bioECE Track Graduate Curriculum
ECE Department
Advising Notes

Graduate advisor: Dr. David Soloveichik

Understanding, engineering, and interfacing with biological systems are among mankind's most important challenges, impacting numerous fields from basic science to health. Motivated by this larger vision, bioECE track is focused on the intersection of electrical and computer engineering with biology and medicine. It includes biomedical instrumentation, biophotonics, health informatics, computational behavior analysis, bioinformatics, neural engineering, computational neuroscience, and synthetic biology. Associated faculty have expertise in diverse topics: cardiovascular instrumentation, neuroscience, neural engineering and the machine-brain interface, image and signal processing (feature extraction and diagnostic interpretation), health information technologies (data mining, electronic medical records analysis), VLSI biomedical circuits (biosensing, lab-on-a-chip), algorithms for large-scale genomic analysis, and molecular programming (engineering molecules that compute).

The bioECE researcher applies ECE engineering principles to the solution of problems of biological or medical origin. This is in contrast to Biomedical Engineering research in the sense that they solve problems of biological or medical origin using appropriate engineering and scientific principles, whichever the specific engineering discipline. The bioECE track is very interdisciplinary, as reflected by the faculty list below.

Alphabetical Listing of Associated Faculty
(ECE GSC members are in bold)

Ben-Yakar, Adela (Biomedical Engineering)
Bovik, Alan
Chang, Joshua (Dell Medical School)
Craddock, Cameron (Dell Medical School)
Dunn, Andrew (Biomedical Engineering)
Ellington, Andrew (Molecular Biosciences)
Ghosh, Joydeep
Lu, Nanshu (Biomedical Engineering)
Markey, Mia (Biomedical Engineering)
Millan, Jose del R.
Milner, Thomas (Biomedical Engineering)
Pearce, John
Porter, Emily
Rylander, H. Grady III (Biomedical Engineering)

Soloveichik, David
Sun, Nan
Taillefumier, Thibaud (Neuroscience + Mathematics)
Thomaz, Edison
Tran, Ngoc (Mathematics)
Tunnell, James (Biomedical Engineering)
Valvano, Jon
Vikalo, Haris
Vishwanath, Sriram
Wang, Zheng
Yankeelov, Tom (Dell Medical School)

Masters Degree Curriculum

The ECE Program of Work Form can be found at:
https://www.ece.utexas.edu/academics/guides-and-procedures

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; 4 to 6 courses in Major Work and 2 to 4 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; 5 to 7 courses in Major Work and 2 to 4 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: 5 to 8 courses in Major Work and 2 to 5 courses in Supporting Work.

Three MS Options		Number of Formal Courses Required			
		Major Work	Supporting Work		Total
		Total	Graduate	Total	
Thesis	**EE698A/B**	4 to 6	1 or more	2 to 4	8
Report	**EE398R**	5 to 7	1 or more	2 to 4	9
No Thesis or Report		5 to 8	1 or more	2 to 5	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.

Major Work: Classes for the MS degree (these classes have substantial EE content)
Important: This is not an exhaustive list. Other classes can be considered major work with Track Advisor approval.

Listed or cross-listed in ECE:
EE381V: Genomics Signal Processing and Data Science [Haris Vikalo]
EE381V: Programming with Molecules [David Soloveichik]
EE380L: Data Mining [Joydeep Ghosh]
EE380L1V: Advanced Data Mining [Joydeep Ghosh]
EE371R: Digital Image & Video Processing [Al Bovik]
EE381K: Digital Video [Al Bovik]
EE351M: Digital Signal Processing [Haris Vikalo]
EE281K-6: Estimation Theory [Haris Vikalo]
EE374K/385J-31: Biomed Elect Instrument Design [John Pearce]
EE338L/382V: Analog Integrated Circuit Design [Nan Sun]
EE381V: Activity Sensing and Recognition [Edison Thomaz]
EE385J: Biomedical Imaging Modalities [Tom Yankeelov]
EE385J: Biomedical Instrumentation [Emily Porter]
EE374L: Applications of Biomedical Engineering [H. Grady Rylander III]
EE385J-18: Biomed Imaging: Signals/Sys [Tom Yankeelov]
EE385J-32: Projects in Biomedical Engr
EE385V: Brain Computer Interaction [Jose del R. Millan]
EE382V: Complex Networks In Real World
EE381V: Computational Magnetic Resonance Imaging [Jon Tamir]
EE385V: Neural Engineering [Jose del R. Millan]
EE381V: Spoken Language Technologies [David Harwath]

Specific courses outside ECE:
BME358 / BME385J: Medical Decision Making [Mia Markey]
BME381J / ME382P2: Optics and Lasers Laboratory [Adela Ben-Yakar]
BME383J: Dynamic Modeling [Marcelo Behar]
CS395T: Neural Computation [Alexander Huth]
BME384J 7-Introduction to Neural Engineering [Samantha Santacruz]

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 bioECE 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 (GSC), 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 and Computer 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 PhD degree in ECE/bioECE must go through three procedures: Candidacy Evaluation, Progress Review, Dissertation Defense. A student is considered in candidacy after successfully passing the Candidacy Evaluation.

The ECE PhD Rules and Procedures can be found at:
https://www.ece.utexas.edu/academics/guides-and-procedures

PhD Degree Course Requirements

- At least 30 hours of "regular classroom instruction" at the graduate level (no individual instruction classes count towards the 30 hours of "regular classroom instruction"),
- At least 12 hours of the 30 should be taken in residence at UT-Austin (i.e., not transferred),
- “Supporting work”: Should be "outside the principal area of study" (no requirement for inside or outside of the department; student's qualifying committee will examine the appropriateness of courses indicated as “supporting” or “major”),
- There should be at least as many “Major work” hours as “Supporting work” hours, with at least 6 hours for “Supporting work”.
- GPA in each category ("Major" and "Supporting") should be at least 3.5.