

DATE: April 26, 2018

TO: Jacqueline E. Huntoon  
Provost & VP for Academic Affairs

FROM: Martin J. Thompson  
Senate President

SUBJECT: Senate Proposal 25-18

COPIES: Glenn D. Mroz, President  
Roberta M. Dessellier, Secretary of the Board of Trustees

At its meeting on April 25, 2018, the University Senate approved Proposal 25-18, "Minor in Biomedical Engineering". The Senate looks forward to approval of this proposal by the administration. Please keep me informed about the decision of the administration on this proposal and feel free to contact me if you have any questions.

**APPROVED:**



Jacqueline E. Huntoon, Provost & VP for Academic Affairs  
on behalf of the University Administration

18 May 2018

Date

# The University Senate of Michigan Technological University

## Proposal 25-18 (Voting Units: Academic)

### “Proposal for a Minor in Biomedical Engineering”

#### 1. Date

March 22, 2018

#### 2. Proposer Contact Information

Sean J. Kirkpatrick, Chair, Department of Biomedical Engineering

Email: [sjirkkpa@mtu.edu](mailto:sjirkkpa@mtu.edu)

#### 3. Introduction

The proposed minor in Biomedical Engineering offered through the Department of Biomedical Engineering in the College of Engineering, will offer Michigan Tech students the opportunity to learn biomedical engineering concepts and integrate them into their major field of study. The proposed minor will help to prepare students for careers in the medical device or related industry sectors, for entry into graduate study at the interface of life science and engineering, and for professional (e.g., medical, dental, PT, OT) careers.

#### 4. Rationale

Biomedical engineering is a rapidly growing and evolving field. The need for biomedical engineers is expected to continue to increase as developments in health care become more and more complicated and interdisciplinary, often requiring highly technical engineering solutions. The need to have a well trained workforce with the ability to integrate life sciences, engineering, and the practices of modern medicine is a pressing issue.

Therefore, there is a strong need to allow Michigan Tech students from all disciplines to learn the fundamental concepts of biomedical engineering as they prepare for their professional careers. The broad nature of biomedical engineering across many scientific and engineering disciplines requires formal, structured education. The era of engineers ‘picking up some biology as they go’ is rapidly coming to a close. This approach has helped students wishing to enter the medical device industry in the past, but it is no longer sufficient in today’s rapidly changing medical environment. Today, and in the future, a more integrative approach is demanded.

The proposed minor consists of a series of courses that are designed to provide students with the necessary theoretical and practical knowledge to gain entry into the biomedical engineering field. The minor is structured in such a manner that it is accessible to a broad range of majors at Michigan Tech,

including but not limited to Electrical Engineering, Materials Science & Engineering, Mechanical Engineering, Chemical Engineering and General Engineering. Science majors can also take advantage of the minor however, they will need to ensure that the proper pre-requisite math and engineering courses are met.

## **5. Details**

### **I. Title of Minor**

Biomedical Engineering

### **II. Catalog Description**

The minor in Biomedical Engineering will provide students who are not Biomedical Engineering majors the opportunity to learn principles and practices of biomedical engineering. This minor is most suitable for students in one of the engineering majors, however non-engineering majors may participate in this minor provided the appropriate prerequisite courses are taken and passed.

Upon successful completion of the minor in Biomedical Engineering, students will be able to:

- a) broadly understand key concepts and principles of biomedical engineering
- b) develop the beginnings of an understanding of how the life sciences and other engineering disciplines can be integrated to solve biomedical engineering problems
- c) apply biomedical engineering principles to the general area of their chosen majors
- d) contribute to solving complex biomedical engineering problems in industry, government, or academic settings

### **III. List of Courses**

The minor in Biomedical Engineering requires the successful completion of 18 credits, including 9 credits of required courses and an additional 9 credits of electives. The required and elective courses are shown in Tables 1 and 2, respectively. Courses counting as minor credits cannot be double counted between minors.

The minor in Biomedical Engineering is intentionally broad. The goal is to provide a minor degree option for students who desire a broad perspective in the field of biomedical engineering. The flexibility in this minor will also allow students who are in a more focused minor within the Department of Biomedical Engineering (Biomaterials, Tissue & Stem Cell Engineering, Medical Devices & Instrumentation) and who cannot complete the requirements for that minor (because of scheduling conflicts, for example) to easily switch to this minor and still receive a minor degree for their coursework in biomedical engineering.

**Table 1. Required Courses (9 credits)**

<b>Required Courses: 9 credits</b>	<b>Credits</b>
BE2700 Biomedical Signals & Systems	3
BE2400 Cellular & Molecular Biology I	3
BE4XXX ( <i>Advanced BE Course of Choice- BE4755, BE4850, or BE4930</i> ) <ul style="list-style-type: none"> <li>• BE4850 Tissue Mechanics (<i>prereq. BE3350</i>)</li> <li>• BE4755 Medical Devices (<i>Junior or Senior Status Required</i>)</li> <li>• BE4930 Industrial &amp; Clinical Issues (<i>Junior or Senior Status Required</i>)</li> </ul>	3

**Table 2. Elective Courses (9 credits, minimum)**

<b>Elective Courses*: 9 credits, minimum</b>	<b>Credits</b>
BE3800 Biomaterials II ( <i>prereq. BE2800 or MSE2100</i> )	3
BE3350 Human Biomechanics ( <i>prereq. BE3300 or MEEM2110</i> )	3
BE3400 Laboratory Techniques for BME ( <i>prereq BE2800 or MSE2100</i> )	2
BE3700 Biomedical Instrumentation ( <i>prereq. EE3010, BE2700; coreq. BE3701 waived for minors</i> )	3
BE3701 Biomedical Instrumentation Lab ( <i>coreq. BE3700</i> )	1
BE2110 Statistical Methods for Biomedical Engineering ( <i>prereq. MA2160</i> )	3
BE4410 Medical Imaging ( <i>Junior or Senior Standing Required</i> )	3
BE4670 Micro- and Nanotechnology for Biomedical Applications ( <i>Junior or Senior Standing Required</i> )	3

\*New courses may be added as faculty teach new BE elective courses

**IV. Prerequisites not listed in the minor**

The minor requires students to have taken CH1150, MA2160, ENG1102, and PH2100. To enroll in BE2700, students must have earned a “C” or better in CH1150, PH2100, and MA2160.

Anatomy and Physiology I & II, with laboratory sections (BL2010, BL2020, BL2011, BL2021, respectively) are required prerequisites for many upper-level BE courses. On an individual basis, these prerequisites may be waived with permission of the faculty member responsible for the course and the Department Chair.

**6. Advising**

The academic advisor for the Department of Biomedical Engineering, Mr. Mike LaBeau, will advise students who choose to enroll in this minor.

**7. New Course Descriptions**

No new courses associated with a minor in Biomedical Engineering are proposed.

**8. Estimated Costs**

No additional costs will be associated with this minor at this time. No additional library resources will be required either. All required and elective courses are currently being taught on a regular basis and there is existing capacity for additional enrollment of 10-15 students per year in terms of classroom seats.

If the minor proves to be popular and exceeds the enrollment capacity, the Department of Biomedical Engineering will explore options to increase the number of sections of key courses that are taught.

**9. Library resources**

No additional library resources are required to implement this minor.

**10. Planned Implementation Date**

Fall 2018