

The University Senate of Michigan Technological University

Proposal 26-18 (Voting Units: Academic)

“Proposal for a Minor in Medical Devices & Instrumentation”

1. Date

March 22, 2018

2. Proposer Contact Information

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3. Introduction

The proposed minor in Medical Device & Instrumentation offered through the Department of Biomedical Engineering in the College of Engineering, will offer Michigan Tech students the opportunity to learn engineering concepts directly related to medical instruments and devices, 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

The broadly defined medical device industry is a rapidly growing and evolving industrial sector. The need for engineers with knowledge of medical devices and related issues (e.g., regulatory and quality systems specific to the medical device industry) 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 medical device and instrumentation 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 medical device industry (very broadly

defined). 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

Medical Device & Instrumentation

II. Catalog Description

The minor in Biomedical Engineering will provide students who are not Biomedical Engineering majors the opportunity to learn principles and practices medical device and instrumentation 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 Medical Devices & Instrumentation, students will be able to:

- a) broadly understand key concepts and principles of medical instrumentation and devices
- 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 12 credits of required courses and an additional 6 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.

Table 1. Required Courses (12 credits)

Required Courses: 12 credits	Credits
BE2700 Biomedical Signals & Systems	3
BE2400 Cellular & Molecular Biology I	3
BE3700 Biomedical Instrumentation (<i>prereq. Be2700, EE3010;coreq. BE3701 waived for minors</i>)	3

BE4755 Medical Devices (<i>Junior or Senior Standing Required</i>)	3
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Table 2. Elective Courses (6 credits, minimum)

Elective Courses: 6 credits, minimum	Credits
BE3400 Laboratory Techniques for BME (<i>prereq BE2800 or MSE2100</i>)	2
BE3800 Biomaterials II (<i>prereq. BE2800 or MSE2100</i>)	3
BE3701 Biomedical Instrumentation Lab (<i>coreq. BE3700</i>)	1
BE4115 Finite Element Modeling (<i>prereq (MA 2320 or MA 2321) and (MA 3520 or MA 3521) and (BE 3350 or MEEM 2150)</i>)	3
BE4250 Biomedical Optics (<i>prereq (MA 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160</i>)	3
BE4510 Cardiovascular Engineering (<i>BE2400; Junior or Senior Standing Required</i>)	3
BE4700 Biosensors: Fabrication & Application (<i>prereq BE 3700 and BE 3701</i>)	3
BE4770 Biomedical Microcontrollers (<i>prereq BE 3700 and BE 3701</i>)	3
BE4930 Industrial & Clinical Issues (<i>Junior or Senior Standing Required</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