

The University Senate of Michigan Technological University
Proposal 70-21
(Voting Units: Academic)

Establishment of a New Graduate Certificate in Medical Imaging

Submitted by: Department of Biomedical Engineering

1. Proposal Date:

June 1, 2020

2. Proposing Contacts and Department:

Dr. Sean J. Kirkpatrick, Department of Biomedical Engineering (sjirkkpa@mtu.edu)

3. Sponsor Department Approvals

At the end of the document

4. General Description and Characteristics of Program:

4.1 General Description of Certificate

The Biomedical Engineering program at Michigan Technological University proposes a ten credit Certificate in Medical Imaging. The Graduate Certificate in Medical Imaging has the following three objectives: i) to attract students from various disciplines who wish to learn the basics of medical imaging as related to devices; ii) to teach students basic skills in the principles, development and characterization of medical imaging devices; and, iii) to develop an understanding of the propagation of radiation through the human body.

4.2 Catalog Description

The Certificate in Medical Imaging is designed to develop skills and competencies in biomedical imaging including the principles of radiation propagation in the human body, imaging device theory and application, design of medical imaging devices and processing of microscopic images. The curriculum integrates application of these skills in real-world problems and implementation of application specific solutions.

5. Rationale for Certificate:

The field of medical imaging has seen tremendous growth in recent years. Imaging technology using both ionizing and non-ionizing radiation is a key part of medical diagnostics and therapeutics. New graduates and experienced industry professionals can benefit from

- A greater understanding of principles and applications of medical imaging systems and medical image processing techniques
- A sound understanding of the propagation of radiation in the human body
- An appreciation of the design, development and applications of diagnostic and/or therapeutic imaging devices for biomedical applications

Completion of the requirements for this certification indicates specialization in medical imaging.

6. Related Programs:

- Stanford Online: Biomedical Engineering: Imaging, Devices and Systems Includes Medical imaging, Technology Assessment and Regulation of Medical Devices and Introduction to Micro and Nano electromechanical systems.
- UMass Lowell: List of Certificates Certifications in Medical Imaging & Instrumentations (<https://www.uml.edu/Catalog/Graduate/Engineering/Electrical-Computer-Engineering/Graduate-Certificates.aspx#MIIC>). Covers the basics of medical imaging. It is comprised of a coordinated collection of courses, laboratories and advanced simulation experiences and allows for in-person and remote enrollment. Students are required to complete 12 credits of coursework.
- Most other Medical Imaging Certificates are aimed at individuals interested in working as a Radiological Technician, which is not the focus of our proposed certificate.

7. Projected Enrollments:

Based on discussions with industry advisors, we have arrived at the following projections:

Academic Year	On-campus Enrollment	On-line Enrollment
2021-2022	3	5
2022-2023	3	5
2023-2024	5	10
2024-2025	5	10

8. Scheduling Plans:

No change in the regular scheduling of the existing courses is anticipated. BME will deliver the courses in our regular scheduling plans. Initially, the courses will be offered remotely with the goal of offering them online when they are approved.

9. Curriculum Design

Required Coursework: 10 credits

BE5250: Biomedical Optics (3)

BE5410: Medical Imaging (3)

BE5870: Computer Vision for Microscopic Images (3)

BE5900: Biomedical Engineering Masters Topics (with prior approval of the dept.) (1)

Course Descriptions:

BE5250: Biomedical Optics Light plays a significant role in modern clinical diagnostics and in the clinical treatment of disease. Examples include non-invasive surgery, optical biopsy, and cancer therapy. This course will focus on the study of how light propagates through biological tissue. Offered every other Spring

BE5410: Medical Imaging This course covers the physical nature of the interactions between the waves and matter, especially the biological tissues, principle imaging modalities used in modern medicine and the common techniques used for processing of the resulting images. Offered every other Spring.

BE5870: Computer Vision for Microscopic Images This course teaches how to quantify data out of images, typically from optical microscopes. It covers thresholding, image derivatives, edge-detection, watershed, multi-scale and steerable filters, 3D image processing, feature extraction, PCA, classification, convolutional neural networks, particle tracking, and diffusion analysis. Offered every other Fall.

BE5900: Biomedical Engineering Masters Topics: Biomedical engineering courses will be offered as professional electives dependent upon the interest of the student & faculty. In the context of this certificate this will be a 1 credit project. (Requires approval of Department).

10. Model Schedule Demonstrating Completion Time

The certificate is designed to be completed in 2 semesters. However, depending on the semester and year (odd vs even) it could take up to 4 semesters initially. Once the courses are certified for online instruction, they will be offered more frequently so that students can complete the certification in 2 semesters no matter when they start the program.

Fall Semester

BE5870: Computer Vision for Microscopic Images

BE5900: Biomedical Engineering Masters Topics

Spring Semester

BE5410: Medical Imaging

BE5250 Biomedical Optics

11. Library and other Learning Resources

No library or other learning resources are required at this time.

12. Faculty Resumes

The following faculty will be supporting the program.

The following faculty will be supporting the program.

Dr. Sean J. Kirkpatrick, Professor, Biomedical Engineering

<https://www.mtu.edu/biomedical/people/faculty/kirkpatrick/>

Dr. Orhan Soykan, Professor of Practice, Biomedical Engineering

<https://www.mtu.edu/biomedical/people/faculty/soykan/>

Dr. Jingfeng Jiang, Associate Professor, Biomedical Engineering

<https://www.mtu.edu/biomedical/people/faculty/jiang/>

Dr. Sangyoon Han, Assistant Professor, Biomedical Engineering

<https://www.mtu.edu/biomedical/people/faculty/Han/>

13. Equipment

No additional equipment will be required.

14. Program Costs

Initially, there will be no additional costs for offering the certificate. However, as enrollment grows additional instructional resources will be needed.

15. Space

There are no new space requirements.

16. Policies, Regulations, and Rules

Not applicable

17. Accreditation Requirements

Michigan Tech is accredited by the [Higher Learning Commission](#) (HLC). The proposed certificate will meet HLC criteria 3 and 4. The proposed certificate will not seek additional accreditation.

18. Planned Implementation Date

Fall 2021

19. Assessment

Upon successful completion of this certificate, students will be able to do the following:

1. Explain and apply the fundamental imaging requirements in biomedical applications
2. Apply engineering and physics principles to specific biomedical imaging problems
3. Apply knowledge of imaging device development and theory of operation to designing medical imaging tools

Approval Process

Departmental Graduate Committee: June 1, 2020

Department: June 1, 2020

College of Engineering:

Graduate School

Provost's Office and Deans' Council

Approved by the Senate:

Approved by the President: