Michigan Technological University
Biomedical Engineering

BME MS Plan of Study Form

Student Name: _____ M #: _____ Date: _____

MS Option Selection: _____ Thesis _____ Report

_____ Coursework _____ Accelerated

Complete Part A prior to the end of the first semester of MS Program.

Complete Part B during undergrad junior year.

PART A
Thesis/Report/Coursework courses to be counted toward MS degree.

Title	Course Number	Number of Credits

PART B – For Accelerated Master's (COURSES TO BE APPLIED TO BOTH BS & MS)

Approval signatures:

Advisor: _____

Biomedical Engineering Fall Semester Graduate Courses

REQUIRED CORE COURSE: MA 5701 - Statistical Methods Introduction to design, conduct, and analysis of statistical studies, with an introduction to statistical computing and preparation of statistical reports. Topics include design, descriptive, and graphical methods, probability models, parameter estimation and hypothesis testing.
Credits: 3.0 **Lec-Rec-Lab:** (0-3-0)
Semesters Offered: Fall and Spring

BE 5000 - Biomedical Masters Research Includes the study of an acceptable biomedical engineering problem and the preparation of a report or thesis.
Credits: variable to 12.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer

BE 5330 - Biomimetic Materials This course introduces students to biologically inspired approaches to design functional biomaterials. Topics include the discovery and incorporation of biological designs into novel materials and their application in the biomedical field.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2014-2015 academic year.

BE 5335 - Smart Polymers This course introduces students to smart polymers that change their physical properties in response to various environmental stimuli. Topics include the molecular origin of the stimuli responsiveness of these materials and their application in the biomedical field.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2015-2016 academic year.

BE5340 – Biocompatibility This course will cover the general principles and biomedical engineering applications of biocompatibility. You will be able to critically read the international standards in the area of biocompatibility.
Credits: 3.0
Semesters Offered: Fall Offered alternate years beginning with the 2022-2023 academic year.

BE 5350 - Cell Biomechanics and Mechanical Transduction This course, will teach basic biology and mechanics behind cell mechanics, methodologies, and models regarding mechanobiology.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Fall – Offered alternate years beginning with the 2021-2022 academic year.

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BE 5510 – Cardiovascular Engineering
Fundamental cardiovascular pathology and the biomedical engineering approaches being developed and used toward problems resulting in significant cardiovascular deficiency such as myocardial infarction, chronic kidney disease, atherosclerosis, and heart valve disease.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Fall

BE5670 – Micro & Nano Technologies This course introduces students to micro- & nano- technologies and the processes involved in their manufacturing. Particular emphasis will be on the use in biomedical applications. Goal is to provide beneficial research and development to the industry.
Credits: 3.0
Semesters Offered: Fall

BE 5700 - Biosensors This course introduces the student to the fundamentals of biosensor development and applications. It provides an understanding of biological components, immobilization methods, transducers, and fabrication techniques.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Fall - Offered alternate years beginning with the 2021-2022 academic year

BE 5755 - Medical Devices An introduction to medical devices used for diagnosis, monitoring, and treatment in clinical medicine. Topics covered include product planning, reliability, clinical trial design, regulatory as well as technical aspects of common medical devices.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Fall

BE 5760 – Numerical Techniques in BME An introductory course on numerical techniques consists of three main components: solution of linear and non-linear sets of equations; computer modeling of physiological systems and medical devices; and numerical optimization of systems.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Fall

BE 5770 - Biomedical Microcontrollers The focus of this course is to provide biomedical engineering students the necessary skills to develop microcontroller-based devices. Provides basic knowledge on computer programming languages, microcontrollers, digital circuits, and microcontroller development kits. Students will design and fabricate a microcontroller-based device using a microcontroller development kit for a specific biomedical application.
Credits: 3.0 **Lec-Rec-Lab:** (1-0-2)
Semesters Offered: Fall - Offered alternate years beginning with the 2022-2023 academic year.

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BE 5870 - Computer Vision for Microscopic Images. This course involves how to quantify data out of images typically from optical microscopes
Credits: 3.0 **Lec-Rec-Lab:** (0-1-2)
Semesters Offered: Fall - Offered alternate years beginning with the academic year 2020-2021

BE 5900 – Biomedical Engineering Master's Topics Biomedical engineering courses will be offered as professional electives dependent upon the interest of the faculty.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer

BE 5930 – Biotransport This course aims to leverage fundamental principles of fluid mechanics, and heat and mass transfer with particular emphasis on physiological and biomedical systems.
Credits: 3.0
Semesters Offered: Fall – Offered alternate years beginning with the academic year 2024-2025

6000 – Biomedical Engineering Doctoral Research Includes the study of an acceptable biomedical engineering problem and the preparation of a report or thesis.
Credits: variable to 12.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer

BE 6900 - Biomedical Engineering Doctoral Topics Biomedical engineering courses will be offered as professional electives dependent upon the interest of the faculty.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer

REQUIRED CORE COURSE: KIP 5500 - Systems Physiology A comprehensive systemic study of the physiological functions of the adult human, including an introduction to the underlying etiologies and clinical indicators of molecular, cellular, and tissue bases for common organ system diseases in humans.
Credits: 3.0
Semesters Offered: Fall
(This course can be taken in place of BE5200 Cellular and Molecular Biology II, which is offered every spring.)
REQUIRED CORE COURSES MUST HAVE A GRADE OF "B" OR BETTER. STUDENTS WILL BE REQUIRED TO RE-TAKE THE COURSE WITH GRADES LESS THAN "B"

These courses are offered fall semester by the department. If your faculty advisor has recommended you take courses that are 4000 level, you must see the staff in H-STEM Complex 339 for a waiver to take these courses.

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Biomedical Engineering Spring Semester Graduate Courses

BE 5000 - Biomedical Masters Research Includes the study of an acceptable biomedical engineering problem and the preparation of a report or thesis.
Credits: variable to 12.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer

BE 5115 - Finite Element Modeling The course teaches both fundamentals of finite element theory and hands-on experience for bio-engineers.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Spring

REQUIRED CORE COURSE: BE 5200 - Cellular and Molecular Biology II Covers, at an advanced level, the general principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Spring
OR
KIP 5500 - Systems Physiology A comprehensive systemic study of the physiological functions of the adult human, including an introduction to the underlying etiologies and clinical indicators of molecular, cellular, and tissue bases for common organ system diseases in humans.
Credits: 3.0
Semesters Offered: Fall
(This course is offered every fall and can be taken in place of BE5200 Cellular and Molecular Biology II.)

BE 5230 – Stem Cell and Tissue Engineering This course will introduce (1) basic concepts of tissue engineering, (2) scaffold materials and biotechnologies for tissue engineering, (3) basic concept of stem cells, (4) review of stem cell sources and related policies, (5) current progress in stem cell research, (6) application of stem cells in tissue engineering and regenerative medicine.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Spring

BE 5250 - 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.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2014-2015 academic year.

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BE 5300 - Polymeric Biomaterials This course focuses on the use of polymeric materials in biomedical engineering. Topics will include synthesis and characterization of polymers, structure-properties relationships, degradation behavior, and biomedical applications for polymeric biomaterials.
Credits: 3.0 **Lec-Rec-Lab:** (3-0-0)
Semesters Offered: Spring - Offered alternate years beginning with the 2020-2021 academic year.

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 the processing of the resulting images.
Credits: 3.0
Semesters Offered: Spring – Offered alternate years beginning with the 2018-2019 academic year.

BE 5412 – Theory of Medical Imaging This course is a one semester course on the theoretical aspects of medical imaging. Course consists of three main components:
1. Wave – matter interactions generating the signals for image formation, 2. Techniques for image construction, and 3. Mathematical techniques and computer algorithms for processing images.
Credits: 3.0
Semesters Offered: Spring – Offered alternate years beginning with the 2025-2026 academic year.

BE 5650 - Neural Basis of Rehab Engineering This course will cover the basic neuroscience topics underlying sensorimotor control will be introduced. Different types of neuromuscular disorders and current techniques used for diagnosis, assessment, and rehabilitation
interventions will be studied.
Credits: 3.0
Semesters Offered: Spring – Offered alternate years beginning with the 2021-2022 academic year.

BE5655 - Neural Prosthetic Systems This course will cover several systems that use electrical stimulation to restore normal function following injury or disease. The underlying biophysical basis and technology for the treatment, and the associated clinical applications and challenges will be studied. The systems to be covered include cochlear implants, spinal cord stimulation for pain relief, brain stimulation for movement disorders, and neuromuscular electrical stimulation for restoration of movement.
Credits: 3.0
Semesters Offered: Spring – Offered alternate years beginning with the 2022-2023 academic year.

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Instructions for changing your Advisor:

Before initiating the process to change your graduate advisor, please consider all the options listed on the Graduate School's website for ***how to address difficulties in the student-advisor relationship:***

Once you have decided to change your graduate advisor, you must follow the steps listed below.

1. Meet with your graduate program director to initiate the process to change advisor. If meeting with the graduate program director is not feasible or appropriate, meet with the Chair or School Dean of the department or school. If you are in a non-departmental program, you may meet with the Chair or School Dean of your administrative home department or school.
2. Discuss the following with the graduate program director (or Chair/School Dean) and, if appropriate, the current advisor:
   - Whether additional resources within or outside the department (such as the Ombuds office) could help resolve the situation.
   - The impact of the change of advisor on your time to complete the degree. Coursework, qualifying exam(s), and the research proposal examination are all factors that could be impacted with a change in advisor.
   - Your current and future funding.
   - Research already conducted. Whether this will be incorporated into the dissertation, thesis, or report, and if so, how.
   - Impact on immigration status (if any). Consult International Programs and Services (IPS), if necessary.
   - Complete the BME Change of Advisor form and record the agreement from the discussions in writing, including indications of agreement from all affected faculty advisors, and provide copies to the student, the graduate program director, and all affected faculty advisors.
3. File an updated *Advisor and Committee Recommendation Form* for approval by the Graduate School.
4. If the student and the graduate program director are unable to reach agreement on the advisor change, contact the assistant dean of the Graduate School to determine additional steps to resolve the situation.

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