ECE Department, BME Track Graduate Curriculum
Advising Notes

Welcome to the University of Texas at Austin! The Biomedical Engineering Track in the ECE Graduate Program includes faculty expertise and research efforts in bioinformatics, circuits and systems, electromagnetic field theory, instrumentation, and signal and image processing. These notes describe the MS and PhD programs of study. There are specific course requirements for MS plans of study. The PhD is a research degree, and no specific courses are required, except as identified by a student's examining or dissertation committee. Biomedical Engineering is an inter-disciplinary engineering profession, as reflected by the faculty list below. In essence, the ECE-BME researcher applies electrical and/or computer engineering principles to the solution of problems of biological or medical origin. This is in contrast to Biomedical Engineering graduate research in the sense that they solve problems of biological or medical origin using appropriate engineering and scientific principles, whichever the specific engineering discipline. It's all a fascinating profession, and cross-collaboration among colleagues is the rule, not the exception.

Faculty Interested in Biomedical Engineering
Members of the ECE Graduate Studies Committee
(Alphabetical Listing)

Ben-Yakar, Adela (Biomedical Engineering)
Bovik, Alan
Dunn, Andrew, (Biomedical Engineering)
Ghosh, Joydeep
Lu, Nanshu, (Biomedical Engineering)
Markey, Mia, (Biomedical Engineering)
Milner, Thomas, (Biomedical Engineering)
Pearce, John
Rylander, H. Grady III, (Biomedical Engineering)
Soloveichik, David
Sun , Nan
Tewfik, Ahmed
Tomaz, Edison
Tunnell, James (Biomedical Engineering)
Valvano, Jon
Vikalo, Haris
Vishwanath, Sriram
Wang, Zheng

Masters Degree Curriculum

EEx97C (Research Problems), EE397K.1 (Conference Course), EE397M (Internship), EE398T (Teaching), or EEx97G (Research Problems) do not count towards the MS degree.

Thesis Option: 8 courses; 6 courses in Major Work and 2 courses in Supporting Work, excluding EE698A and EE698B. You take EE698A only once, and in a separate semester before taking EE698B. You must take EE 698B in the semester you file to earn the MSE degree, even if you have to repeat it.

Report Option: 9 courses; 6 to 7 courses in Major Work and 3 to 2 courses in Supporting Work, excluding EE 398R. You take EE398R in the semester you file to earn the MSE degree, even if you have to repeat it.

No-Thesis/No-Report Option: 10 courses: 6 to 8 courses in Major Work and 4 to 2 courses in Supporting Work.

Three MS Options		**Number of Formal Courses Required**			
		Major Work	**Supporting Work**		**Total**
		Total	**Graduate**	**Total**	
Thesis	**EE698A/B**	6	1 or more	2	8
Report	**EE398R**	6 to 7	1 or more	3 to 2	9
No Thesis or Report		6 to 8	1 or more	4 to 2	10
Min GPA Required		3.0	3.0	3.0	3.0

1) No more than 6 semester hours of upper-division undergraduate course work may be included on the ECE MSE Program of Work. No EE required course can be counted on an MS plan of study.

2) For the No Thesis/No report option, at least 30 semester hours of formal classroom instruction is required. Formal classroom instruction excludes EE397K.1 (Conference Course).

3) For the MS report option, at least 27 semester hours of formal classroom instruction, plus 3 hours of the report course (EE398R) for a minimum total of 30 semester hours. Formal classroom instruction excludes EE397K.1 (Conference Course).

4) For the MS Thesis option, at least 24 semester hours of formal classroom instruction, plus 6 hours of thesis courses (EE698A, EE698B) for a minimum total of 30 semester hours. Formal classroom instruction excludes EE397K.1 (Conference Course).

5) No course of less than a grade of C and no more than one course with a grade of C or C+ may be included on the ECE MSE Program of Work.

Physiology Requirement

Total requirement: 3 semester hours, maximum 6 semester hours.
These courses are counted as Major Work
Graduate versions are to be taken when available

Possibilities include, but are not limited to

BME 365R Quantitative Engineering Physiology I
BME 365S Quantitative Engineering Physiology II
BME 385J Quantitative Physiology
BIO 380T = BIO 365R Vertebrate Physiology I* (Muscle and Nerve Physiology)
BIO 380T = BIO 365S Vertebrate Physiology II* (Systemic Physiology)
* To sign up, students must see Sandy Monahan, the Graduate Advisor, in BIO 311A.
* Graduate students must register for BIO 380T, the graduate version of these two courses.

Major Work: Classes for the MS degree (these classes have substantial EE content)

Three (or 6) hours of Physiology, plus

EE 385J.3	Bioelectric Phenomena
EE 385J.9	Laser-Tissue Interactions: Thermal
EE 385J.16	Laser-Tissue Interactions: Optical
EE 385J.17	Biomedical Instrumentation II (Prerequisite: EE 385J.31 or the equivalent)
EE 385J.18	Biomedical Imaging Systems (also satisfies IGERT requirements)
EE 385J.23	Optical Spectroscopy (also satisfies IGERT requirements)
EE 385J.26	Thermal Therapies
EE 385J.28	Noninvasive Optical Tomography
EE 385J.31	Biomedical Instrumentation I
EE 385J.32	Projects In Biomedical Engineering (Pre-requisite: topic 31)
EE 385J.33	Neurophysiology / Prosthesis Design
EE 371R	Digital Image and Video Processing (upper division undergraduate class)
EE 380L	Introduction to Pattern Recognition (suitable as Major Work if a thesis topic is in the Image Processing area)

EE 380L Data Mining
EE 383P.7 Laboratory Projects in Optics (also satisfies IGERT requirements)
EE 390C Statistical Methods in Engineering and Quality Assurance
EE 382M.14 Analog Integrated Circuit Design
EE351M Digital Signal Processing

Examples of Supporting work:

BME topics from the BME Department (courses without substantial EE content), graduate courses from other ECE tracks; courses from Mathematics, Physics, Biology, other basic sciences; and other courses as approved by the ECE-BME Graduate Track Advisor.

Undergraduate courses allowed for the master's degree:

1) The number of courses allowed does not depend on the thesis/report/NT-NR option
2) You must take the course for a letter grade
3) There is a limit of 2 total undergraduate courses allowed
4) There must be at least one graduate course in the supporting work category
5) A supporting work course cannot be required for all ECE undergraduates
6) It cannot be a 0x or 1x course number (i.e. it must be upper division)
7) It must be a class that students in that department use for their degree. It cannot be a survey class for non-majors.
8) You must get approval from the Track Advisor before taking any supporting work classes.

Masters Thesis

The Masters Thesis is a more substantial undertaking than the Masters Report, described in the next section. The subject of the thesis may be either a research project or a substantial design project executed in close collaboration with a supervising professor. The supervising professor may be any member of the ECE Graduate Studies Committee (there are two in the ECE Department and three listed from the BME Department), or under a co-supervision arrangement in order to work with other UT Austin faculty. The project need not be original research or design, but must have a substantial Electrical Engineering content. It takes approximately one whole semester to write a Masters Thesis. You must allow two weeks for your supervising faculty to read and edit each draft of your thesis. You should plan on three drafts, though it may not actually take that many drafts to finish. The standard Masters Thesis outline has four major components: 1) Introduction (review the state-of-the-art, the relevant literature and a clear definitive statement of your particular problem), 2) Methods (experimental, theoretical or numerical techniques, calibration methods, design criteria and constraints, performance evaluation processes, quality control processes, experiment design and the like), 3) Results (the experimental data that you measured, the final design embodiment, the results of numerical model calculations, performance measurements), and 4) Discussion. (What do the results mean? How does the design perform? What overall contribution have you made?)

Masters Report

There are two types of reports. A regular report is a project that typically takes 1 semester at 20 hours/week to complete. The scope ranges over engineering processes: research, design, implementation and/or evaluation. Reports, unlike theses, do not usually include all four of the above components. The second type of report is an industrial report, which is available only to full-time employees working in a Biomedical Engineering field. For this you must get approval from

your boss at work and a professor at UT (a member of the ECE GSC, as above). You write a report about a project for which you made a major engineering contribution. You work out some way to convince the professor at UT that you personally performed enough design, implementation and testing to be classified as a major engineering design project without having to disclose into the UT library the company secrets. The official report may be short and contain general statements about the project. This report follows all format specifications defined by the University and is recorded in the library. If you perform all of the work at the outside company, then the University of Texas will not attempt to obtain ownership. On the other hand, if some of the creative ideas come from the professor, or if any of the design/development/testing occurs on campus, then this is not an industrial report and the usual collaborative arrangements will apply. Your boss at work and the professor at UT are co-supervisors of the industrial report.

PhD Degree Curriculum

A student who wishes to obtain a Ph.D. degree in ECE/BME must go through three procedures: the qualifying exam step 1, the qualifying exam step 2 and the final defense. If a student is denied in any of the steps of the qualifying exam, then that is considered a denial for the whole qualifying exam.

PhD Degree Course Requirements

- At least 6 hours of physiology or advanced medical sciences, as approved by the ECE-BME Track Adviser,
- At least 36 hours of "regular classroom instruction," 30 hours must at the graduate level,
  (NOTE: this is six more hours than the ECE department requirement of 30 hours)
- No individual instruction classes count towards the 36 hours of "regular classroom instruction",
- At least 30 hours of the 36 should be graduate level classes,
- At least 15 hours of the 36 should be taken in residence at UT-Austin,
- 6 hours should be "outside the principal area of study" (no requirement for inside or outside of department; student's qualifying committee will examine appropriateness of courses indicated as "supporting work"),
- GPA in each category ("Major" and "Supporting") should be at least 3.5.

Ph.D. Qualifying Exam Step 1

The goal of this step is to ensure that the student has demonstrated the necessary academic preparation to pursue a Ph.D. degree. The student will choose from the following list five general engineering disciplines that constitute his or her research area of interest. In consultation with the PhD supervisor, the Track Advisor or Qualifying Exam Coordinator may define other general disciplines, fundamental in nature, but specific for the student's chosen field of study. This list, signed by the supervisor, should be submitted to the Track Advisor or Qualifying Exam Coordinator. The Track Advisor or Qualifying Exam Coordinator in consultation with the PhD supervisor will select and invite at least three members of the ECE GSC to conduct the oral exam. The supervisor and co-supervisor are not voting members of this examining committee. The student then schedules a one-and-a-half hour oral exam with the faculty members. There is no deadline for the step 1 but a student has to pass the qualifying exam - step 1 before taking the qualifying exam - step 2. We recommend that the student take this part of the exam before finishing the MS degree as soon as he or she has taken at least five graduate BME courses. The possible outcomes are: (1) student passes without any stipulations, or (2) student fails and is allowed to re-take this part of the exam one more time.

Fundamental Areas

Physiology (with an optional focus e.g., neural, cardiac, muscular, etc.)
Probability and Statistics
Imaging and Image Processing
Acoustics

Instrumentation
Biosignal Analysis
Tissue Optics
Electromagnetic Fields
Numerical Methods
Bioelectric Phenomena
Large Scale Integrated Circuits / Biosensors
Analog IC design / Mixed signal design
Machine Learning / Data Mining

Ph.D. Qualifying Exam Step 2

The second part of the qualifying exam consists of an NSF- or NIH-style (PHS 398 format) proposal on the research topic written by the student independently, presented orally and defended in front of the Ph.D. committee by the end of the second year. In addition to the NSF or NIH style proposal, the student should provide to his/her dissertation committee: (1) a brief (2-3 page) summary of the student's past research experience and career goals, (2) a timetable for the completion of the dissertation project, and (3) a list of all coursework completed after the bachelors' degree.

Two weeks prior to the exam, the student should see the ECE Graduate Coordinator to complete necessary paperwork (provide the ECE Graduate Coordinator with a list of the committee members, date and time of the exam, and the proposed title of the dissertation). The student should submit the written proposal to the dissertation committee two weeks in advance of the exam. The proposal is limited to the 15-page NSF or NIH format for the project description for standard guidelines. The oral portion of this exam should be limited to 30 minutes for the presentation with about 1 hour reserved for questions from and interaction with the committee. The possible outcomes are: (1) student passes without any stipulations, (2) student passes with a stipulation of taking and passing certain courses with a minimum GPA, or (3) student fails and is allowed to re-take the exam once.

Application to Ph.D. Candidacy

Upon completion of both parts of the qualifying exam, the student should complete the Application for Candidacy (available from the Office of Graduate studies in MAI 101, or online). A copy of the completed form must be provided to the Graduate Office in ENS 101. After the official letter of acceptance has been received, the student may register for the dissertation course EE x99R and EE x99W). The student is required to be registered for dissertation continuously until graduation.

The Ph.D. Supervising Committee must consist of a total of either five or six faculty members, including the supervisor (and co-supervisor, if one exists). No other number of total committee members is permitted. The supervisor (or one of the co-supervisors) must be a member of the ECE Graduate Studies Committee (GSC). If the committee has 5 members, then 3 or 4 must be members of the ECE GSC. If the committee has 6 members, then 4 or 5 must be members of the ECE GSC.

At least 1 member of the committee must be from another program (i.e., not on the ECE GSC or not in ECE but not in the BME area).

A recommendation to appoint an off-campus scholar should be accompanied by a curriculum vitae and a letter stating that the person is willing to serve on the student's committee and understands that the University will not reimburse for any expenses incurred.

PhD Defense

When your dissertation is ready you can defend it with your supervisor's approval. You have to arrange for the room and the time when the committee members can meet for your defense. The format of the defense is similar to the qualifying exam. A defense must be advertised so that other people can attend the open exam part.

The graduate school has the following guidelines about submitting a dissertation to committee members:

"Not less than four weeks before the date on which the student intends to defend the dissertation, a copy of the final draft of the dissertation, reviewed for technical and grammatical correctness by the supervisor, should be submitted to each member of the dissertation committee. Two weeks before the defense, a written request to hold the final oral examination must be submitted to the Graduate School. This request signifies the receipt of the doctoral dissertation for the purpose of giving the examination. The committee's decision to examine a dissertation must be unanimous." from page 26 of the UT Austin Graduate Catalog 2007-2009.