BIOMEDICAL ENGINEERING *PRE-MED BIOINSTRUMENTATION* CURRICULUM – *FALL 2023*

1	**BMEN 1025 (4)** Computer-Aided Design & Fabrication	**CHEN 1201 (4)** Gen Chem for Engineers (CR: CHEM 1114)	**CHEM 1114 (1)** Gen Chem 1 Lab (CR: CHEN 1201)	**Clear All**	**Humanities & Social Science (3)** Lower Division	**APPM 1350 (4)** Calculus 1 For Engineers
2	**BMEN 1000 (1)** Explore BME Spring Only	**CHEM 1133 (4)** Gen Chem 2 (PR: CHEN 1201, CHEM 1114)	**CHEM 1134 (1)** Gen Chem 2 Lab (PR: CHEN 1201, CHEM 1114) (CR: CHEM 1133)	**PHYS 1110 (4)** General Physics 1 (CR: APPM 1350)	**CHEN 1310 (3)** Intro to Engineering Computing (CR: Math- see class search for options)	**APPM 1360 (4)** Calculus 2 For Engineers (PR: APPM 1350)
3	**BMEN 2000 (3)** Intro to Biomedical Engineering (CR: MCDB 1150, CHEN 1201)	**MCDB 1150 (3)** Intro to Molecular and Cellular Biology	**PHYS 1120 (4)** General Physics 2 (PR: PHYS 1110)(CR APPM 1360	**PHYS 1140 (1)** Experimental Physics (CR: PHYS 1120)	**Humanities & Social Science (3)** Lower Division	**APPM 2350 (4)** Calculus 3 For Engineers (PR: APPM 1360)
4	**BMEN 2010 (3)** Biomaterials (PR: CHEN 1201) Spring Only	**CHEM 3311 (4)** Organic Chem 1 (PR: CHEM 1133/1134) (CR: CHEM 3321)	**CHEM 3321 (1)** Organic Chem 1 Lab (PR: CHEM 1133/1134) (CR: CHEM 3311)	**MCDB 1161 (2)** Phage Genomics Lab 1I	**ECEN 2250 (3)** Intro to Circuits & Electronics (PR: APPM 1360, PHYS 1120) (CR: APPM 2360 or MATH 3430)	**APPM 2360 (4)** Linear Algebra & Differential Equations (PR: APPM 1360)
5	**BMEN 3010 (3)** Biotransport (PR: BMEN 2000, CHEN 1310, PHYS 1110) (CR: APPM 2360) Fall Only	**CHEM 3331 (4)** Organic Chem 2 (PR: CHEM 3311/3321) (CR: CHEM 3341)	**CHEM 3341 (1)** Organic Chem 2 Lab (PR: CHEM 3311/3321) (CR: CHEM 3331)	**General Technical Elective (3)** Lower or Upper Division	**ECEN 2260 (3)** Circuits as Systems (PR: ECEN 2250, APPM 2360)	**ECEN 2270 (3)** Electronics Design Lab (CR: ECEN 2260)
6	**BMEN 3030 (3)** Bioinstrumentation (PR: BMEN 2000, ECEN 2260, ECEN 2270) Spring Only	**MCDB 2150 (3)** Principles of Genetics (RPR: MCDB 1150)		**Humanities & Social Science (3)** Lower Division	**Writing Requirement (3)**	**ECEN 3301 (3)** Biomedical Signals/Systems (PR: ECEN 2260) Spring Only
7	**BMEN 4010 (3)** BME Design 1 (PR: BMEN 1025, BMEN 2010, BMEN 3010) (CR: Writing) Fall Only	**Engineering Technical Elective (3)** Upper Division	**MCDB 2161 (2)** Phage Genomics Lab 2 (PR: MCDB 1161) Spring Only	**Humanities & Social Science (3)** Upper Division		**CHEN 3010 (3)** Applied Data Analysis (PR: APPM 2360, CHEN 1310) Fall Only
8	**BMEN 4020 (3)** BME Design 2 (PR: BMEN 4010) Spring Only	**Engineering Technical Elective (3)** Upper Division	**BCHM 4611 (3)** Principles of Biochemistry (PR: CHEM 3311)	**Humanities & Social Science (3)** Upper Division	**Free Elective (2)**	**Example** **COURSE NUMBER (Cr.)** Course Name (PR: Pre-Requisites) (CR: Co-Requisites) (RPR: Recommended Pre-Req)

Effective: Fall 2023

Biomedical Engineering Curriculum

Standard Course Substitutions

- **APPM 1350**: MATH 1300, APPM 1345
- **APPM 1360:** MATH 2300
- **APPM 2350:** MATH 2400
- **APPM 2360:** MATH 2130 and MATH 3430
- **BMEN 1025:** MCEN 1025, GEEN 3830-800 (fall 2020 only)
- **BMEN 4117**: MCEN 4117, IPHY 3410 and IPHY 3430
- **CHEM 1221**: CHEM 1114, CHEM 1134
- **CHEN 1201**: CHEN 1211 (CHEM 1113 approved for transfer students)
- **CHEN 1203:** CHEN 1211 (CHEM 1133 approved for transfer students)
- **CHEN 1310**: ECEN 1310, CSCI 1300, (CSCI 1320, ASEN 1320 approved for transfer students)
- **MCDB 1150:** CHEN 2810, EBIO 1210 and 1220
- **MCDB 1161 or 2161:** MCDB 1171, 1181, or 2171
- **CHEN 3010:** STAT 4000, MCEN 3047, GEEN 3853
- **ECEN 2250:** ECEN 3010, GEEN 3010
- **ECEN 3301**: ECEN 3300
- **MCEN 2023**: CVEN 2121, GEEN 2851
- **MCEN 2063**: CVEN 3161

Technical Electives

Pre-Med Bioinstrumentation requires a total of 9 technical elective credits, of which at least 6 credits must be BME-Approved Engineering Technical Elective credits, and at least 6 credits of the total must be upper-division . Visit the program's Advising & Curriculum webpage for options

Humanities & Social Science Electives/Writing Requirements

VisitHumanities, Social Sciences, and Writing Requirements for options.

Writing Requirement Options

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

Grade Requirements

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-**. In addition, students need to have a cumulative and major GPA of at least 2.000 in order to graduate from the College of Engineering. **Pass/Fail** is only permitted for BMEN 1000 and Free Elective credits.

Pre-med Tracks: Biomechanics vs. Bioinstrumentation

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.

Image Credit: www.verywellfit.com

Why pursue Biomechanics?

Biomechanics draws from the traditional engineering discipline of mechanical engineering. You may wish to take the biomechanics track if you are interested in human motion, performance, disabilities, prosthetics or orthopedics. You may find biomechanics interesting if you 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.

Courses Added:

- MCDB 1161 (2) Genetics Lab 1
- MCDB 2150 (3) Principles of Genetics
- MCDB 2161 (2) Genetics Lab 2
- CHEM 3311/3321 (5) Organic Chemistry 1 w/ lab
- CHEM 3331/3341 (5) Organic Chemistry 2 w/ lab
- CHEM 4611 (3) Biochemistry

Recommended Technical Electives:

- MCEN 2043 (3) Dynamics
- MCEN 4228 (3) Modeling Human Movement

Courses Removed:

- ECEN 2250 (3) Intro to Circuits & Electronics
- ECEN 2260 (3) Circuits as Systems
- ECEN 2270 (3) Electronics Design Lab
- ECEN 3301 (3) Biomedical Signals and Systems
- BMEN 3030 (3) Bioinstrumentation
- Free Electives (5)

Bioinstrumentation 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.

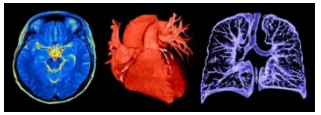

Image Credit: www.englewoodhealth.org

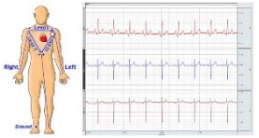

Image Credit: www.biopac.com

Why pursue Bioinstrumentation?

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.

Courses Added:

- MCDB 1161 (2) Genetics Lab 1
- MCDB 2150 (3) Principles of Genetics
- MCDB 2161 (2) Genetics Lab 2
- CHEM 3311/3321 (5) Organic Chemistry 1 w/ lab
- CHEM 3331/3341 (5) Organic Chemistry 2 w/ lab
- CHEM 4611 (3) Biochemistry

Recommended Technical Electives:

- Take two technical electives in ECEN to earn a Minor in Electrical Engineering

Courses Removed:

- MCEN 2023 (3) Statics
- MCEN 2063 (3) Solids
- MCEN 4133 (3) Tissue Biomechanics
- BMEN 4117 (3) A&P for Biomedical Engineering
- Technical Electives (3)
- Free Electives (5)