ELECTRICAL AND COMPUTER ENGINEERING, PHD

The Ph.D. in Electrical and Computer Engineering is oriented with an emphasis on scholarship and research rather than formal coursework. Our Ph.D. program is designed to be easily tailored to the needs and interests of individual students. There are no lists of required courses. The program is directed at independent, highly motivated individuals who desire to work closely with faculty members at the forefront of research in a variety of scientific areas, such as:

- Computational and Biomorphic Systems
- Computational Systems Biology and Bioinformatics
- Computer & Neuromorphic Engineering
- Control Systems
- Image Processing and Analysis
- Integrated Circuits and Microsystems
- Language and Speech Processing
- Photonics and Optoelectronics
- Signal Processing & Machine Learning
- Artificial Intelligence and Data Science

The Ph.D. requirements apply to all part-time and full-time students in the program. Time limits, however, are stated in the context of full-time graduate study. Time limits for part-time programs must be individually arranged with the student's advisor and the Associate Chair of Graduate Studies. The Ph.D. degree certifies that the holder has demonstrated research capability. Accordingly, the Ph.D. requirements are used as checkpoints leading the student through this research experience. Because students tend to spend more than ample time on the path to research, several requirements prescribe time limitations. The requirements stated on the requirements tab include university-wide requirements for the Ph.D.

Financial Aid

Once accepted into our program, all Ph.D. candidates are fully funded for the duration of their program while they are in a full time, resident status, through a fellowship or research assistantship which covers full tuition, health insurance, and a stipend of approximately $37,600 annually. As part of their program, students conduct research in their research advisor's lab and sometimes serve as a course assistant for undergraduate or graduate classes.

Ph.D. Program Requirements

University requirements for the Ph.D. degree are listed under Academic Information for Graduate Students (https://e-catalogue.jhu.edu/ engineering/full-time-residential-programs/graduate-policies/). In addition, the department requires satisfactory completion of the Ph.D. departmental qualifying examination, the university Graduate Board oral examination and submission of a research proposal, and submission of a dissertation and successful completion of a public dissertation defense.

1. Departmental Qualifying Exam

The departmental qualifying examination is offered twice yearly. The student must select and complete the examinations posed by three examiners eligible to supervise doctoral dissertations in the Department of Electrical and Computer Engineering, of which at least two must be tenure-track ECE faculty. Each faculty member prepares a set of questions, and the student must select and complete the sets. The respective examiners grade completed examinations, but it is the ECE Department faculty that makes a collective decision on whether the student has adequately fulfilled the Departmental Qualifying Examination requirement. This decision involves the student's cumulative academic performance in the graduate program, as well as performance on the examination. This examination must be passed before the beginning of the fourth semester of full-time graduate study. The departmental qualifying examination cannot be taken more than twice. Failure to pass the exam after two attempts will result in the student being dismissed from the PhD program. If the student passes the examination, the student can select one of those faculty members to oversee the student's research. Students must select a Research Advisor immediately upon passing the Departmental Qualifying Examination requirement. This research advisor then guides the student for the remainder of the student's program leading to the Ph.D. degree. These may include a teaching requirement, particular coursework, a reading program, or a preliminary research project.

2. Written Research Proposal and Graduate Board Oral Examination

Prior to taking the Graduate Board Oral (GBO) examination, students should work with their research advisor and write a research proposal. The written proposal should be sent to the Graduate Board Oral committee and the ECE academic program coordinator at least two weeks prior to the scheduled exam date. While all committee members are encouraged to provide feedback, following the GBO, the proposal must be approved by only the ECE members of the exam committee.

A. Written Research Proposal

The written proposal should be no more than 6 pages with 1 inch margins and 10 point font, excluding references. The proposal should be organized into 3 sections as follows.

1. Description of the significance of the proposed work

    - Describe the problem that will be addressed
    - Summarize the current state of the art and the limitations of current approaches

2. Description of the innovation of the proposed work

    - Describe what is new in the proposed research and how it will address the limitations of current approaches.
    - Describe the anticipated impact of the proposed research in terms of what difference it will make if it is successful.
    - Describe any preliminary results that have already been achieved for the proposed work.

3. Description of the anticipated approach to completing the research

    - Organize the work into the major tasks and describe them.
    - Provide an anticipated timeline for the completion of the tasks.
    - Summarize the anticipated risks to success and provide some alternative strategies.

B. Graduate Board Oral (GBO) Examination

Students must pass the Graduate Board Oral (GBO) Examination. The exam should be scheduled prior to the start of the sixth semester although the exam can take place after this date. The purpose of the examination is to test the depth and breadth of

the student's knowledge and reasoning abilities. The examination typically is based on the student's course background but may include the proposed dissertation topic. The examination is conducted by five faculty members: <u>two ECE professors, two professors from JHU PhD granting departments outside ECE, and one additional professor that can be either from inside or outside of ECE. At least one of the outside members must be Professor or Associate Professor ranking such that they can chair the exam</u>. Additionally, one departmental alternate and one outside alternate are also required. Note that for GBO examination committee purposes, the research advisor is counted as a member of the ECE Department regardless of affiliation.

The GBO exam is scheduled for 2 hours. Per the GBO rules, the exact format is at the discretion of the GBO chair. Generally, it will consist of a short (approximately 10 minute) presentation by the candidate on their research followed by the GBO exam. Per GBO rules this is a closed exam and the scope of the GBO questions is not limited to the candidate's research and can cover things such as coursework, etc.

The possible outcomes of the GBO examination include: an unconditional pass, a conditional pass (with the requirements to be met written down on the report form), or failure. In the latter case, if the chair of the GBO committee recommends reexamination, they must indicate with whom and when. At least one person from the original committee must be on the next committee. The Graduate Board does not allow more than two examinations. For more information on the GBO, consult the following website:

http://homewoodgrad.jhu.edu/academics/graduate-board/graduate-board-oral-exams (http://homewoodgrad.jhu.edu/academics/graduate-board/graduate-board-oral-exams/)

3. Dissertation & Dissertation Defense

Finally, a public dissertation defense will be conducted before a panel of readers consisting of at least two Electrical and Computer Engineering faculty members. The Dissertation Committee votes on the acceptance of the dissertation. and if it is accepted, then the dissertation is submitted electronically to the library.   Further details concerning Ph.D. requirements are published in the advising manual for Ph.D. students in Electrical and Computer Engineering. Further information on the dissertation defense preparation is available at http://engineering.jhu.edu/ece/dissertation-defense-preparation (http://engineering.jhu.edu/ece/dissertation-defense-preparation/) .