



# PhD

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# **BIOMEDICAL ENGINEERING GRADUATE STUDENT HANDBOOK**

July 2024



**Michigan  
Technological**  
University

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## Contents

<b>Biomedical Engineering Faculty and Staff.....</b>	<b>4</b>
<b>Departmental Assessment Plan .....</b>	<b>5</b>
<b>Biomedical Engineering Doctoral Admission Process .....</b>	<b>6</b>
<b>Choosing an Advisor: .....</b>	<b>7</b>
<b>Choosing a Committee: .....</b>	<b>7</b>
<b>Keys, Desk, Computers, and Research Space Assignments:.....</b>	<b>7</b>
<b>Mail Service, Photocopier, Supplies, and Printers:.....</b>	<b>7</b>
<b>International Students:.....</b>	<b>7</b>
<b>University Student Policies: .....</b>	<b>7</b>
Academic Standards .....	7
Course and Credit Policies.....	8
Degree Completion Requirements .....	8
Financial Policies.....	8
Professional Conduct.....	8
Student Support and Health Insurance .....	8
<b>Biomedical Engineering Requirements and Deadlines .....</b>	<b>9</b>
<b>BME PhD Coursework Requirements .....</b>	<b>9</b>
Required Core Courses:.....	10
Requirements for Students with Non-Engineering Degrees:.....	10
<b>Research Proposal Exam and Qualifying Exam .....</b>	<b>10</b>
<b>Petition to Enter Candidacy .....</b>	<b>11</b>
<b>Graduate Teaching Assistant Requirement .....</b>	<b>12</b>
Graduate Language Assessment and Support (GLAS) Language Assessment Bandwidth Rubric.....	13
Graduate Language Assessment and Support (GLAS) Placement Guidelines.....	14
<b>Dissertation and Dissertation Defense .....</b>	<b>15</b>
<b>Biomedical Engineering Academic Timeline: .....</b>	<b>16</b>
<b>Grad School/BME Doctoral Timeline.....</b>	<b>18</b>
<b>Graduate School/BME Doctoral Timeline - Continued .....</b>	<b>19</b>

**Biomedical Engineering Plan of Study Form ..... 20**

**BE6900 Biomedical Engineering Doctoral Topics ..... 21**

**Instructions for changing your advisor ..... 22**

**Change of Advisor Form ..... 23**

**Graduate Seminar Series ..... 24**

**Graduate Seminar Assessment Form ..... 25**

**Biomedical Engineering Fall Semester Graduate Courses ..... 26**

**Biomedical Engineering Spring Semester Graduate Courses ..... 29**

**Evaluation and IDP Instructions ..... 32**



Michigan Technological University

## Biomedical Engineering

### Biomedical Engineering Faculty and Staff

Name	Title	Office	Email Address
Sean J. Kirkpatrick	Department Chair & Professor	Room 339A	<a href="mailto:sjkirkpa@mtu.edu">sjkirkpa@mtu.edu</a>
Jingfeng Jiang	Graduate Program Director & Professor	Room 336	<a href="mailto:jjiang1@mtu.edu">jjiang1@mtu.edu</a>
Graduate School Committee:	Jingfeng Jiang, Smitha Rao, Hoda Hatoum, Chunxiu (Traci) Yu		
Alexandra Holmstrom	Department Coordinator	Room 339	<a href="mailto:aholmstr@mtu.edu">aholmstr@mtu.edu</a>
Devin Seppala	Senior Office Assistant	Room 339	<a href="mailto:devin@mtu.edu">devin@mtu.edu</a>
Sunyoung Ahn	Lecturer & Biostatistician	Room 342	<a href="mailto:sahn@mtu.edu">sahn@mtu.edu</a>
Jeremy Goldman	Professor	Room 359	<a href="mailto:jgoldman@mtu.edu">jgoldman@mtu.edu</a>
Sangyoon Han	Associate Professor	Room 358	<a href="mailto:sjhan@mtu.edu">sjhan@mtu.edu</a>
Hoda Hatoum	Assistant Professor	Room 352	<a href="mailto:hhatoum@mtu.edu">hhatoum@mtu.edu</a>
Weilue He	Assistant Teaching Professor	Room 333	<a href="mailto:weilueh@mtu.edu">weilueh@mtu.edu</a>
Jingfeng Jiang	Professor	Room 336	<a href="mailto:jjiang1@mtu.edu">jjiang1@mtu.edu</a>
Bruce P. Lee	Professor	Room 337	<a href="mailto:bplee@mtu.edu">bplee@mtu.edu</a>
Steve Lehmann	Staff Engineer II	Room 351	<a href="mailto:sdlehman@mtu.edu">sdlehman@mtu.edu</a>
Smitha Rao	Associate Professor	Room 338	<a href="mailto:smithar@mtu.edu">smithar@mtu.edu</a>
Orhan Soykan	Professor of Practice	Room 342	<a href="mailto:soykan@mtu.edu">soykan@mtu.edu</a>
Chunxiu (Traci) Yu	Assistant Professor	Room 335	<a href="mailto:chunxiuy@mtu.edu">chunxiuy@mtu.edu</a>
Graduate Student Government Representative:	Fatemeh Razaviamri	Room 345	<a href="mailto:srazavia@mtu.edu">srazavia@mtu.edu</a>



Michigan Technological University

# Biomedical Engineering

## Departmental Assessment Plan

At the end of the Biomedical Engineering PhD program, students will be able to:

Learning Goals	Measures
Demonstrate mastery of the subject matter.	Graduate course grades Qualifying Exam Research Proposal Dissertation and Defense PhD Evaluation and IDP
Demonstrate advanced research skills; design and execute a research project and conduct original and publishable research in the field. <ul style="list-style-type: none"> <li>Master application of existing methodologies and techniques.</li> <li>Critically analyze and evaluate one's own findings and those of others.</li> </ul>	Research Proposal Dissertation and Defense PhD Evaluation and IDP
Make an original and substantial contribution to the discipline. <ul style="list-style-type: none"> <li>Think originally and independently to develop concepts and methodologies.</li> <li>Identify new research opportunities within one's field.</li> </ul>	Research Proposal Dissertation and Defense PhD Evaluation and IDP Publications Conference presentations Doctoral Candidate Seminar
Demonstrate professional skills. <ul style="list-style-type: none"> <li>Effective oral communication skills.</li> <li>Effective written communication skills.</li> <li>Graduate Teaching</li> </ul>	Qualifying Exams Research Proposal Dissertation and Defense PhD Evaluation and IDP Publications Doctoral Candidate Seminars Conference presentations GTA evaluations
Practice responsible conduct of research.	Research Proposal Dissertation and Defense PhD Evaluation and IDP Publications Doctoral Candidate Seminars Conference presentations RCR Training GTA evaluations

## Biomedical Engineering Doctoral Admission Process

Applications must be received by the admissions deadline to receive support from the Department of Biomedical Engineering (BME) PhD program:

- Fall semester admission: PhD application deadline is **January 15**.
- Spring semester admission: PhD application deadline is **July 1**. *However, most applicants are awarded support for the fall semester, very few applicants are awarded support for the spring semester.*

Applications submitted after the deadline will be considered on a rolling basis. **For full consideration of support, applications should be submitted by the deadline.**

Support letters will be sent to applicants prior to the start of the semester.

### Admission Requirements:

**Applicants that meet the required criteria are not guaranteed acceptance into the program.**

- GPA of 3.25 on a 4.0 scale
- To convert your GPA to the 4.0 scale, please use this link: [GPA Calculator](#)
- GRE: Recommended scores of 85% (*Michigan Tech students are exempt*)
  - 165 Quantitative
  - 153 Verbal
  - 3.0 Analytical
- TOEFL: Recommended Score of 110 iBT (*International Students*)
- IELTS: Recommended Overall Band Score of 8.0 (*International Students*)

The graduate committee will review applications approximately biweekly and reject any applications that do not meet the basic requirements.

The applications that were not rejected will be sent to department faculty. Faculty will review applications and identify applicants with mutual research interests. Applicants whose statement of purpose poses a mutual research interest will be approved for acceptance into the program (this final approval does not indicate funding will be received). The applicant will be temporarily paired with the faculty member for advising.

[Table of Contents](#)

## Choosing an Advisor:

PhD students are assigned a temporary advisor upon their acceptance into the Biomedical Engineering Graduate Program. Students must choose an advisor prior to the end of the first semester and submit the [Advisor and Committee Recommendation Form](#) to the department and Graduate School.

## Choosing a Committee:

Complete Advisor & [Committee](#) Recommendation Form and submit to the [Graduate Program Assistant](#) prior to the end of the 2<sup>nd</sup> semester (post MS) or prior to the end of the 4<sup>th</sup> semester (post BS). A doctoral student committee must consist of at least four faculty members listed as [graduate faculty](#) by the graduate school. One of the committee members must be outside the Biomedical Engineering Department (hereafter referred to as an external member) and the (primary) students' advisor must have at least 50% of a full-time-equivalent appointment with the Biomedical Engineering Department. If the student has a co-advisor outside the BME department, the co-advisor cannot be listed as an external member to meet the graduate school requirements.

## Keys, Desk, Computers, and Research Space Assignments:

See office staff at front desk in H-Stem Complex 339 for office assignment, computer and swipe access (or keys).

See your advisor for appropriate lab training and workspace.

## Mail Service, Photocopier, Supplies, and Printers:

Students will receive announcements and information via the departmental graduate student Google group (begrad-l@mtu.edu).

Copy machine, printers, and campus mail boxes are located in H-STEM Complex 332 pantry/copier room.

## International Students:

Please refer to the International Programs and Services [website](#) for helpful information.

## University Student Policies:

The following links from the Graduate School website explain University [Student Policies](#)

## Academic Standards

- [Appeals of Suspension or Dismissal](#)
- [Attendance Policy](#)
- [Exam Policies](#)
- [Good Academic Standing and Dismissal](#)
- [Scholastic Standards](#)

[Table of Contents](#)

Continued next page.

## Course and Credit Policies

- [Adding and Dropping a Course](#)
- [Bills, Due Dates, Refunds, and Payment Plans](#)
- [Credit Hours and Expectations](#)
- [Enrollment Policies and Full-Time Status](#)
- [Full-Time Course Listing](#)
- Medical ([Voluntary](#) and [Involuntary](#)) and [University Withdrawal](#)
- [Entering Candidacy](#) (also see department [guidelines](#))
- [Reusing Credits](#)
- [Transfer, MIGS, and Senior Rule Credits](#)

## Degree Completion Requirements

- [Degree Requirements](#) (also see department [guidelines](#))
- [Dissertations, Theses,](#) and [Reports](#) (also see department [guidelines](#))
- [Holds FAQ](#)
- [Graduation, Certification, and Commencement](#)
- [Tracking and Status Forms](#)

## Financial Policies

- [Assistantships](#)
- [CGS Resolution Regarding Graduate Scholars, Fellows, Trainees, and Assistants](#)
- [Federal Financial Aid](#)
- [Fellowships](#)
- [Financial Aid Policies](#)
- [Minimum Stipend Rates](#)

## Professional Conduct

- [Academic Integrity](#)
- [Conduct Policies](#)
- [Consensual Relationships](#)

## Student Support and Health Insurance

- [Disability Services](#) and [Policies](#)
- Grievances: [Dean of Students](#) | [Graduate School](#)
- [Health Insurance Policy and Information](#)
- Medical Withdrawal: [Voluntary](#) | [Involuntary](#)
- [Parental Accommodation](#)

[Table of Contents](#)

## Biomedical Engineering Requirements and Deadlines

Each PhD student enrolled in the Department of Biomedical Engineering (BME) PhD program is required to adhere to the following **requirements** and deadlines. Students requiring additional coursework will be notified of any required prerequisites as determined by the student's advisor and/or BME graduate program director.

REMEMBER THAT FORMS ARE AVAILABLE ON THE [GRADUATE SCHOOL WEBSITE](#), [MyMichiganTech](#) AND THE [BIOMEDICAL ENGINEERING WEBSITE](#).

**STUDENTS ARE REQUIRED TO MONITOR THEIR ACCOUNTS AND SUBMIT FORMS BY THE REQUIRED DEADLINES.**

**Newly accepted student responsibilities upon arrival on campus and prior to 1st day of class:**

Obtain Husky Card

International students report to International Programs and Services (IPS)

Attend Graduate School Orientation

- Complete Basic Responsible Conduct of Research Training:
  - Provided during Graduate School Orientation Or
  - [Basic RCR Training](#)
- Complete on [MyMichiganTech](#) the Patent, Research, & Proprietary Rights Agreement Form
- Submit official proof of previous degrees earned to the Graduate School

Attend BME Department Graduate Student Orientation Meeting.

Meet with your temporary assigned advisor to discuss which courses to enroll in.

## BME PhD Coursework Requirements

### Coursework Requirements:

A total of 60 credit hours (post bachelors) or 30 credit hours (post masters) of coursework, research credits, and at least 1 semester of teaching are required prior to graduation. All PhD students must take a minimum of 12 BME departmental credits.

- 24 credits of coursework (including a minimum of 12 BME credits) are required for students entering the PhD program with an accredited (or equivalent) bachelor's degree.
- 18 credits of coursework (including a minimum of 12 BME credits) are required for students with a non-MTU BME master's degree. Course waivers (up to 6 credits) can be granted upon approval of the advising committee and graduate director.
- 24 post-bachelor MTU course credits (including a minimum of 12 BME credits) are required for students with an MTU BME master's degree.

**Student's coursework must be approved by their advisor, BME graduate program director, and/or BME department chair using the [Plan of Study Form](#).** Coursework requirements will vary by individual student based on his or her background.

One 3000 level course (3 credits) can be counted toward graduate coursework requirements with the following criteria: (1) outside the department, (2) a prerequisite of an advanced graduate course that is essential in the student's [plan of study](#), and (3) with prior approvals from the advisor and graduate director.

Graduate students who wish to take 4000 level courses (9 maximum) must get special approval from their advisor.

## Required Core Courses:

**The following courses are required core courses, all students must take and pass with a minimum of a “B” grade. Students will be required to re-take the course with grades less than “B”:**

- MA5701 Statistical Methods I - offered Fall, Spring, and Summer
- BE5200 Cellular & Molecular Biology II - offered Spring OR KIP 5500 Systems Physiology offered Fall

There is potential for a waiver of the core courses if students from universities other than MTU have taken graduate level courses and received a satisfactory GPA. Waivers will be granted at the discretion of the advisor.

Up to 6 credits of SCV/BC/C grades are allowed as long as they (1) aren't one of the required core courses and (2) are approved by the advisor and graduate program director.

## Requirements for Students with Non-Engineering Degrees:

In addition to students with BS or MS engineering degrees, the BME department also accepts qualified students from non-engineering programs. To ensure success of these students in the program, students with non-engineering degrees will need to demonstrate proficiencies in mathematics and engineering knowledge. Deficiencies in engineering topics will be determined by their advisor and BME graduate program director. The requirement to fulfill these deficiencies can be accomplished with the following options.

- **Courses:** Students need to take specific courses to fulfill the engineering requirement. The exact courses will depend on the student's deficiencies. The number of credits and courses will be determined by the student's advisor (and advisory committee, if applicable), and approved by the BME graduate program director. **These extra credits cannot be counted towards the credit requirement for the degree.**
- **Independent Projects:** If a student does not have the proper engineering background in a certain area, he/she can enroll in an independent study/project advised by a faculty with the appropriate expertise and approved by the BME graduate program director. **The independent project can be counted towards the credit requirement for the degree.** See [BE6900 Biomedical Engineering Doctoral Topics](#)

## Research Proposal Exam and Qualifying Exam

The student needs to pass the research proposal exam and the qualifying exam to become a PhD candidate and enter candidacy. All coursework requirements must be completed, with a minimum cumulative GPA of 3.25. A minimum of 12 credits must be from the BME department.

- The exam must be scheduled before the beginning of the 3<sup>rd</sup> year (5<sup>th</sup> semester) of the PhD program.
- The exam should be scheduled 3 weeks prior to the exam date.
- Students must contact the [Graduate Program Assistant](#) for instructions for the defense process.
- Provide the date, time, building/room number and proposal title to the departmental coordinator. H-STEM Complex 339 staff can reserve a room.
- The advisory committee needs to select a chairperson to oversee the exam. The chairperson must be a primary BME faculty member. The advisor shall only serve as an observer during the exam process.
- If a student fails a portion of the exam, he or she must retake the failed portion of the exam within a year. A student that fails either portion of the exam 2 times will be dismissed from the program.

Continued next page.

[Table of Contents](#)

**Research Proposal Exam and Qualifying Exam:** This is a public presentation of the student's research proposal to the advisory committee covering the background, hypotheses, aims, goals, preliminary data, and experimental methods of the proposed research for their defense dissertation (this constitutes the research proposal exam). After the presentation the student's advisory committee meets with the student alone to ask the student questions (this constitutes the qualifying exam section). Both exams will also serve to test the student's basic knowledge of the research topic. The research proposal exam and qualifying exam are typically performed on the same day, one immediately following the other.

- The student must provide each committee member the abstract and scope of the research proposal no later than 3 weeks prior to their exam. The written research proposal must follow the full research proposal guidelines of a federal funding agency (NIH, NSF, DoD, etc.). The final proposal must be submitted to each committee member 2 weeks before the exams.
- The proposal presentation is open to the public. The student will give a presentation (45-minute maximum) to the audience covering the background, hypotheses, aims, goals, preliminary data, and experimental methods of the proposed research. The general audience and committee members will question the student on the proposal.
- Based on the feedback from the entire audience, the committee will evaluate the student's ability to present and defend a reasonable and technically sound research plan using the Biomedical Engineering PhD Evaluation Rubric and record the results on the Biomedical Engineering Evaluation of PhD Graduate Student Outcomes – Research Proposal and Biomedical Engineering Evaluation of PhD Graduate Student Outcomes – Qualifying Exam.
- Approval of the research proposal exam and qualifying exam may come upon successful completion of the proposal presentation and question session or may require additional meetings with the committee and the approval of another separate oral qualifying exam covering basic research topics discussed with the advisory committee. Approval must be made within a year of the proposal presentation or the student will be dismissed from the program.

## Petition to Enter Candidacy

A student is eligible for Candidacy after successfully completing all required coursework and passing the qualifying exam and research proposal exam. **The [Candidacy Petition](#), with the [Degree Schedule](#) if not previously submitted, must be submitted to the Graduate School 1 week prior to the 1<sup>st</sup> day of the next semester or 1 week prior to the end of the previous semester, whichever is earlier.**

[Table of Contents](#)

# Graduate Teaching Assistant Requirement

## GTA GUIDELINES:

- GTA positions are usually only offered to students who have at least 12 MTU credits. All PhD students are required to be a GTA for at least 1 semester.
- All international doctoral students are required to take GLAS assessment (Graduate Language Assessment and Support) in the first semester. If a student should fail to meet the GLAS-3 designation, the student must work with his/her advisor to establish a plan of improvement to ensure the student would pass at least GLAS-3 before or in his/her 3rd year or **before their TA appointment**. The improvement plan should be submitted to the graduate committee and followed up as a part of his/her semester-based performance assessment. GLAS assessment is scheduled through the [testing center](#).
- Required Center for Teaching and Learning (CTL) Graduate Teaching Assistant Training must be completed at least 2 weeks prior to the start of a GTA appointment. The Graduate Teaching Assistant Training is 7 weeks (20hrs) of content badge course along with assessments at the end of each module and a final project. The training begins in early August. Department staff will arrange this for you.
- TA positions will be assigned 6 weeks prior to the semester.
- 1 week prior 1<sup>st</sup> day of class:
  - Instructor will provide and review the GTA teaching requirements.
- At the end of TA assignment:
  - Instructor will provide the TA with results using an evaluation rubric.
- GTA must pass teaching assignment with an overall assessment of “satisfactory”.
- If GTA teaching performance is not satisfactory the graduate student’s committee will meet and recommend a remedy for the poor performance. Possibilities include, but are not limited to:
  - Taking another MTU course and receiving a determined grade
  - TA another course
  - Loss of future funding

[Table of Contents](#)

## Graduate Language Assessment and Support (GLAS) Language Assessment Bandwidth Rubric

Score	Description
4 – Strong	Clearly demonstrates understanding of all of the questions. All responses are on topic. Speech is fluent and effortless. Vocabulary is similar to that of a native speaker. Pronunciation is accented but easily understood. Grammar is similar to that of a native speaker.
3 – Acceptable	Clearly demonstrates understanding of all of the questions. One response may be somewhat off topic. Speech is generally fluent with occasional lapses to search for words. Few misused words (meaning, word form). Sometimes rephrases due to an unknown word. Pronunciation is accented but easily understood most of the time. Makes occasional grammatical errors. Errors do not cause confusion.
2 – Marginal	Demonstrates understanding of 2/3 of the questions; more than one response is somewhat off topic. Speech frequently disrupted by search for words. Limited vocabulary makes comprehension difficult at times. Words are sometimes misused (meaning, word form). Pronunciation problems require concentration on the part of the listener and occasionally lead to misunderstanding. Makes frequent grammar errors. Errors cause confusion.
1 – Weak	Demonstrates understanding of 0-1 question. Most responses are off topic. Speech is hesitant and minimal due to language limitations. Vocabulary is limited, and words are often misused (meaning, word forms). Pronunciation and/or grammar errors greatly limit communication.

For more information on how to apply GLAS Language Assessment scores to Graduate Assistant roles, see the “GLAS Placement Guidelines” document.

For more information on the GLAS program, visit <https://www.mtu.edu/gradschool/resources-for/students/glas/> or contact Sarah Isaacson, GLAS Program Director (sisaacso@mtu.edu).

[Table of Contents](#)

## Graduate Language Assessment and Support (GLAS) Placement Guidelines

Role	Method to satisfy proficiency
<b>No role suggested</b>	<ul style="list-style-type: none"> <li>• TOEFL/IELTS score meets or exceeds admission requirements</li> <li>• GLAS Language Assessment score is <b>“1 – Weak”</b></li> <li>• GLAS program and assessment recommended until student’s GLAS Language Assessment score is “4 – Strong.”</li> </ul>
<b>Grader / Lab Prep</b>  Minimum direct student contact	<ul style="list-style-type: none"> <li>• TOEFL/IELTS score meets or exceeds admission requirements</li> <li>• GLAS Language Assessment score is <b>“2 – Marginal”</b></li> <li>• GLAS program and assessment recommended until student’s GLAS Language Assessment score is “4 – Strong.”</li> </ul>
<b>Lab Teaching Assistant</b>  Closely supervised by faculty or staff who set course content, policies and grading	<ul style="list-style-type: none"> <li>• TOEFL/IELTS score meets or exceeds admission requirements</li> <li>• GLAS Language Assessment score is <b>“3 – Acceptable”</b></li> <li>• GLAS program and assessment recommended until student’s GLAS Language Assessment score is “4 – Strong.”</li> </ul>
<b>Recitation Instructor</b>  Closely supervised by faculty or staff who set course content, policies, and grading	<ul style="list-style-type: none"> <li>• TOEFL/IELTS score meets or exceeds admission requirements</li> <li>• GLAS Language Assessment score is <b>“4 – Strong”</b></li> <li>• GLAS program recommended to maintain communication skills of instructional role</li> </ul>
<b>Instructor of Record</b>  Course content, policies, and grading are set by instructor of record.	<ul style="list-style-type: none"> <li>• TOEFL/IELTS score meets or exceeds admission requirements</li> <li>• GLAS Language Assessment score is <b>“4 – Strong”</b></li> <li>• GLAS program recommended to maintain communication skills of instructional role</li> </ul>

For more information on the interpretation of GLAS Language Assessment scores, see the “GLAS Language Assessment Bandwidth Rubric” document.

For more information on the GLAS program, visit <https://www.mtu.edu/gradschool/resources-for/students/glas/> or contact Sarah Isaacson, GLAS Program Director (sisaacso@mtu.edu).

[Table of Contents](#)

## Dissertation and Dissertation Defense

A dissertation is the culmination of a research project. Students must prepare their document using the guide found on the Graduate School [website](#).

Students must contact the [Graduate Program Assistant](#) for instructions for the defense process.

The final oral dissertation defense may be scheduled in the Current Students tab on [MyMichiganTech](#). See the Graduate School [website](#) for more information. This form requires a date, time and building/room number for the defense. **Students must provide this information along with the title of the defense to the department coordinator before or at the same time the defense is scheduled.** Staff in H-STEM Complex 339 can reserve a room for the defense.

**All defenses must be scheduled two weeks in advance of the desired date.** Students must submit the complete defense draft of their dissertation to the Graduate School and also to their advisor and committee two weeks before their defense. **The deadline to submit a committee approved post-defense dissertation, thesis or report is 4:00 p.m. on the Monday of week 14.**

**There is a grace period from Tuesday of week 14 to Wednesday 4:00 p.m. of the week before classes begin for the next semester. Students who submit their dissertation, thesis, or report will qualify to enroll in UN5951 in the upcoming semester. These students will pay the resubmission fee (25% of one-credit of tuition) when their documents are accepted.**

The dissertation defense is open to the public. The student will give a presentation to the audience. The general audience will first question the student on the proposal. Upon dismissal of the general audience, the dissertation committee members will continue to question the student. The committee will evaluate the student's ability to present and defend the dissertation based on the Biomedical Engineering PhD Evaluation Rubric and record the results on the Biomedical Engineering Evaluation of PhD Graduate Student Outcomes – Dissertation & Defense. If the student does not pass the defense, he/she can retake the defense a second time. Failure in the second defense will result in the student's dismissal from the PhD program.

Upon completion of the oral dissertation defense, students should make any technical corrections requested by their advisor and committee and also any formatting corrections from the Graduate School. Print the Approval of Dissertation, Thesis or Report Form from the Graduate School website and obtain signatures from advisor and all committee members. The completed form must be submitted to the Graduate School. Within one week and prior to the deadline, submit the final dissertation to the Graduate School (see the [website](#) for submission instructions). The deadline to submit a final dissertation is Monday of week 14 of the semester.

[Table of Contents](#)

# Biomedical Engineering Academic Timeline:

## Beginning of 1<sup>st</sup> semester:

- Complete [EverFi training](#)
- Complete [Advisor](#) & Committee Recommendation Form and submit to the Department Coordinator. This process is to confirm who the advisor will be. Students may choose to change their assigned advisor at this time.

## 2<sup>nd</sup> semester:

- Complete Advisor & [Committee](#) Recommendation Form and submit to the Department Coordinator prior to the end of the semester. **(Post Master's students only)** This process is to choose an advisory committee. The committee will consist of the student's advisor, and at least 3 additional full-time faculty members. Two members must have a primary appointment in the BME department. There must be at least one member who does not have a primary appointment in the BME department.
- Proposed coursework: Biomedical Engineering [Plan of Study Form](#). The proposed coursework will include the classes taken during the first semester. This must be signed by the advisor. This form is for department files only.

## 2<sup>nd</sup> – 3<sup>rd</sup> semester:

- Complete [Advanced Responsible Conduct of Research Training](#)
  - Students are recommended to take these courses fall or spring semester

## 3<sup>rd</sup> - 6<sup>th</sup> semester: (completion of coursework)

- **One semester of GTA**
- **Proposal Defense**
  - Provide date, time, building/room number and proposal title to departmental coordinator.
- Submit [Qualifying Exam](#) and [Research Proposal Exam](#) to the department. Staff enters into BANNER.
- Submit Evaluation Rubrics to the department. (These will be provided to you at the appropriate time)
- Submit Petition to [Enter Candidacy](#) to the Graduate School
- Submit [Degree Schedule](#) to the Department Coordinator
- ***All PhD students will be required sometime during their study (prior to their defense) to present a seminar to BME faculty and other BME graduate students. Two students will be selected per semester. Discussions with selected students will occur early in the semester to allow presenting students time to prepare their seminar.***

## 4<sup>th</sup> semester:

- Complete Advisor & [Committee](#) Recommendation Form and submit to the Department Coordinator prior to the end of the semester. **(Post Bachelors students only.)** This process is to choose an advisory committee. The committee will consist of the student's advisor, and at least 3 additional full-time faculty members. Two members must have a primary appointment in the BME department. There must be at least one member who does not have a primary appointment in the BME department.

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**Every semester:**

- ***Must attend a minimum of 6 BME [graduate seminars](#) each semester. Attendance of other department seminars is required if there are not enough BME seminars offered.***
- ***Must attend 1 WRITE-D workshop per month. Students will receive information from department facilitator.***

**At the end of every semester:**

- Submit Graduate Student [Evaluation and IDP](#) to advisor at the end of each semester/prior to the beginning of the next semester. (This form will be sent to student by office staff).
- Arrange meeting with advisor to review the Evaluation and IDP
- The purpose of the Evaluation and IDP is to keep the advisor abreast of progress and garner their feedback. The advisor may determine if more frequent meetings are required. This also provides graduate students with a review of their performance and expectations for the coming semester. Negative reviews will reflect in the graduate student's grade.

**SEMESTER OF PLANNED DEGREE COMPLETION:**

Students need to monitor their [MyMichiganTech](#) account for required [Graduate School forms and deadlines](#)

**6th - 10th Semester:**

- Submit [Degree Completion Form](#) to the Graduate School

**Defense of research proposal presentation (dissertation defense):**

**2 weeks prior to defense:**

- Provide date, time, building/room number and defense title to departmental coordinator. H-STEM Complex 339 staff can reserve a room for the defense.
- Schedule the defense in the Current Students tab on [MyMichiganTech](#) and submit the Defense Draft to the Graduate School and your advisory committee. Committee members may request to have the defense draft turned in sooner.

**On the day of the defense:**

- Bring a copy of the Report on Final Oral Examination Form and Evaluation Rubrics (provided by office staff) to the defense
- The dissertation defense is open to the public. The student will give a presentation to the audience. The general audience will first question the student on the proposal. Upon dismissal of the general audience, the committee members will continue to question the student. The committee will evaluate the student's ability to present and defend the dissertation. If the student does not pass the defense, he/she can retake the defense a second time. Failure in the second defense will result in the student's dismissal from the PhD program.

**Please refer to the Graduate School guidelines for remaining procedures at:**

[Theses dissertation policies and procedures](#) or [MyMichiganTech](#)

**Staff at the front desk will send you a departmental Exit Interview to complete before you leave the university.**

[Table of Contents](#)

<b>Grad School/BME Doctoral Timeline</b>
<b>Before you arrive on campus:</b>
<ol style="list-style-type: none"> <li>1. Arrange for housing</li> <li>2. Consult with your assigned BME advisor for course selection</li> <li>3. International students must submit arrival information on <a href="#">MyMichiganTech</a> to notify International Programs and Services (IPS)</li> </ol>
<b>Upon arrival on campus:</b>
<ol style="list-style-type: none"> <li>1. Obtain Husky Card</li> <li>2. International students report to IPS</li> </ol>
<b>Prior to 1<sup>st</sup> week of class:</b>
<ol style="list-style-type: none"> <li>1. Attend Graduate School Orientation</li> <li>2. Complete Basic Responsible Conduct of Research Training</li> <li>3. Complete Patent, Research, &amp; Proprietary Rights Agreement Form on <a href="#">MyMichiganTech</a></li> <li>4. Submit official proof of previous degrees earned to the Graduate School</li> <li>5. Attend BME Grad Student Orientation</li> </ol>
<b>Beginning of 1<sup>st</sup> semester:</b>
<ol style="list-style-type: none"> <li>1. Submit Advisor Recommendation Form to the Graduate School</li> <li>2. Complete EverFi training</li> </ol>
<b>Every year:</b>
<ol style="list-style-type: none"> <li>1. Provide proof of health insurance or pay University policy</li> <li>2. Obtain parking permit</li> <li>3. Attend BME GTA meeting if teaching</li> </ol>
<b>Every semester:</b>
<ol style="list-style-type: none"> <li>1. Register for courses</li> <li>2. Pay tuition bill</li> <li>3. Confirm enrollment</li> <li>4. Attend required graduate seminars and WRITE D workshops</li> </ol>
<b>At the end of every semester:</b>
<ol style="list-style-type: none"> <li>1. Submit Evaluation and IDP to advisor</li> </ol>
<b>Prior to the end of the 2<sup>nd</sup> semester PM (4<sup>th</sup> semester PB):</b>
<ol style="list-style-type: none"> <li>1. Submit Advisory Committee Form to the Graduate School</li> <li>2. Complete BME Plan of Study Form</li> </ol>
<b>2<sup>nd</sup> or 3<sup>rd</sup> semester:</b>
<ol style="list-style-type: none"> <li>1. Complete Advanced Responsible Conduct of Research Training</li> </ol>
<b>3<sup>rd</sup> – 5<sup>th</sup> semester:</b>
<ol style="list-style-type: none"> <li>1. Complete GTA requirement</li> </ol>
<b>4<sup>th</sup> semester PM (6<sup>th</sup> semester PB): (Proposal Defense)</b>
<ol style="list-style-type: none"> <li>1. Provide date, time, building/room number and proposal title to departmental coordinator. H-STEM Complex 339 staff can reserve a room.</li> <li>2. Pass Qualifying Exam and Research Proposal Exam submit to department to enter in BANNER</li> </ol>
<b>Semester coursework is complete or before entering candidacy:</b>
<b>4<sup>th</sup> semester PM (6<sup>th</sup> semester PB)</b>
<ol style="list-style-type: none"> <li>1. Submit Degree Schedule to the Graduate School</li> </ol>
<b>1 week prior to beginning of semester you wish to enter candidacy:</b>
<ol style="list-style-type: none"> <li>1. Submit Petition to Enter Candidacy to the Graduate School</li> </ol>

Continued next page.

<b>Graduate School/BME Doctoral Timeline - Continued</b>
<b>Semester of planned degree completion (6<sup>th</sup> semester PM or 10<sup>th</sup> semester PB):</b>
1. Present a seminar for BME graduate students and faculty
<b>10 weeks prior to commencement:</b>
1. Submit Commencement Application Form to the Graduate School
2. Submit Degree Completion Form to the Graduate School
<b>4 weeks (PM) - 6 weeks (PB) prior to defense:</b>
1. Plan for defense: schedule date, time, and room with advisor committee and department. (H-STEM Complex 339 staff can reserve a room.)
2. Provide date, time, building/room number and title of defense to departmental coordinator.
<b>2 weeks prior to defense:</b>
1. Schedule the defense in the Current Students tab on <a href="#">MyMichiganTech</a> and submit the Defense Draft to the Graduate School and advisor committee
<b>Defense date:</b>
1. Defend and bring a copy of Report on Final Oral Examination Form Evaluation Rubrics
<b>Post – defense (refer to deadlines on Graduate School web-site)</b>
1. Submit Approval of Dissertation, Report, or Thesis Form to the Graduate School
<b>Within 1 week of submitting Approval Form and by semester deadline MONDAY OF WEEK 14:</b>
1. Submit Thesis/Report to Digital Commons and ProQuest
<b>Before leaving Campus and completing degree:</b>
1. Complete Graduate Student Workspace Cleanout Form on <a href="#">MyMichiganTech</a>
2. Complete Survey of Earned Doctorates and Exit Survey
3. Complete departmental Exit Interview

[Table of Contents](#)



Michigan Technological University

# Biomedical Engineering

## Biomedical Engineering Plan of Study Form

Student Name: \_\_\_\_\_ M #: \_\_\_\_\_ Date: \_\_\_\_\_

### List of courses to be counted toward PhD Degree

Title	Course Number	Number of Credits

Approval signatures: \_\_\_\_\_ Advisor \_\_\_\_\_

[Table of Contents](#)



## BE6900 Biomedical Engineering Doctoral Topics

Title of topic/project: \_\_\_\_\_

# of credits: \_\_\_\_\_ *BE6900 will receive a letter grade.*

Student Name: \_\_\_\_\_ M# \_\_\_\_\_

Faculty Approval:

\_\_\_\_\_  
Printed                      Signature                      Date: \_\_\_\_\_

[Table of Contents](#)

## Instructions for changing your advisor

This process is for when you wish to change your advisor after the Advisor and Committee Recommendation Form was already submitted to the Graduate School.

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.  
File an updated [Advisor and Committee Recommendation Form](#) for approval by the Graduate School.
3. 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.

[Table of Contents](#)



Michigan Technological University

# Biomedical Engineering

## Change of Advisor Form

I will be changing Advisors effective (date) \_\_\_\_\_

Student Name (printed):

Student Signature:

Date:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Current Advisor (printed):

Current Advisor Signature:

Date:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Future Advisor (printed):

Future Advisor Signature:

Date:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Graduate Seminar Series

Attendance of all Biomedical Engineering Graduate Seminars is **required**.

PhD students are required to present a seminar to BME faculty and BME graduate students.

Faculty attending the PhD student's seminar will use the Biomedical Engineering PhD Evaluation Rubric and record the results on the Biomedical Engineering Evaluation of PhD Graduate Student Outcomes – Seminar.

The department staff will email notifications about the date, time, and location for seminars that will occur (a seminar will not be held every week so please watch your email closely).

Seminars and defenses held during the summer are not to be counted toward the spring or fall seminar requirements.

### Requirements:

- All graduate students **MUST** attend all Biomedical Engineering seminars.
  - There will be a sign-in sheet at the seminar to ensure attendance.
- Graduate students must attend 6 seminars per semester (emails are sent from the department staff announcing other departmental seminars as well). If the BME department does not hold 6 seminars per semester, students must attend seminars from other departments.
  - BME PhD proposal defense, dissertation defense and MS Thesis/Report defense are considered to be part of the seminar series.
- Graduate students must write up a [brief summary](#) of each seminar attended. They must have their advisor approve and sign the summary and then turn it in to staff at the front desk.
- Failure to attend the appropriate number of seminars will result negatively on student's evaluations that occur each semester and will negatively impact their research grade.

### Events that are not acceptable for seminar assessments:

- Seminars that are **not** a scientific or technical research topic
- Webinars
- Graduate School workshops or training sessions
- PhD proposal defense, dissertation defense and MS Thesis/Report defense **outside of the BME department**
- Conferences
- Tech Talk Series



Michigan Technological University

# Biomedical Engineering

## Graduate Seminar Assessment Form

**Student Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**Title of Seminar attended:** \_\_\_\_\_

**Name of Seminar Presenter:** \_\_\_\_\_

**Summary of Seminar:**

**Advisor Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

[Table of Contents](#)

## 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.

### **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

Continued next page.

**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

**BE5770 - 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.

**BE5870 - 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

**BE5900 – 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

Continued next page.

**BE5930 – 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

**BE 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

Continued next page.

**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.

[Table of Contents](#)

## 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.

**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.

Continued next page.

**BE 5410 – 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.

**BE5900 – 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

**BE6000 – 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

Continued next page.

**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

***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 spring 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.

[Table of Contents](#)

## Evaluation and IDP Instructions

- Completed after each semester in the first year and then annually for PhD students.
- Completed annually by Master's students.
- Both the student and advisor need to complete sections on the assessment.
- Assessments will contain written feedback and must be discussed during a meeting between the advisor and student and then signed and dated.
- The assessment is a shared document between the advisor and student and is kept in the departmental shared drive.
- In the event that serious deficiencies are identified, they must be clearly identified in the advisor expectations with a plan to remedy the deficiencies.

**The Evaluation and IDP forms will be sent to students as a shared document by office staff.**

**EVALUATION FORMS MUST BE COMPLETED ELECTRONICALLY AND CANNOT BE FILLED OUT BY HAND.**

Student:

You will receive a shared document from office staff.

Complete all questions pertaining to **student information** in the live document. Do not make a copy.

Prepare an updated Curriculum Vitae.

Share your CV and Evaluation document with your advisor to complete.

You should arrange to meet with your advisor to discuss, sign, and date the evaluation.

Advisor:

You will receive a shared document from your grad student.

Complete all questions pertaining to **advisor information** in the live document. Do not make a copy.

The completed Evaluation and IDP should be discussed, signed and dated at the meeting with your student.

Notify office staff that the Evaluation is complete. Students can access their Evaluation and IDP form anytime.

[Table of Contents](#)