



College of Engineering and Technology
Department of Engineering

Master of Science

Biomedical Engineering

Master of Science

Mechanical Engineering

Graduate Student Handbook

AY 2019-2020

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WELCOME

Welcome to the graduate program in the Department of Engineering at East Carolina University! We are delighted that you have decided to join us. You are about to embark upon a truly rewarding journey. Over the next two years, you will have many new experiences and discover unique opportunities for intellectual inquiry, camaraderie and personal growth. The challenge of graduate study may benefit from a note of caution.

By pursuing a graduate degree, you are entering a new and different phase of your academic career and intellectual development. **Graduate study is not simply a continuation of your undergraduate degree, but is qualitatively different in a number of important respects.** As a graduate student, you will:

- Begin a transition from being primarily a consumer of knowledge and information to being a producer of knowledge and information. This transition requires different and higher-level skills than you employed as an undergraduate.
- Be more independent. Within the requirements of the MS-BIME or MSME program, you will engage in a new course of study, academic specialization, and a research agenda. More of your time will be spent on primary research and independent scholarly activity rather than classroom assignments.
- Assume an important and active role in your courses.
- **Read and write more than you ever imagined possible!**

PURPOSE

This handbook is a guide to the East Carolina University (ECU) graduate programs in Biomedical Engineering and Mechanical Engineering for Graduate Students and faculty. It is meant as a supplement to the regulations set forth by the East Carolina University Graduate School (<http://www.ecu.edu/gradschool/>) and should be used as a reference for program-level policies and procedures. **Exceptions to the policies described herein should be made in consultation with and formal written approval by, the Graduate Program Director and the student's research advisor.** The Engineering program's graduate committee will decide whether to grant or decline the student's petition for an exception.

CONTACTS

Department Chair

Dr. Barbara J. Muller-Borer (mullerborerb@ecu.edu)

Graduate Program Director

Dr. Sunghan Kim (kims@ecu.edu)

MS-BIME Program Coordinator

Dr. Sunghan Kim (kims@ecu.edu)

MSME Program Coordinator

Dr. Brian Sylcott (sylcottb15@ecu.edu)

IMPORTANT GRADUATE PROGRAM LINKS

- MS Biomedical Engineering
<https://cet.ecu.edu/engineering/ms-biomedical-engineering/>
- MS Mechanical Engineering
<https://cet.ecu.edu/engineering/ms-mechanical-engineering/>
- ECU Graduate School
<http://www.ecu.edu/gradschool/>
- ECU Graduate Catalog
<http://www.ecu.edu/registrar/catalog.cfm>
- ECU Graduate School – Current Student Information (Graduation, Academic Support, Financial)
<http://www.ecu.edu/cs-acad/gradschool/current.cfm>
- ECU Graduate School Listing of Graduate Programs
<http://www.ecu.edu/cs-acad/gradschool/Find-Your-Graduate-Program.cfm?id=396&view=program>

IMPORTANT ECU LINKS

- East Carolina University <http://www.ecu.edu/>
- ECU Department of Engineering <http://www.ecu.edu/cs-cet/engineering/>
- ECU Academic Calendars <http://www.ecu.edu/fsonline/senate/fscalend.cfm>
- ECU Registrar <http://www.ecu.edu/registrar/>
- Financial Resources, Tuition and Fees
<http://www.ecu.edu/cs-acad/gradschool/Graduate-School-Financial-Resources.cfm>
- Pirate Port and Access to DegreeWorks <https://pirateport.ecu.edu/portal/>

ACADEMIC SUPPORT SERVICES & COUNSELING

- ECU's Writing Center
<http://www.ecu.edu/cs-acad/writing/uwc/>
- ECU's Writing Center, section on Plagiarism
<http://www.ecu.edu/cs-acad/writing/uwc/>
- ECU Student Handbook, section III on Academic Integrity
<http://www.ecu.edu/studenthandbook/policies.htm>
- The Speech Communication Center, School of Communication
<http://www.ecu.edu/cs-cfac/comm/center/index.cfm>
- ECU Disability Support Services
<http://www.ecu.edu/accessibility/>
- ECU Center for Counseling & Development
<http://www.ecu.edu/counselingcenter/>
- Navigate Counseling Clinic
<http://www.ecu.edu/cs-dhs/ah/clinics/navigate/index.cfm>

ADMINISTRATION OF THE GRADUATE PROGRAM

The Graduate Program Director (GPD) manages both the Biomedical and Mechanical Engineering graduate programs. The Director, in consultation with the graduate engineering core faculty, generally has decision-making power over admissions and degree requirements. The GPD reports directly to the Department of Engineering Chair and serves as the program's representative to the ECU Graduate School.

GRADUATE PROFESSIONAL DEVELOPMENT

In addition to the formal requirements and coursework, there are numerous opportunities for professional, scholarly, and social enrichment. These include guest speakers from other universities and institutions, professional meetings and conferences, the bi-weekly Department of Engineering Seminar Series, weekly UNC/NC State Graduate Biomedical Engineering Seminar Series, Journal Clubs, the Graduate and Professional Student Senate, Graduate Student Advisory Council, informal field trips and social opportunities. These opportunities for learning and networking are an integral part of graduate training and are invaluable for professional development. While it is recognized that students have lives and responsibilities beyond ECU, **it is expected that graduate students will actively contribute to the intellectual climate and scholarly culture of the program.**

A. MS DEGREES

Specific degree requirements are set forth in the Graduate catalog for the year in which students enter the program. The MS-BIME and MSME are managed by Department of Engineering in the College of Engineering and Technology.

ACCELERATED BS/MS

Students enrolled in the accelerated BS/MS programs must be mindful of additional scheduling constraints when selecting coursework.

- Only 12 s.h. of graduate credit (5000 and 6000 level) taken while still in the undergraduate program may “transfer” to the graduate degree.
- A total of 6 s.h. of graduate credit may ALSO be applied to technical elective requirements for the undergraduate degree.

Both degree programs require a minimum of 32 semester hours. These hours include courses in the common core made up of required courses and technical electives. Technical electives are chosen, in consultation with the student's research advisor, from an approved list. The complete list of approved technical electives can be obtained from the Graduate Program Director.

Each student is required to engage in independent scholarly research on a topic of interest, culminating in the oral and written presentation of a thesis. The degrees require 26 hours of coursework including and 6 hours of thesis credit.

All students are strongly encouraged to actively participate in the academic process through academic output such as a professional poster, oral presentation, or journal publications highlighting their research topic. Ideally, this should be accomplished before graduation.

MS-BIME

The Biomedical Engineering degree is designed for individuals interested in the application of advanced technologies to solve complex problems in the health sciences. The educational objectives of the program are to educate and train students to meet the challenges of biomedical discovery and the application of engineering principles to advance health care in eastern North Carolina. The MS-BIME program prepares students to support the regional workforce in industry, healthcare, government or pursue doctoral studies in biomedical engineering or advanced professional degrees.

REQUIRED COURSES: MS-BIME

The courses are designed to provide students with a solid foundation in research methods, life science, advanced mathematics and biostatistics and facilitate the preparation of a thesis proposal. All students are required to take 14 s.h. of BIME courses. **Courses should be chosen in consultation with the student's research advisor.**

BIME 6000 - Introduction to Biomedical Engineering Research (2 s.h.). Offered each fall. Required for all first semester graduate students.

BIME 7000 - Thesis (6 s.h.). Register for thesis hours **after** their thesis proposal has been approved.

Biomedical Engineering

Four courses offered with the BIME prefix are required:

- BIME 6200 Biomedical Instrumentation/Measurements (3 s.h.)
- BIME 6250 Biomedical Signal Processing (3 s.h.)
- BIME 6300 Cardiac Electrophysiology (3 s.h.)
- BIME 6350 Cardiac Mechanics (3 s.h.)
- BIME 6400 Biomaterials (3 s.h.)
- BIME 6450 Biomolecular Engineering (3 s.h.)
- BIME 6500 Tissue Engineering (3 s.h.)
- BIME 6700 Selected Topics in Biomedical Engineering (3 s.h.)
- BIME 6700 Selected Topics in Biomedical Engineering – Numerical Methods (3 s.h.)

Biomedical Engineering courses are typically offered either fall or spring, every other year. Please check the Graduate Catalog and Pirate Port for course offerings.

One Life Science course

- PHL Y 6330 Human Physiology (5 s.h.)
- PHL Y 7702 Graduate Physiology (5 s.h.)
- BIOL 6071 Human Gross Anatomy (4 s.h.)
- BIOL 6300 Neurophysiology (3 s.h.)
- BIOL 7480/7481 Cell Biology/Cell Biology Laboratory (4 s.h.)
- KINE 6208 Cardiopulmonary Physiology (3 s.h.)

One Biostatistics course

- BIOS 7021 Biostatistics for Health Professionals (I) (3 s.h.)
- BIOS 7501 Experimental Design (3 s.h.)
- MATH 5031 Applied Statistical Analysis (3 s.h.)
- MATH 5801 Probability Theory (3 s.h.)
- PHAR 7777 Biometry (3 s.h.)

One Advanced Mathematics course

- MATH 5101 Advanced Calculus I (3 s.h.)
- MATH 5102 Advanced Calculus II (3 s.h.)
- MATH 5110 Elementary Complex Variables (3 s.h.)
- MATH 5121 Numerical Analysis in One Variable (3 s.h.)
- MATH 6401 Introduction to Partial Differential Equations I (3 s.h.)
- MATH 6411 Ordinary Differential Equations I (3 s.h.)
- PHYS 5311 Mathematical Physics (3 s.h.)

One Technical Elective

Students are encouraged to select courses that combine to form a coherent program of study. Approved technical electives include:

- BIME 6200 – 6700
- KINE 6803 Special Topics in Neuromotor Control (3 s.h.)
- KINE 7200 Biomechanics (3 s.h.)
- PHYS 6715 Biomedical Physics (3 s.h.)
- PHYS 6720 Physics of Medical Imaging (3 s.h.)
- PHYS 7715 Biomedical Optics (3 s.h.)
- BIOC 7301 Biochemistry 1 (4 s.h.)
- BIOL 7880, 7781 Bioinformatics (3 s.h.)
- CHEM 7522 – Current Good Manufacturing Practices (3 s.h.)

Please check the Graduate Catalog and Pirate Port for course offerings per semester.

Table 1: Two Year MS-BIME Program Offerings*

<p style="text-align: center;">Semester 1 (Y1)– Fall</p> <ul style="list-style-type: none"> • BIME 6000 - Intro to Biomedical Engineering Research • BIME 6400 Biomaterials • Biostatistics • Math <p style="text-align: center;">or</p> <ul style="list-style-type: none"> • Life Science (most Life Science courses are offered in the fall semester) 	<p style="text-align: center;">Semester 2 (Y1) –Spring</p> <ul style="list-style-type: none"> • BIME 6200 - Biomedical Instrumentation/Measurements • BIME 6500 - Introduction to Tissue Engineering <ul style="list-style-type: none"> • Technical Elective, Biostatistics or Math
<p style="text-align: center;">Semester 3 (Y2) – Fall</p> <ul style="list-style-type: none"> • BIME 6250 - Biomedical Signal Processing • BIME 6350 - Cardiovascular Biomechanics • Technical Elective, Biostatistics or Math or Life Science • BIME 7000 Thesis hours 	<p style="text-align: center;">Semester 4 (Y2) – Spring</p> <ul style="list-style-type: none"> • BIME 6300 - Cardiac Electrophysiology • BIME 6450 - Biomolecular Engineering • Technical Elective, Biostatistics or Math • BIME 7000 Thesis hours

* Use Pirate Port and Degree Works to map individual course plan

Building on the research strengths of the affiliated ECU schools and colleges students may opt to focus their studies in one of the following areas:

- **Cardiovascular Biomedical Engineering**
 - BIME 6350 (Cardiovascular Mechanics)
 - BIME 6300 (Cardiovascular Electrophysiology)
 - BIME 6200 (Biomedical Instrumentation)
 - BIME 6250 (Biomedical Signal Processing)
- **Biomolecular & Tissue Engineering**
 - BIME 6500 (Introduction to Tissue Engineering)
 - BIME 6450 (Biomolecular Engineering)
 - BIME 6400 (Biomaterials)
 - BIME 6200 (Biomedical Instrumentation)
- **Biosensors and Biosignals**
 - BIME 6200 (Biomedical Instrumentation)
 - BIME 6250 (Biomedical Signal Processing)
 - BIME 6300 (Cardiovascular Electrophysiology)

MSME

The MSME program has two focus areas of research:

- **Advanced energy systems:** research includes sustainable and efficient energy systems, wind-energy, ocean wave energy generation and storage, energy harvesting, and energy transport and conversion processes, and
- **Mechanics of biomaterials:** research includes mechanical behavior of structural tissues, cellular materials, metals for medical implants and biological tissues.

Students are prepared for employment in a variety of areas of industry and the program provides training and research experience for students who are interested in pursuing a Ph.D. in mechanical engineering or related fields.

REQUIRED COURSES: MSME

ECU's MSME is a two-year program with a minimum of 32 semester hours of coursework and thesis. At least 14 s.h. of the coursework will come from the Department of Engineering, with an additional 6 s.h. of thesis credit and additional courses from the Departments of Mathematics, Physics, Biology, Biostatistics, and other disciplines as required to support the interests and research of individual students and faculty. **Courses should be chosen in consultation with the student's research advisor.**

MENG 6000 - Introduction to Engineering Research (2 s.h.). Offered each fall. Required for all first semester graduate students.

MENG 6100 - Finite Element Analysis of Solids and Fluids (3 s.h.)

MENG 6220 - Advanced Thermodynamics (3 s.h.)

MENG 6310 - Advanced Mechanics of Materials (3 s.h.)

MENG 7000 - Thesis (6 s.h.). Register for thesis hours **after** their thesis proposal has been approved.

In addition to the required courses listed above, students must take one advanced math course and four graduate level technical electives from the following list:

Advanced Mathematics Courses (1):

- MATH 5101 Advanced Calculus I (3 s.h.)
- MATH 5102 Advanced Calculus II (3 s.h.)
- MATH 5110 Elementary Complex Variables (3 s.h.)
- MATH 5121 Numerical Analysis in One Variable (3 s.h.)
- MATH 6401 Introduction to Partial Differential Equations I (3 s.h.)
- MATH 6411 Ordinary Differential Equations I (3 s.h.)
- PHYS 5311 Mathematical Physics (3 s.h.)

Mechanical Engineering Electives Courses (4):

- MENG 6210 Thermal Systems Design (3 s.h.)
- MENG 6230 Renewable and Sustainable Energy Systems (3 s.h.)
- MENG 6320 Advanced Engineering Design (3 s.h.)
- MENG 6330 Advanced Vibration and Structural Dynamics (3 s.h.)
- MENG 6340 Mechanical Behavior of Materials (3 s.h.)
- MENG 6343 Advanced Composite Materials (3 s.h.)
- MENG 6350 Theory of Elasticity (3 s.h.)
- MENG 6410 Bioheat and Mass Transfer (3 s.h.)
- MENG 6700 Selected Topics in Mechanical Engineering (3 s.h.)

With prior approval from the program coordinator, one graduate level technical elective from outside the Engineering Department may be substituted for one MENG elective. Contact the program coordinator for approved list of graduate courses offered outside of the Department of Engineering.

Please check the Graduate Catalog and Pirate Port for course offerings per semester.

Table 2: Two Year MSME Program Offerings*

<p>Semester 1 (Y1)– Fall</p> <ul style="list-style-type: none"> • MENG 6000 - Intro to Engineering Research • MENG 6100 - Finite Element Analysis • MENG 6210 – Advanced Thermodynamics • MENG 6310 – Advanced Mechanics of Materials • Advanced MATH course 	<p>Semester 2 (Y1) –Spring</p> <ul style="list-style-type: none"> • MENG 6230 – Renewable and Sustainable Energy Systems • MENG 6350 – Theory of Elasticity • MENG 6700 - Selected Topics in Mechanical Engineering
<p>Semester 3 (Y2) – Fall</p> <ul style="list-style-type: none"> • MENG 6220 – Advanced Thermodynamics • MENG 6340 – Mechanical Behavior of Materials • MENG 6410 – Bioheat and Mass Transfer • MENG 7000 Thesis hours 	<p>Semester 4 (Y2) – Spring</p> <ul style="list-style-type: none"> • MENG 6320 – Advanced Engineering Design • MENG 6330 – Advanced Vibration and Structural Dynamics • MENG 6343 - Advanced Composite Materials • MENG 7000 Thesis hours

* Use Pirate Port and Degree Works to map individual course plan

B. COURSEWORK AND GRADE POLICIES

Course Schedule

The typical course load is three courses, or 9 hours, per semester. In some cases, 12 or up to 15 hours may be taken, although this is discouraged. A graduate student is considered full-time if they are registered for 9 or more hours in a given semester. **An exception is made for thesis students in the last semester of their program.** *For example, a student registered for BIME 7000, (3 or 6 credit hours), is considered by the registrar to be a full-time student and eligible to continue on assistantship.* **A student must be registered for at least 5 hours to be considered half-time, the threshold to delay repayment of student loans.**

Advising

All course selections must be approved by the student's academic/research advisor. The Graduate Program Coordinator or designated graduate faculty members will serve initially as temporary advisor. **Students should select a permanent advisor before the beginning of their second semester.** Advisors must be members of the graduate faculty. Students may change their advisor upon mutual agreement between the student, the new advisor and the Graduate Program Coordinator. It should be noted that as a professional courtesy, students are expected to discuss this change in advisor with their former advisor and the Graduate Program Coordinator before a final change occurs.

Thesis Credit

A minimum of 6-credit hours of BIME/MENG 7000 (Thesis) is required. This course is designed to provide students with the time necessary to work toward completion of the thesis, generally in the second year.

Thesis courses are graded satisfactory/unsatisfactory. A grade of 'S' (satisfactory-progress) or "U" (unsatisfactory progress) will be assigned by the registrar until all requirements for the degree have been met, including the successful defense of the thesis. The grade of S will denote satisfactory progress in research; credit hours will be included in attempted and earned hours. The grade of U will denote unsatisfactory progress in research; **credits will not be earned but credit hours will be included in attempted hours.** Grades of S or U will carry no quality points and will not be included in the calculation of grade point averages.

Grade Policies and Incompletes

According to ECU Graduate School Policy, students receiving a grade of C or F in courses totaling more than 6 hours will have their program terminated. In addition, students must maintain an average grade of 'B' or risk having their program terminated.

If a student receives a grade of 'Incomplete' for any course, they are given one year to complete the coursework. *After one year any grade of I will automatically become an F.* **It is the student's responsibility to ensure that a 'Change of Grade' form is submitted by the appropriate faculty member once an Incomplete has been resolved.**

C. PROGRAM STEPS AND MILESTONES

Graduate Students are advised to adhere to the schedule below if they plan to complete the program in two years. Meeting the milestones listed below and summarized in Tables 3 is considered “satisfactory progress” toward completion of the degree. Failure to meet the milestones can jeopardize financial aid. It is the responsibility of the student (not the advisor) to see that any necessary paperwork is completed at the appropriate time.

Note that, according to graduate school policy, any course taken more than six years ago may not count toward a degree. **That is, students who do not complete their program in six years will be required to repeat coursework in order to receive their degree.**

Table 3: Summary and Checklist of Graduate Program Milestones

First semester	<ul style="list-style-type: none"> • Enroll in BIME/MENG 6000 & 9 s.h. coursework • Identify permanent advisor and thesis topic • Request final undergraduate transcript(s) sent to admissions
Second Semester	<ul style="list-style-type: none"> • Enroll in 9 s.h. of coursework • Assemble thesis committee (BIME must have 2 ENGR faculty and 1 external to ENGR, MENG may have 3 ENGR or 2 ENGR+1 external to ENGR; Note members external to ECU do not count toward 3 required) • Write and defend thesis proposal
Summer	Begin work on thesis research (completion in 4 semesters depends on completion of substantial work during this summer)
Third Semester	<ul style="list-style-type: none"> • Enroll in 3 s.h.thesis hours (BIME/MENG 7000) & 6 s.h. coursework • Begin writing thesis • Submit Graduate Application form
Fourth Semester	<ul style="list-style-type: none"> • Enroll in thesis hours (BIME/MENG 7000) & 0-3 s.h. coursework • Finish writing thesis • Schedule defense • Defend thesis • Submit electronic thesis to Graduate School by published deadline • Follow Graduate School guidelines for electronic submission of thesis http://www.ecu.edu/cs-acad/gradschool/current.cfm

First Year Milestones

Thesis Committee

The thesis committee consists of an advisor (the committee chairperson) and two additional faculty members. For the MS-BIME degree no more than two committee members may be from the same department on campus, i.e., the committee should be composed of two Department of Engineering faculty and one faculty member from outside the Department of Engineering. For the MSME degree all

three thesis committee members may be from the Department of Engineering or the committee can be composed of two Department of Engineering faculty and one faculty member from outside the Department of Engineering. Additional members, formal or informal, may be added to any committee by mutual agreement between student and advisor. Members from industry or another university must be approved by the Graduate School and serve as additional members.

Thesis Proposal

Students writing a thesis will develop a written proposal by the end of their first year, and give an oral presentation of the proposal to faculty and students. The advisor has discretion over the length and format of the document, but in general the proposal should include a review of the relevant literature, and clearly describe the research questions, theoretical framework, methodology and expected outcomes of the thesis. Copies of the proposal will be distributed to the advisor and committee members **at least two weeks prior to the oral presentation of the proposal.**

The *proposal defense* will take place at the end of the student's second semester. The defense will begin with a presentation by the student of approximately 30 - 45 minutes, followed by questions from the thesis committee. The student's advisor and committee members will confer and vote pass or fail on the proposal. If the outcome of the vote is not unanimous, the student's committee will decide upon additional requirements. The advisor will submit a written pass/fail evaluation of the proposal to the Graduate Program Director soon after the presentation. An evaluation rubric is used for assessment. See Appendix for "Proposal Evaluation Rubric".

Thesis Topic Approval Form

Students will submit a completed "Pre-Thesis or -Dissertation Research Approval Form" (form available online on the program websites under RESOURCES) to the Graduate Program Director after completing the oral presentation and submitting the thesis proposal to their advisor. The name and Banner ID of the thesis advisor and committee members are required.

<https://cet.ecu.edu/engineering/ms-mechanical-engineering/>

<https://cet.ecu.edu/engineering/ms-biomedical-engineering/>

Second Year Milestones

Graduate Application for Graduation

This form is available from the Graduate School or Registrar's Office and must be filled out by the student the semester prior to that in which he/she plans to graduate. Submission of the form will normally occur at the end of the student's third semester. Students should meet with their academic advisor before submitting Graduate Application. At the time of application, students will be required by the graduate school to complete an on-line graduate student exit survey.

The Thesis

The M.S. thesis should represent a substantial piece of original, innovative research and must show the linkage and integration of biomedical or mechanical engineering to the research topic. Guidelines for preparation and presentation of thesis texts are available from the Graduate School.

<http://libguides.ecu.edu/c.php?g=694874&p=4925841>

The student and advisor should agree in advance on a referencing style. Normally, the student and advisor consult until the advisor feels the thesis draft is of sufficient quality to be reviewed by the committee. The draft is then submitted to the entire committee. The committee may elect to require further work or modifications or determine that the thesis is ready to defend.

All students are strongly encouraged to participate in the academic process through academic output such as a professional poster, oral presentation, or journal publication highlighting their research topic. Ideally, this should be accomplished before graduation.

Timing and Scheduling of the Thesis Defense

Thesis Defense - When the committee determines that the thesis is ready to defend, a date is set. As a matter of courtesy, students should allow committee members at least two weeks to evaluate the draft thesis. **It is the responsibility of the student to publicize the date and reserve a room for the defense by making arrangements with the department secretary.**

Graduation Schedules - Students wishing to graduate in the spring semester usually face a mid-April deadline for successfully defending and submitting their thesis (see the current Graduate School Academic Calendar for the exact dates, <http://libguides.ecu.edu/vireo/etd>). To meet a spring deadline, students are strongly advised to complete a final draft of their thesis no later than March 15, to ensure sufficient time for edits and revisions.

Students who are registered in the Spring Semester but do not finish their degree requirements may graduate in the summer without re-registering or paying tuition. **Please note however, that faculty members are frequently unavailable during summer months.** Students should not expect to receive significant input from their advisor or committees and will likely have to work around busy schedules. For a summer graduation, the deadline for the successful defense and submission of the thesis is mid-July. To meet a Summer Session deadline, students are strongly advised to complete a final draft of their thesis no later than June 15, in order to ensure sufficient time for edits and revisions.

Students anticipating a defense or completion at other times of the year should consult the current Academic Calendar for deadlines. If a student has accumulated sufficient hours for their degree, they no longer need to register for classes while finishing a thesis. An inactive student, however, must apply for readmission to the graduate school, and must be registered for at least one credit hour during the semester in which they intend to graduate.

Only students who have successfully defended their thesis project will be allowed to walk and be hooded during commencement (spring or fall). Please contact the Graduate Program Director if you intend to walk and be hooded at commencement. **Students who fail to confirm and/or communicate completion of MS requirements with the Graduate Program Director will not be recognized during the graduation ceremony.**

The Thesis Defense

The thesis defense represents the final assessment of the student's knowledge in his or her area of expertise and the quality of the research project. This defense will normally take place in the student's fourth semester. Students should allow at least two weeks advance notice, so that the thesis committee will have an adequate opportunity to review the manuscript. The defense should be well publicized and all College of Engineering and Technology faculty, graduate and undergraduate students invited to attend. **It is the responsibility of the student to publicize the date and reserve a room for the defense by making arrangements with the department secretary.**

The thesis defense will begin with a 30-45 minute presentation by the student, highlighting the major findings and implications of the thesis research. Following a brief question-and-answer period, the committee will meet in closed session with the candidate for the formal defense. The committee may ask questions about the research documented in the thesis and further assess the student's knowledge in

the area of expertise. After the committee's questioning period, the committee will determine whether the student has passed or failed. Students passing the defense should expect that they will have to make additional changes to the thesis to remedy deficiencies identified by the committee. Students failing the defense should work with their committee to correct problems and schedule a future defense. See Appendix for "Written Thesis Evaluation Rubric" and "Oral Presentation Evaluation Rubric"

Only students who have successfully defended their thesis project will be allowed to walk and be hooded during commencement (spring or fall). Please contact the Graduate Program Director if you intend to walk and be hooded at commencement.

Electronic Submission of Thesis

The Graduate School has strict guidelines governing the formatting of any ECU thesis and requires submission of electronic theses. Students should consult the Graduate School's website <http://libguides.ecu.edu/vireo/etd> for details. Upon completion of all required revisions, the student must print out the thesis 'signature page' and have it signed by the student's advisor, committee and the program chairperson.

Students are required to submit a final bound copy of the thesis to the Graduate Program Director after the thesis signature page has been given to the Graduate School and the electronic thesis submission is complete. It is also customary to provide a bound final copy to your primary research advisor.

D. DEPARTMENTAL ASSISTANTSHIPS

Departmental assistantships are awarded on a competitive basis and provide modest stipends to students in exchange for employment. The number and dollar value of assistantships are dependent upon both levels of funding and the nature of the student applicant pool and may vary from year to year. Generally, there are two types of funding.

Graduate Assistantships (GAs) are funded by the ECU Graduate School and allocated by the Graduate Program Director. Assistantships are awarded on a semester-by-semester basis. **Continued funding is contingent upon both satisfactory progress toward the degree (i.e. minimum 3.0 GPA) and acceptable performance of assistantship duties.** Students are not typically funded for more than four semesters.

Graduate Teaching Assistantships (GTAs) are funded by the Department of Engineering and are awarded in consultation with the Graduate Program Director and the Department of Engineering Chair. These positions are often advertised by faculty and can be found on the ECU people admin webpage https://ecu.peopleadmin.com/applicants/jsp/shared/Welcome_css.jsp (i.e. Student Positions).

Duties, Responsibilities, and Evaluations

The typical Graduate Assistant works 15 - 25 hours per week depending on funding level. Assistants are responsible for doing their jobs during all times school is in session, regardless of the demands placed on them by course or thesis work and generally involve employment under the supervision of one or more faculty members. GA's are expected to meet with their faculty supervisor at the beginning of each semester to set up a work schedule and a schedule of regular meetings with faculty supervisor

(weekly or alternate weeks is suggested). Graduate Assistants will be evaluated at the end of each semester, and poor performance may result in the discontinuation of funding. Graduate Assistant responsibilities are determined by the primary research advisor and may include responsibilities not directly related to the student's research thesis topic. **All BIME GA's are expected to arrange their schedules and attend the weekly UNC/NC State Graduate Biomedical Engineering noon seminars each semester. All ME GA's are expected to attend the bi-weekly Department of Engineering seminars or the weekly UNC/NC State Graduate Biomedical Engineering noon seminars.**

E. NON-RESIDENT TUITION ASSISTANCE

The Department of Engineering awards a limited number of non-resident tuition assistantships for individual students on a competitive basis. Students receiving non-resident tuition assistance pay tuition at the rate of a North Carolina resident. ***Funding is contingent upon satisfactory progress toward the degree (i.e. minimum 3.0 GPA).*** Assistance will not automatically be renewed for a second year, and **students are strongly encouraged to take the necessary steps to secure North Carolina residency by the beginning of their second year.** Students receiving non-resident tuition assistance who leave their assistantship or drop courses will be responsible for re-paying their remissions in full. Non-resident tuition assistance may not be used to pay for distance education courses.

F. NORTH CAROLINA RESIDENCY

Non-resident students who are US citizens may qualify for North Carolina residency (and thus in-state tuition rates) after one year if certain conditions are met. Information about the requirements and application procedures for residency can be found at the graduate school web site.

<http://www.ecu.edu/cs-acad/gradschool/Residency.cfm>

G. TRAVEL

All students are strongly encouraged to participate in the academic process through academic output such as a professional poster and oral presentations and conference attendance. The Department of Engineering supports student travel, however, student travel funding is extremely limited. Travel request forms should be completed and submitted to the student travel review committee as soon as you and your research advisor identify an event for you to present your work. You must complete the department AND university travel pre-approval process before you should spend any funds for registration or make any reservations for the event you are proposing to attend. Ideally, you will submit the request to the department committee well before submitting an abstract to a conference. A letter of support from your faculty advisor must accompany this form. Travel forms and instructions to request funding are included in the Appendix.

H. DESKS, OFFICES AND LABS

The Department of Engineering has a limited amount of graduate student office space. Priority will be given to students receiving assistantships. Desks and offices are intended to be active work spaces, not storage closets or social areas. Students who are not making appropriate use of their office space will have their desk reassigned to another student.

Please endeavor to keep program and Department facilities neat and clean. Use of Department equipment is limited to work-related activities, and students should refrain from using computers or printers for personal use.

I. LAB SAFETY TRAINING

East Carolina University's policy is "*All lab users – staff, students, and faculty – must have lab safety training prior to using the lab.*" To complete the lab safety training go to the College of Engineering's Lab Website: <https://collab.ecu.edu/sites/engtechlabs/default.aspx>

To find the appropriate training module, click on your lab room number, and select "Safety Training Module Link". Open **LAB SAFETY TRAINING** folder, select the **VIDEOS FOLDER** for modules. If you need an attendance form or blank quiz, open the **FORMS FOLDER**. Print the quiz answer sheet for the appropriate module or see a lab supervisor, 238 Science & Tech for a blank form. Submit completed quiz to Chad Spruill, 238 Science & Tech.

J. ACADEMIC ENVIRONMENT

All students are expected to participate and contribute to the collegial academic environment. Generally, courses are offered in the evening to allow students time during core business hours to work on research and complete expectations of any assistantships. Participation in seminars, peer review of other student's academic products, and participation in other scholarly activity (like topical journal paper reviews, sometimes known as journal clubs) is expected.

K. AFFILIATE FACULTY

Affiliate faculty are those faculty who share an interest in biomedical or mechanical engineering applications and research activities in conjunction with the MS program, serve as thesis advisors and members, and mentor students working on related research. They represent degree programs, departments and disciplines including the Brody School of Medicine, the School of Dental Medicine, College of Nursing, College of Allied Health Sciences, Thomas Harriot College of Arts and Sciences, and the College of Health and Human Performance.

L. BEFORE YOU LEAVE

Students are reminded to please turn in all keys and fill out an Alumni Contact Sheet at the time of graduation. We wish you well – please keep in touch!

EVALUATION RUBRIC: MS THESIS PROPOSAL

Student Name: _____

MS Program: _____

	poor			excellent	
	1	2	3	4	5
1. Described goals in pursuing this research project					
2. Described a research problem suitable for study					
3. Demonstrates a knowledge of the literature relevant to their research problem					
4. Demonstrates an understanding of the potential significance of the resolving the problem within the context of their field of study					
5. Shows an understanding of how to use research methods/tools effectively, and how to apply them to solve their research problem					
6. Provides a plan for analyzing/interpreting the research data					
7. Communicates research proposal clearly and professionally.					
8. Proposed project demonstrates potential to advance knowledge and understanding within its own field or across different fields					
9. Proposed project demonstrates potential to benefit society or advance desired societal outcomes					

Total Score _____

Please include comments on back of sheet

COMMITTEE MEMBER SIGNATURE _____

DATE _____

MS Biomedical Engineering
Written Thesis Evaluation for Assessment

Student name: _____ Date: _____
Faculty reviewer: _____ Total points (out of 100) _____

1. **Content (70 pts):** Rate each criterion using the scale:
1 = poor, 2 = fair, 3 = adequate, 4 = good, 5 = excellent

Introduction (20 pts):

- Comprehensive review of literature _____
- Communicates an understanding of the significance of the research topic within the context of the field of study _____
- Proposed project demonstrates potential to benefit society or advance desired societal outcomes _____
- Research objectives are clearly stated and hypothesis(es) and/or experimental approach(es) is logical and concisely stated. _____

Materials and methods (15 pts):

- Materials and measurement techniques are appropriate and clearly stated _____
- Experimental design and controls are well defined, the experimental approach acknowledges necessary approvals for animal/human data collection _____
- Data analysis techniques and/or statistics are described and supported _____

Results/Data Analysis (15 pts):

- Data is appropriate and sufficient _____
- Data analysis is correct _____
- Data is clearly presented _____

Discussion (20 pts):

- Data adequately supports specific device, software or process studied _____
- Conclusions/interpretations are sound and related to representative literature. _____
- Demonstrates an understanding of the significance/impact of the research question within the context of the field of study _____
- Future research directions and questions are presented. _____

2. **Presentation (30 pts):**

- **Tables:** Necessary, concise, accurate, functionally well laid out **5 points** _____
- **Figures:** Necessary, effective in conveying information, sufficiently high technical quality **5 points** _____
- **Writing style:** Grammatically correct, clear, concise **15 points** _____
- **Formatting:** Complies the “Manual of Basic Formatting Requirements for Theses and Dissertations” as defined by ECU’s Graduate School. **5 points** _____

90-100 points: Excellent, Demonstrates and communicates a thorough command of the subject matter and context. Communication skills and level of professionalism are strong, indicating a readiness to produce publishable academic products.

80-89 points: Good, Demonstrates and communicates a satisfactory command of the subject matter and context. Communication skills and level of professionalism are satisfactory, indicating ability to produce publishable academic products.

70-79 points: Fair, Demonstrates and communicates a below average command of the subject matter and context. Communication skills and level of professionalism are mediocre.

<70 points: Poor, Fails to demonstrate and communicate a command of the subject matter and context. Communication skills and level of professionalism are in adequate.

Department of Engineering
MS Thesis Seminar
Evaluation for Assessment

1. Content:	Points earned
Conceptual Background: Introduction, problem statement presented.	10 points ____
Objectives/Hypothesis: Purpose of study clearly stated.	10 points ____
Materials & Methods: Described clearly, with adequate information.	10 points ____
Results: Analysis appropriate and adequate, interpretation valid	10 points ____
Discussion: Includes speculation and suggestions for future directions	10 points ____
Summary: Conclusions and discussion of how results advance the field and relate to other fields.	10 points ____
2. Graphics: Slides/handouts/transparencies legible.	10 points ____
3. Speaking style: Poised, well-prepared, communicates well.	15 points ____
4. Questions: Replied to questions satisfactorily and professionally	15 points ____
Total points (out of 100) _____	

90-100 points: Excellent, Demonstrates and communicates a thorough command of the subject matter and context.

80-89 points: Good, Demonstrates and communicates a satisfactory command of the subject matter and context.

70-79 points: Fair, Demonstrates and communicates a below average command of the subject matter and context.

<70 points: Poor, Fails to demonstrate and communicate a command of the subject matter and context.

Student name: _____

Faculty reviewer: _____

Date: _____