

## Biomedical Engineering Minor

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Biomedical Engineering is an interdisciplinary field that combines principles of biology and medicine with engineering design to produce healthcare innovations. Biomedical engineers contribute to medical technologies in a variety of areas including diagnostics, therapeutics, imaging, bioinformatics, and rehabilitation.

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### Learning Outcomes:

A student who has completed the Biomedical Engineering Minor will have:

1. Experience and proficiency in applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, differential equations, and statistics;
  2. Experience and proficiency in solving biomedical engineering problems, including those associated with the interaction between living and nonliving systems;
  3. Experience and proficiency in analyzing, modeling, designing, and realizing medical devices, systems, components, or processes;
  4. Experience and proficiency in making measurements on and interpreting data from living systems;
  5. An ability to identify, formulate, and solve complex biomedical engineering problems by applying principles of engineering, science, and mathematics.
  6. An ability to 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.
  7. An ability to communicate effectively with a range of audiences.
  8. An ability to recognize ethical and professional responsibilities in medical and engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
  9. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
  10. An ability to design and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
  11. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
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Biomedical Engineering is an interdisciplinary field that combines principles of biology and medicine with engineering design to produce healthcare innovations. Biomedical engineers contribute to medical technologies in a variety of areas including diagnostics, therapeutics, imaging, bioinformatics, and rehabilitation. Accordingly, biomedical engineers typically possess a broad biology background and strong engineering design and problem-solving principles. The Biomedical Engineering minor will prepare students studying engineering or the life sciences for careers in industries that develop technologies to advance medicine.

The following curriculum is accessible to students from any major degree program in the College of Engineering and Physical Science (CEPS), as well as students from other programs on campus. Tracks covering different the different engineering disciplines that comprise biomedical engineering are provided below. Students are encouraged to select a track that most closely aligns with their interests and preparation. A specialized, more comprehensive program of study is available for students with a particular interest in medical school preparation.

## Coursework:

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**The minimum required coursework consists of 18 credits.** Students must complete one of the tracks provided below, including all required courses listed within each track. Additional coursework may be chosen from the list of Approved Elective Coursework below. Approval by the Minor Coordinator is required for any substitutions or electives not appearing in the approved list below.

### Chemical Engineering

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Chemical Engineering draws upon the fundamentals of chemistry, physics, and biology to analyze and design processes. Chemical Engineers work in a variety of biomedical disciplines including pharmaceutical production, biomedical devices, tissue engineering, and medical sensing. The following coursework covers biological fundamentals and materials with a focus on process and device design.

- [CHE3100 - Fundamentals of Bioengineering](#) Credits: 3
  - [CHE4100 - Biochemical Engineering](#) Credits: 3
  - [CHE4160 - Biomedical Engineering-Transport Processes](#) Credits: 3
  - [CHE4165 - Biomaterials](#) Credits: 3
- + 6 Credits of approved coursework

### Electrical Engineering

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This track offers opportunities for those interested in applying electrical engineering to problems of environmental science, wildlife studies, biology, and medicine. Application areas include the use of telemetry for wildlife management, environmental monitoring, design and development of biological and medical instrumentation and clinical engineering.

- [BE4810 - Bioinstrumentation](#) Credits: 3
- [BE4820 - Biomedical Signal Processing](#) Credits: 3
- [EE5410 - Neural and Fuzzy Systems](#) Credits: 3
- [CHE3100 - Fundamentals of Bioengineering](#) Credits: 3
- [CHE4165 - Biomaterials](#) Credits: 3

- [KIN2040 - Human Anatomy](#) Credits: 3

## Mechanical Engineering

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With a focus upon biomaterials and biomechanics, this track combines biology and physiology with mechanical engineering. This coursework helps students apply mechanical engineering principles to biological challenges including prosthetics, robotic surgery instruments, and medical device design.

- [CHE3100 - Fundamentals of Bioengineering](#) Credits: 3
- [CHE4160 - Biomedical Engineering-Transport Processes](#) Credits: 3
- [CHE4165 - Biomaterials](#) Credits: 3
- [KIN2040 - Human Anatomy](#) Credits: 3
- [ME4250 - Biomechanics of Movement](#) Credits: 3
- + 3 Credits of approved coursework

## Physical and Life Sciences

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This track is encouraged for students **not** majoring in an engineering discipline or those who may be preparing for medical school\*. Relying heavily upon advanced coursework from the life sciences, this track will provide students with an engineering perspective and design mindset. Substitutions may be made to customize the track to students' interests and preparation, but must be approved by the Minor Coordinator.

- [MOLB2240 - Medical Microbiology](#) Credits: 4
- [MOLB3610 - Principles of Biochemistry](#) Credits: 4
- [CHE4160 - Biomedical Engineering-Transport Processes](#) Credits: 3
- [CHE4165 - Biomaterials](#) Credits: 3
- [PHCY3450 - Foundational Pathophysiology](#) Credits: 4

\*For students who are interested in medical school, please contact advisors at the College of Health Sciences Prehealth Advising Office (<https://www.uwyo.edu/preprof/index.html>).

## Approved Elective Coursework:

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The following approved courses may be counted in fulfillment of additional technical elective requirements within the discipline-specific track, but may not be substituted for required courses.

- [CHE3100 - Fundamentals of Bioengineering](#) Credits: 3
- [CHE4100 - Biochemical Engineering](#) Credits: 3
- [CHE4160 - Biomedical Engineering-Transport Processes](#) Credits: 3
- [CHE4165 - Biomaterials](#) Credits: 3
- [CHE3900 - Undergraduate Research](#) Credits: 1-6 (in an appropriate laboratory)
- [CHE4220 - Metabolic and Protein Engineering](#) Credits: 3
- [BE4810 - Bioinstrumentation](#) Credits: 3
- [BE4820 - Biomedical Signal Processing](#) Credits: 3
- [EE4800 - Problems in \\_\\_\\_\\_\\_](#) Credits: 1-6 Problems in Bioengineering
- [EE5410 - Neural and Fuzzy Systems](#) Credits: 3
- [KIN2040 - Human Anatomy](#) Credits: 3
- [KIN2041 - Human Anatomy Laboratory](#) Credits: 1
- [LIFE3050 - Genetics](#) Credits: 4
- [LIFE3600 - Cell Biology](#) Credits: 4
- [MOLB2240 - Medical Microbiology](#) Credits: 4
- [MOLB3000 - Introduction to Molecular Biology](#) Credits: 3
- [MOLB4100 - Clinical Biochemistry](#) Credits: 4
- [MOLB4260 - Quantitative Microscopy](#) Credits: 1
- [MOLB4400 - Immunology](#) Credits: 4
- [MOLB4600 - Advanced Biochemistry](#) Credits: 3
- [MOLB4610 - Biochemistry 2: Molecular Mechanisms](#) Credits: 3
- [PHCY3450 - Foundational Pathophysiology](#) Credits: 4
- [PHCY6120 - Advanced Pathophysiology](#) Credits: 4
- [ZOO3115 - Human Systems Physiology](#) Credits: 4
- [ZOO4125 - Integrative Physiology](#) Credits: 5

\*NOTE\*

CHE 3100 fulfills the LIFE 2021 & 3050 pre-requisite requirements for CHE 4100, 4160, and 4165. Alternatively, students may take the following in lieu of CHE 3100 as a pre-requisite: MICR 2021 Microbiology (4) and MOLB 3610 Principles of Biochemistry (4).

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