would not transfer if the grade is lower than C-, but the student can send their official transcript to CU Boulder Admissions Office for the purposes of satisfying MAPS foreign language requirement.

## **5.11 Minors**

Biomedical engineering students have access to multiple minors which align well with the required curriculum. Numerous minor opportunities exist satisfying humanities/social science electives and/or technical electives. Many minors require few additional courses beyond the standard BS requirements. Common minors completed by biomedical engineering students are listed below.

- [Applied Math Minor](#)
- [Biochemistry Minor](#)
- [Business Minor](#)
- [Computer Science Minor](#)
- [Engineering Entrepreneurship Minor](#)

- [Engineering Management Minor](#)
- [Electrical Engineering Minor](#)
- [Global Engineering Minor](#)

Information regarding specifics for each minor, as well as additional minor options, can be found [here](#). Students may choose to complete a minor offered outside of the College of Engineering and Applied Science, though it will likely have less coursework overlap with the biomedical engineering major. In order to declare a minor, students must meet with their academic advisor, the academic advisor for the minor, and complete the [Change of Major Form](#) for minors within the College of Engineering and Applied Science.

## 5.12 Course Substitutions

In some situations, students may consider a course substitution from another department to satisfy degree requirements. The preference is always for students to take courses through biomedical engineering, though these alternatives may help students in difficult scheduling and long-term planning situations. Please consult with an advisor before enrolling in a substitute course. While some substitutes are almost identical to the BMEN version, others are only appropriate for students pursuing a specific minor or option track.

- Core Class: APPM 1350
  - Accepted Substitute: MATH 1300, APPM 1345
- Core Class: APPM 1360
  - Accepted Substitute: MATH 2300
- Core Class: APPM 2350
  - Accepted Substitutes: MATH 2400
- Core Class: APPM 2360
  - Accepted Substitutes: MATH 2130 and MATH 3430
- Core Class: BMEN 1025
  - Accepted Substitutes: MCEN 1025, GEEN 1017 and BMEN 1035
- Core Class: BMEN 4117
  - Accepted Substitutes: BMEN 5117, MCEN 4117/5117, or IPHY 3410 and IPHY 3430
- Core class: CHEM 1221
  - Accepted Substitutes: CHEM 1114, CHEM 1134
- Core class: CHEN 1201
  - Accepted Substitutes: CHEN 1211 (CHEM 1113/1400 approved for transfer students)
- Core class: CHEN 1203
  - Accepted Substitutes: CHEN 1211 (CHEM 1133 approved for transfer students)
- Core Class: CHEN 1310
  - Accepted Substitutes: CSCI 1300 (CS Minors only), (ASEN 1320, CSCI 1320 approved for transfer students)
- Core class: BIEN 2810
  - Accepted Substitutes: MCDB 1150, EBIO 1210 and EBIO 1220
- Core Class: CHEN 3010
  - Accepted Substitutes: STAT 4000 (CS Minors only)
- Core class: ECEN 2250
  - Accepted Substitutes: ECEN 3010, GEEN 3010
- Core class: ECEN 3301
  - Accepted Substitutes: ECEN 3300
- Core class: MCEN 2023
  - Accepted Substitutes: GEEN 2851, CVEN 2121
- Core class: MCEN 2063
  - Accepted Substitutes: CVEN 3161



### 5.13 AP & IB Credit

For most students, the allocation of their AP (Advanced Placement) & IB (International Baccalaureate) credit is available in the degree audit after CU Boulder has received their test scores. Within the degree audit, students may see their AP & IB credit applied to sections within the degree such as "Humanities & Social Sciences" or "Mathematics". AP & IB credit cannot satisfy the upper-division humanities & social sciences credit for the degree. A more comprehensive list of AP & IB credit can be found at the bottom of the degree audit in "Coursework History" or in the "Transfer Evaluations" tab at the top of the degree audit. If a student does not see a particular AP & IB credit applied in the degree audit, although other AP & IB credit is applied, this may indicate the student did not receive a high enough score on the exam. Scores for each AP & IB course received by the University are available in the "Transfer Evaluations" tab. If a student has questions or concerns regarding their AP & IB credit, they can discuss this with their academic advisor. For more information regarding AP & IB credit, please review the [University course catalog](#).

### 5.14 Math Placement

Incoming freshmen are placed into their first math course based on a placement exam, and data including the admission application, high school transcripts, and previous CU Boulder coursework, if any. Students who do not start in Calculus 1 their first semester will not be able to follow the standard BME graduation plan, as they will not have the prerequisites to take all courses in the semesters shown. These students are encouraged to complete Calculus 2 during the summer after their freshman year in order to stay on schedule with the standard flowchart.

Students who cannot take Calculus 2 during the summer session will need to follow a modified degree plan. While students following this modified plan may still be able to graduate in four years, please note that the four-year guarantee does not apply. The Program will make every effort to avoid course conflicts for students following the modified plan but cannot guarantee that students will never encounter conflicts.

### 5.15 Chemistry Placement

Standard/Industry track students with AP/IB chemistry credit or who take a chemistry placement exam can opt to take the accelerated chemistry course (CHEN 1211). Students should consult the Undergraduate Academic Advisor to see how this impacts their graduation requirements. **Pre-Med students should not take CHEN 1211** and should take both General Chemistry 1 & 2 rather than take accelerated Chemistry.

### 5.16 Transfer Credit

Students may enter the Program with transfer credit or have an interest in taking summer courses at a different institution. Regardless, it is important to understand the difference between transferability and applicability. Due to the specialized nature of an engineering degree, some credit may transfer to the University and be accepted as credit but may not apply to the degree requirements.

The initial transfer credit evaluation is performed by the Office of Admissions upon receiving an official transcript directly from the institution where the credit was earned. After the Office of Admissions has completed their evaluation, the student's major department can indicate the specific courses applying to the student's major. The Office of Admissions may accept credits, though this does not mean the major department will utilize that credit towards degree requirements. The Office of Admissions will not accept coursework in which the student received a non-letter grade or a grade lower than a "C-". Credits from an Engineering Technology program will not transfer. It is the academic policy of this College that credits accrued in the official records of a student that were awarded for work or co-op experience do not apply toward degree requirements.

Accepted transfer students are advised to contact their major department about applicability of their transfer credits towards degree requirements before registering for courses. Students should log onto [Buff Portal](#) to run a degree audit to review how their courses transfer and to guide their conversation with their academic advisor.

Students may use [Transferology](#) as a resource when determining applicability of transfer credit. This resource can also be helpful for students planning to take a course outside of CU Boulder. If [Transferology](#) does not show equivalency information for a particular course, the student can submit a request for review through the [CEAS Transfer Credit Review Form](#). For courses offered outside of the College of Engineering and Applied Science (math, physics, chemistry, etc.), students can submit a request [Transfer Credit Review](#) through the College of Arts & Sciences.

Due to the [In-Residence Credit Requirement](#), students are not permitted to take a course outside the University within 45 credit hours of graduation. If a student seeks to take a course outside CU Boulder within the last 45 credit hours of their degree, the student should consult with their academic advisor to see if other options exist or if they should submit a petition.

Credit hours required for graduation earned more than ten years prior to transferring into an undergraduate degree program at CU Boulder may not apply to the completion of the student's graduation requirements.

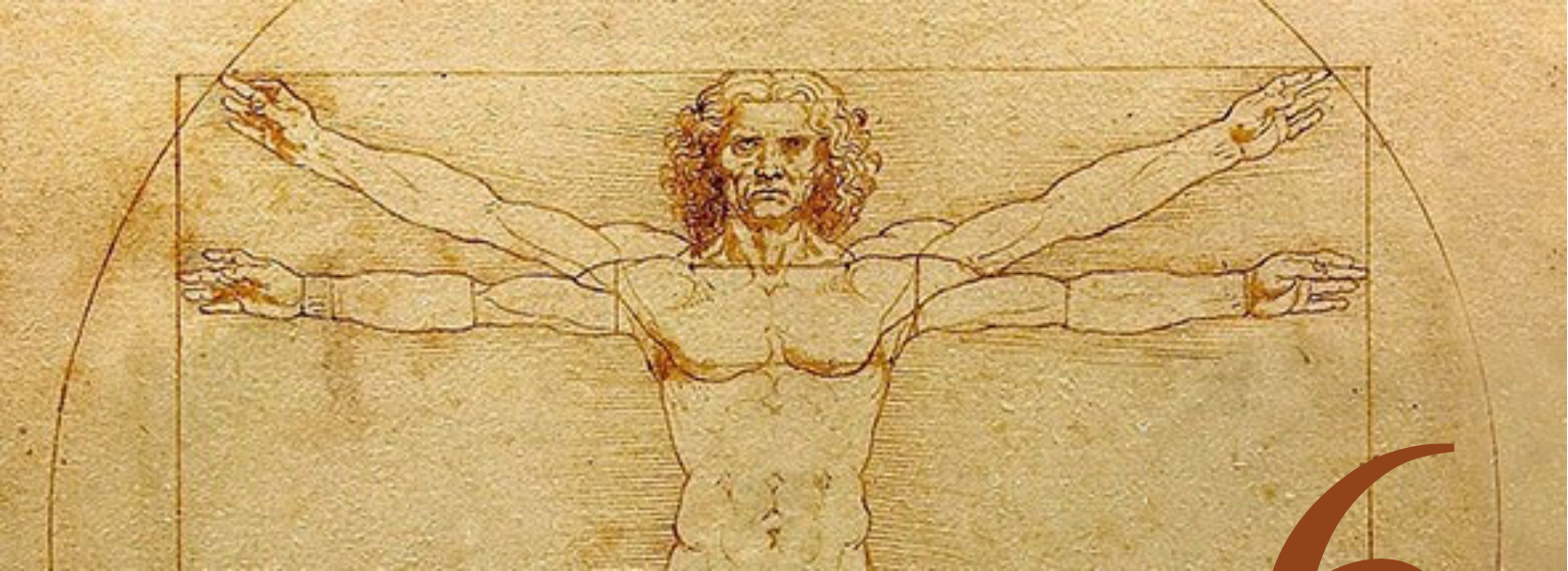
*\*Due to the impact of COVID-19 on grading at some institutions, students may need to provide additional grading information for courses taken for a non-letter grade (pass/fail or satisfactory/unsatisfactory). Students with transfer credit lacking a letter grade from the Spring 2020 semester, or subsequent semester due to COVID-19 policy changes, should contact their academic advisor.*

### **5.17 Petitions**

Any exceptions or waivers to program or College policies must have prior approval by petition. Petitions must be completed online and will be reviewed by the program. Some petitions may need to be sent to the Dean's Office for additional review. Petitions may be used for the following:

- to take less than 12 credits for any semester
- to take more than 17 credits in their first semester or more than 19 credits in any future semesters
- to enroll in a course without proper prerequisites
- to ensure courses taken elsewhere will count towards degree requirements
- to use a substitution for a required course not already listed by the program
- to transfer a course within the last 45 hours of the degree

For more information about program or College policies and procedures, students can contact their academic advisor. After consulting with their academic advisor, students can access the online petition form [here](#).



## 6 STUDENT EXPERIENCE

### 6.1 Student Organizations

Students have excellent opportunities to participate in discipline-related activities outside of the classroom. The CU Boulder Biomedical Engineering Society chapter (BMES), founded in February 2012, aims to introduce members to the profession of Biomedical Engineering. Student members are provided with up-to-date knowledge of tools and techniques used in industry, opportunities to grow as leaders, and plenty of networking, outreach, and volunteering events. BMES generally meets every week to every other week, and regularly hosts guest speakers and panels.

The College of Engineering and Applied Science also has active student chapters in a number of societies including Engineers without Borders (EWB-CU) and the American Medical Student Association at CU. Engineering student organizations can be found [here](#). [Engineering Immersion](#), an event hosted by the College of Engineering and Applied Science each fall and spring semester, provides a great opportunity for students to learn about student organizations and societies.

Students are also encouraged to explore the hundreds of student organizations across campus. A directory of student organizations can be found [here](#).

### 6.2 Center for Student Involvement

The [Center for Student Involvement](#) (CSI) is a service department of the University of Colorado Boulder Student Government (CUSG) within the Division of Student Affairs. They cultivate an environment for building vibrant, engaging and safe communities through programming, leadership development, cultural awareness and learning opportunities. CSI aims to connect all CU Boulder students with experiences promoting student success, personal growth, and a vibrant campus community. Every fall semester, the [Be Involved Fair](#) is a great way for students to learn about clubs, organizations, and departments in the CU Boulder community.

### 6.3 Undergraduate Research

Undergraduates can participate in ongoing research through independent study projects, the [Undergraduate Research Opportunities Program](#) (UROP), and as research assistants for sponsored projects. These opportunities promote individual contact with faculty and graduate students and provide a novel educational experience beyond the normal classroom setting. More information regarding undergraduate research opportunities with the College can be found [here](#).

#### 6.4 Discovery Learning Apprenticeships (DLA)

Undergraduate engineering students have the opportunity to engage in and experience research through [Discovery Learning Apprenticeships](#) (DLA). As an undergraduate discovery learning apprentice, students earn an hourly wage while working alongside graduate students, post-doctoral fellows and faculty as collaborative partners on original research. Undergraduate students often bring a fresh perspective to the research team while also learning from their more experienced partners. Positions are announced in April for the following fall term and spring term. The minimum GPA to apply for a DLA position is 2.0. Eligible students will receive an email with a link to the application in early April. Selection for DLA positions is competitive.

#### 6.5 Summer Program for Undergraduate Research (CU SPUR)

Undergraduate engineering students have the opportunity to engage in and experience research through [CU SPUR](#). As an undergraduate SPUR apprentice, students earn an hourly wage while working alongside graduate students, post-doctoral fellows and faculty as collaborative partners on original research. Undergraduate students often bring a fresh perspective to the research team while also learning from their more experienced partners. Positions are announced in February for the summer term. The minimum GPA to apply for a SPUR position is 2.0. Eligible students will receive an email with a link to the application in early February. Selection for CU SPUR positions is competitive.

#### 6.6 Double Degrees

It is possible to obtain double degrees in two engineering disciplines or one degree in engineering and a second degree from a department in another college or school of the University. Students must satisfy curricula for both programs in order to graduate. In some cases, it may be preferable to pursue an MS degree rather than two undergraduate degrees. Students are encouraged to talk to the academic advisors in both areas of study to better understand the feasibility of a double degree.

#### 6.7 Bachelor's-Accelerated Master'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.

#### 6.8 Education Abroad

[Studying abroad](#) can often be integrated into the biomedical engineering degree plan. The enriching experience can range from a two-week summer program to a semester overseas. Students who want to study abroad should start planning early and save as many electives and humanities & social science courses as possible. These are the easiest courses to transfer back to the University. Many students in biomedical engineering can find programs abroad already affiliated with CU Boulder and can choose from a [list](#) of pre-approved courses. In order to guarantee the courses taken abroad will count toward their degree, students must submit proposed courses for evaluation before enrollment at the partner institution.





## 7 POLICIES & RESOURCES

### 7.1 Student Expectations and Policies

Students should review the College expectations and policies [here](#). Students can consult their academic advisor if they have questions or concerns about policies within the College.

### 7.2 Mental Health and Other Campus Resources

Students with a variety of concerns, such as academics, anxiety, body image, depression, relationships, substance use and more, should contact [Counseling & Psychiatric Services](#) (CAPS), which is a confidential, on-campus mental health and psychiatric service. The College of Engineering and Applied Science has an embedded CAPS counselor working specifically with the engineering student population. Engineering students may work with the embedded CAPS counselor or a counselor in the central office.

#### **Counseling & Psychiatric Services (CAPS)**

*Website:* <https://www.Colorado.edu/counseling/>

*Phone:* 303-492-2277 (24/7 phone)

*Location:* Center for Community, N352

*Office Hours:* <https://www.Colorado.edu/counseling/hours-and-contact>

The [Office of Victim Assistance](#) (OVA) also provides free and confidential information, consultation, support, advocacy, and short term counseling services to CU Boulder students, graduate students, faculty and staff who have experienced a traumatic, disturbing or life disruptive event.

**Office of Victim Assistance (OVA)** *Website:* <https://www.Colorado.edu/ova/>

*Email:* [assist@Colorado.edu](mailto:assist@Colorado.edu)

*Phone:* 303-492-8855 (24/7 phone); after hours press 2 to talk to a counselor

*Location:* Center for Community, N450

*Office Hours:* Monday-Friday 8am–5pm (summer 8:30am–4:30pm)

Additional campus resources can be found [here](#) and more general health resources are available [here](#).



### 7.3 Problematic Language, Behavior, and Discrimination

The Biomedical Engineering Program holds students, faculty, and staff accountable for racist, sexist, ableist, classist, heterosexist, ageist and other types of prejudiced comments and behavior, whether intentional or unintentional. We expect members of our community to recognize and speak up when witnessing comments and actions that may be discriminatory to others. The biomedical engineering community strives to actively eliminate language and behaviors that perpetuate inequities and bias towards marginalized populations. More information and resources are available at [An Antiracist CU](#) and the [campus IDEA Plan](#).

### 7.4 Discrimination and Harassment Policy

CU is committed to providing an inclusive environment where all individuals can achieve their academic and professional aspirations free from discrimination, harassment, and/or related retaliation based upon protected classes.

CU prohibits discrimination and harassment on the basis of protected-class status in admission and access to, and treatment and employment in, its educational programs and activities. For purposes of this CU policy, “protected classes” refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation, and political philosophy.

CU takes prompt and effective steps reasonably intended to stop any form of protected-class discrimination and harassment, and related violations, to eliminate any hostile environment, to prevent its recurrence, and as appropriate, to remedy its effects.

At CU, the [Office of Institutional Equity and Compliance](#) (OIEC) implements this policy and administers related campus procedures. Anyone who encounters an issue or seeks guidance related to this policy should consult with the OIEC. CU Boulder employees who are mandatory reporters (i.e., “Responsible Employees”), including faculty and advisors, must promptly report allegations of protected-class discrimination and harassment, and related violations, as further outlined in the policy.

The full university Discrimination and Harassment Policy can be viewed [here](#).

Instructors are required to observe religious holidays for absences from class and exams, according to the policies outlined [here](#).

Students with concerns about discrimination or harassment actions should immediately contact the instructor, the Program Director, their academic advisor, or [Office of Institutional Equity and Compliance \(OIEC\)](#).

### 7.5 Discrimination and Harassment Policy

All students of CU Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. Specific examples of actions that are considered to be cheating and therefore violations of academic integrity: plagiarizing a homework, lab report, or problem set. Any activity that could give a student an unfair advantage over other students may be cheating.

On assignments requiring a student to use supplemental materials, the student must properly document the sources of information used. If a student is uncertain about allowable reference materials or how to document sources, ask the instructor in advance.

All incidents of academic misconduct shall be reported to the Honor Code Council ([honor@Colorado.edu](mailto:honor@Colorado.edu); 303-735-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). The University Honor Code and Procedures are accessible via the Student Conduct and Conflict Resolution website and can be found [here](#). More information regarding the student honor code policy is also available [here](#).

### 7.6 Student Conduct

Students are required to abide by the University’s [Code of Conduct](#). They should also be aware of updates to the Code of Conduct due to COVID-19. Students can review information on protecting themselves, and the community through the [Protect Our Herd](#) campaign.

## 7.7 Classroom Behavior Policy

Students and faculty each have a responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran status, sexual orientation, gender, gender identity and gender expression, age, disability, and nationalities. Class rosters are provided to instructors with the student's legal name, but instructors will honor student requests to address them by an alternate name or gender pronoun. Students should advise instructors of this preference early in the semester so that they may make appropriate changes to their records. Additional policy details are available at [here](#).

## 7.8 Academic Calendar and Registration Deadlines

Details for the current academic calendar can be found [here](#). Additional information on course add/drop, tuition/fees, and registration deadlines is available from the Office of the Registrar [here](#). Students are expected to be aware of any add/drop deadlines and tuition/fees impacts of their enrollment decisions. If students are unsure of the consequences of adding/dropping a course (especially outside of your university designated enrollment window), they should contact their academic advisor.

## 7.9 Deadlines

The BME Program adheres to the deadlines and calendar established by the Office of the Registrar. Students can find these dates for the current and future semesters [here](#). The primary deadlines to be aware of, with dates varying by semester, are as follows:

- Last day to add a class: After this date, students can only be enrolled pending a petition to the Office of the Registrar, submitted by the Department on behalf of the student. Such requests will only be entertained in exceptional circumstances. This date is typically during the second week of the semester.
- Tuition and fees payment due: Students must pay tuition and fees, or enroll in a payment plan, by this date. This date is typically the day following the deadline for the last day to add a class.
- Last day to drop a class: After this date, students choosing to drop a course will receive a withdrawal (i.e., grade of W) on their transcripts; tuition for dropped courses will not be refunded. This date is typically during the third week of the semester.

Students should familiarize themselves with these dates since it can be difficult or impossible to add/drop classes after the deadlines.

## 7.10 Adding and Dropping Courses

Students should be aware of their enrollment dates and ensure all holds are removed before their enrollment date starts. Enrollment dates are determined by the Office of the Registrar and are visible to students in [Buff Portal Advising](#). For instructions on adding, swapping, editing, and dropping courses, please view the resources [here](#) provided by the Office of the Registrar.

Students who want to drop a course after the drop deadline should meet with their academic advisor to assess what options may be available.

Students who want to withdraw from all classes should consult the Office of the Registrar's [website](#) and schedule a meeting with their academic advisor.

## 7.11 Helpful Links

Resources and additional information for undergraduate students is found in the following links:

- [University Home Page](#)
- [College of Engineering](#)
- [Biomedical Engineering Program](#)
- [Engineering Ambassadors](#)
- [Engineering Honors Program](#)
- [Study Abroad](#)
- [Buff OneCard](#)
- [Bursar's Office](#)
- [Campus Policies](#)
- [Undergraduate Catalog](#)
- [Center for Inclusion and Social Change](#)
  - Encompasses the previously separate offices:
  - Gender and Sexuality Center
  - Women's Resource Center
  - Cultural Unity & Engagement Center
- [Medical Services](#)
- [Office of Information Technology](#)
- [Office of Institutional Equity and Compliance](#)
- [Office of the Registrar](#)
- [Parking and Transportation](#)
- [Recreation Services](#)
- [Athletics](#)
- [Local News](#)
- [Elevations Credit Union](#)
- [Regional Transportation District \(RTD\)](#)