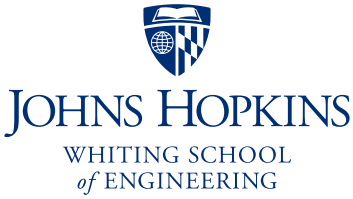


# Two-Semester Thesis Option
# Master of Science or Post-Master's Certificate in
# Electrical and Computer Engineering

## JHU Engineering for Professionals

Updated August 2024

## Background

The Electrical and Computer Engineering (ECE) program offers motivated students the opportunity to do in-depth research and development through the two-semester thesis option. The discussion below summarizes the requirements that students and faculty are to follow relative to the thesis option. Sections 1 – 3 summarize the requirements as they apply to either the Master of Science (MS) degree or the Post-Master's Certificate (PMC). Section 4 spells out the step-by-step procedure to be followed by students and research advisors. Section 5 is the list of ECE faculty available to serve as research advisors while Section 6 provides the contact information for the ECE leadership team. The Appendix gives the catalog descriptions for the thesis courses.

## 1. Requirements for MS Degree in ECE

Ten graduate courses must be completed within five years. At least seven of the ten courses must be from the Electrical and Computer Engineering program (525.xxx) or the Department of Electrical and Computer Engineering (520.xxx) in the full-time program, and at least four of the ten required courses must be at the 700-level or above. Approved transfer courses count as 600-level technical electives. At most, three of the ten courses required for the MS degree may be selected from outside the program, subject to advisor approval.

If the student pursues the thesis option, the two-course sequence 525.803-804 Electrical and Computer Engineering Thesis may replace two of the four required 700-level courses.
**Note**: **students cannot take independent study courses (801/802) as well as Thesis courses (803/804).** Exceptions to that require program leadership approval.

## 2. Requirements for PMC in ECE

Five graduate courses must be completed within five years. At least four of the five courses must be from the Electrical and Computer Engineering (525.xxx) program or the Department of Electrical and Computer Engineering (520.xxx) in the full-time program. At least two of the four required Electrical and Computer Engineering courses must be 700-level. Students are allowed to take one elective. All course selections are subject to advisor approval.

If the student pursues the thesis option, the two-course sequence 525.803-804 Electrical and Computer Engineering Thesis may replace two of the four required ECE courses.

## 3. Thesis Requirements and Deliverables

It is required that the thesis research be applied or theoretical work that goes beyond a straightforward implementation of known methods. The intent of the research is to expand the body of knowledge in the broad area of electrical and computer engineering. Students may

pursue the thesis option after completing all other requirements for their MS degree or PMC. Each thesis project is to be guided by a research advisor, chosen from ECE Research Faculty below (the research advisor may be different from the student's academic advisor assigned at admission to the ECE Program). In addition, each student is required to select a thesis committee that consists of the research advisor, a second reader, and a third reader to provide independent opinions on the research and the associated documentation. One reader must be a part of the Johns Hopkins University community and the other readers may be any member of the technical community (Johns Hopkins or elsewhere) who has deep knowledge in the area of research. Both readers are subject to approval by the thesis advisor, academic advisor, and ECE Program Chair.

The final deliverable is an electronic thesis submission to the Milton S. Eisenhower Library following standards posted at http://guides.library.jhu.edu/etd. See additional requirements for the final deliverable below.

A professional-quality thesis defense presentation is also required. The defense is to be scheduled near the end of the project, but prior to the assignment of the final grade. The presentation must be open to the public and the audience must include the members of the thesis committee.

## 4. Thesis Proposal Process

Students and research advisors are to follow the steps below:

1. The student contacts a potential research advisor from within the ECE Research Faculty below. The student may approach the advisor with either a project in mind or with the intention of soliciting suggestions for a topic from the advisor.

2. After choosing a topic, the student selects the other members of the thesis committee, consisting of the research advisor, a second reader, and a third reader to provide independent opinions on the research and the associated documentation. One reader must be a part of the Johns Hopkins University community and the other readers may be any member of the technical community (Johns Hopkins or elsewhere) who has deep knowledge in the area of research. Both readers are subject to approval by the thesis advisor, academic advisor, and ECE Program Chair.

3. After settling on the committee members and a potential topic, the student conducts a thorough literature survey to identify related work and to clarify precisely what is known and not known about the potential area of study. The goal is to identify topics that would be new or add to the volume of knowledge and understanding in the areas of electrical and computer engineering.

4. After settling on a topic of study, the student writes a research proposal of

approximately two-to-three pages. The proposal approval form must identify both the research advisor and the other members of the thesis committee. The proposal must clearly discuss the problem motivation, what the student intends to accomplish, and why the research will be an original contribution to the field using knowledge gained from the literature survey in step 3 above. The proposal is to also discuss the plans for final documentation including mention of likely coauthors (if any) beyond the student and his/her advisor.

5. The thesis committee endorse the proposal and forward it to the academic advisor for approval, who then forwards the proposal to the Program Chair for final approval. After final approval, the proposal and communication chain of approvals are added to the student's academic file.

6. Given the approved proposal and registration in the appropriate course (525.803), the research plan in the proposal is implemented by the student with an expectation of at least biweekly contact with the research advisor. Registration in this course cannot occur until the proposal is approved (step 5 above).

7. At the end of the first semester, the student shall schedule a status update presentation at a time and location of convenience to the student and the thesis committee (a synchronous online meeting is acceptable). If there are unique challenges or problems, these should be mentioned as part of the status update presentation. The status update presentation should provide a clear indication of what needs to be done to ensure completion of the project by the end of the second semester. The research advisor will assign a grade for the first semester based, in part, on this status update presentation.

8. Given success in the first semester, the student will complete a new thesis approval form and obtain necessary signatures to be enrolled in 525.804 and continue the research.

## 5. Thesis Submission process

1. Ideally, a final defense and corresponding deliverable are to be completed by the end of the second semester. The defense is to be scheduled at a time and location of convenience to the student and thesis committee (a synchronous online meeting is acceptable). The academic advisor should also be informed about the defense. The final thesis must take account of relevant comments or questions that arise during the defense. Upon approval by the committee, the final electronic thesis is submitted to the library. **Note: If the final electronic thesis has not been submitted to the MSE library (https://www.library.jhu.edu/library-services/electronic-theses-dissertations/) by the end of the second semester, the research advisor may assign an "I" [incomplete] grade until all conditions are met.**

2. Once the library has accepted the final electronic thesis document, the student will

receive an email notification of acceptance. The student forwards this email to thesis committee with the final thesis document and defense presentation.

3. Once the thesis committee receives the acceptance email, the thesis advisor needs to submit a grade in SIS or grade change form if not completed in time (Doug has accepted email notifications for grade changes as well).

4. After receiving the final acceptance email form the student, a final message that certifies the satisfactory completion of thesis, the defense presentation, and the thesis is sent by the research advisor to the academic advisor and the Program Chair. The Program Chair gives the final approval, and the research advisor then assigns the final grade to the relevant course. The approval message from the Chair to the research advisor and the final thesis are placed in the student's academic file and to the MSE Library. If the research advisor assigned an "I" grade for reasons discussed in item 8 above, the submission of the approved checklist and final thesis for the student's academic file should be delayed until the advisor is ready to assign a final letter grade.

## 6. Research and Travel Funds

Limited funds, on the order of $1,000 or less, are available to support the student's independent study and research for purchasing mechanical and electrical hardware components.

Students are encouraged to publish their research at a conference. The ECE program provides up to $2,000 in travel and registration fees for students who choose to submit a paper at a conference. The following link provides additional information on student travel funds: https://ep.jhu.edu/student-services/student-travel-fund/

## 7. ECE Research Faculty

The following ECE faculty members are available to supervise two-semester thesis projects.

| Name | Contact Info | Courses Taught in ECE | Areas of Specialization | Comments |
|---|---|---|---|---|
| **Nicholas Beser** | Nick.Beser@jhuapl.edu | 525.612 Computer Architecture; 525.712 Advanced Computer Architecture, 525.759 Image Compression, Packet Video and Video Processing | Computer Architecture and Video Processing (including Media Forensics) | Student expected to have taken a course from the instructor prior to research |

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| **Saeed Chaudhry** | Schaud25@jhu.edu | 525.742 System-on-a-Chip FPGA Design Laboratory | DSP/AI Algorithms implementation on FPGAs | |
| **Daniel Chew** | dchew@jhu.edu | 525.201 Circuits, Devices and Fields; 525.751 Software Radio for Wireless Communications; 525.752 Digital Receiver Synchronization Techniques | DSP, Software-Defined Radio, Cognitive Radio, FPGA, and Embedded systems | Prior class experience with student desirable, but not necessary |
| **Brian Choi** | Brian.Choi@jhuapl.edu | 525.616 Communication Systems Engineering | Communications and Networks | Student expected to have taken a course from the instructor prior to research |
| **Arnab Das** | Arnab.das@jhuapl.edu | 525.616 Communication Systems Engineering | Communications and Networks | Student is expected to have familiarity with communications and networking |
| **Cleon Davis** | Cleon.Davis@jhuapl.edu | 625.201 General Applied Mathematics; 625.615 Introduction to Optimization; 625.690 Computational Complexity | Intelligent systems (neural networks, genetic algorithms, fuzzy logic) | |
| **George (Dan) Dockery** | Dan.dockery@jhuapl.edu | 525.771 Propagation of Radio Waves in the Atmosphere | EM/RF Propagation and scattering, Radar systems | Students should have basic electromagnetics coursework completed satisfactorily |
| **Ashutosh Dutta** | Ashutosh.Dutta@jhuapl.edu | 525.641 Computer and Data Communication Networks I; 525.678 Next Generation Mobile Networks and Security with 5G | Security, Virtualization, Mobility, SDN | Student is expected to have familiarity with communications, networking, and wireless |
| **Clint Edwards** | Clint.edwards@gmail.com | 525.202 Signals & Systems; 525.627 Digital Signal Processing; 525.648 Introduction to Radar Systems | Optics, Remote Sensing, Remote Sensing Sensors, Digital Signal Processing | |
| **A. Roger Hammons Jr.** | roger.hammons@verizon.net | 525.707 Error Control Coding; 525.708 Iterative Methods | Communication Systems especially Physical Layer | Student expected to have taken a course from the instructor prior to research. |
| **Ramsey Hourani** | Ramsey.Hourani@jhuapl.edu | 525.642 FPGA Design Using VHDL | FPGA Design | Student expected to have taken a course |

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|---|---|---|---|---|
| | | | | from the instructor prior to research |
| **Jeff Houser** | jghouser@gmail.com, (301) 394-0797 | 525.624 Analog Electronic Circuit Design; 525.654 Communications Circuits Laboratory; 525.732 Advanced Analog Electronic Circuits; 525.743 Embedded Systems Development Laboratory | Analog Circuit Design, Embedded Systems, Communications Engineering | |
| **Daniel Jablonski** | Dan.Jablonski@jhuapl.edu | 525.645 Modern Navigation Systems; 525.778 Desi gn for Reliability, Testability, and Quality Assurance; 525.783 Spread Spectrum Communications; 525.789 Digital Satellite Communications | Microwave systems and communications, including radio navigation, GPS, broadband wireless and cellular, satellite communications, and aircraft avionics systems | Student expected to have taken a course from the instructor prior to research |
| **David Jansing** | David.jansing@jhupl.edu; David.jansing@jhu.edu | 525.612 Embedded Systems; 525.670 Machine Learning for Signal Processing; 525.748 Synthetic Aperture Radar | Remote Sensing, particularly Applied Remote Sensing (Synthetic Aperture Radar [SAR], EO/IR, Hyperspectral [HSI]) | Interested in students who are looking for projects in remote sensing and the extraction of actionable information from remotely sensed data, particularly in SAR and HSI |
| **Brian Jennison** | Bjennis1@jhu.edu | 525.202 Signals & Systems; 525.627 Digital Signal Processing; 525.780 Multidimensional Digital Signal Processing | Signal Processing | Student expected to have taken a course from the instructor prior to research |
| **Chiman Kwan** | Chiman.kwan@jhuapl.edu | 525.650 Introduction to EO/IR Systems | Image processing, control, fault diagnosis, remote sensing, machine/deep learning | My aim is help the MS student publish a conference paper in IEEE, OSA, or SPIE. I am a fellow of OSA and a fellow of SPIE, and have over 30 years of R&D experience. |
| **Jeff Lesho** | Jeffery.lesho@gmail.com | 525.786 Human Robotics Interaction | Robotics or Systems engineering fields | |

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| **Tim Miller** | Timothy.miller@jhuapl.edu | 525.746 Image Engineering | Imaging, Optical Sensors, Image Processing Algorithms | |
| **Neil F. Palumbo** | Npalumb1@jhu.edu | 525.609 Continuous Control Systems; 525.770 Intelligent Algorithms | Control and Estimation, Intelligent Systems | Prior class experience with student desirable, but not necessary. |
| **John Samsundar** | John.samsundar@jhuapl.edu | 525.670 Machine Learning for Signal Processing; 525.745 Applied Kalman Filtering; 525.744 Passive Emitter Geo-Location | Tracking/Geolocating via Sensor Fusion, Sensor Scheduling, Machine Learning | |
| **Haya Shajaiah** | Hshaja1@jh.edu | 525.634 High Speed Digital Design | Wireless systems, Cognitive systems and spectrum sharing, Machine learning and optimization | Prior class experience with student desirable, but not necessary |
| **Ray Sova** | Raymond.sova@jhuapl.edu | 525.691Fundamentals of Photonics; 525.796 Introduction to High-Speed Optoelectronics; 525.772 Fiber-Optic Communication Systems; 525.636 Optics & Photonics Lab | Optics and Photonics, fiber opticcommunications, biophotonics, RF photonics, free space optics, electro-optic systems, space-based optical instrumentation, etc. | I will work with the student to choose a research topic that is based on the current state-of-the-art research in a selected area of specialization. The research activities will include performing a literature search, finding a topic that is manageable within the time frame of the master thesis. |
| **Steve Weiss** | Sweiss7@jhu.edu | 525.605 Intermediate Electromagnetics; 525.618 Antenna Systems; 525.738 Advanced Antenna Systems | Antenna Theory | A student should have at least taken Antenna Systems |

# 8. ECE Leadership Team

## Program Chair

Cleon Davis, PhD
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### Program Manager

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## 9. Appendix

Below are catalog descriptions for the thesis courses. Students pursuing the thesis option for either an MS degree or Post-Master's Certificate are required to register for these courses. The relevant sequence below may be used to fulfill two courses within the 700-level course requirements for the ECE MS degree.

**525.803-804 Electrical and Computer Engineering Thesis**
The two-course sequence 525.803-804 are designed for students in the Electrical And Computer Engineering (ECE) graduate program who wish to undertake a thesis project after completing all other requirements for their degree or post-master's certificate. Students work with an advisor to conduct independent research and development in ECE, leading to a written thesis and oral presentation to a thesis committee. The intent of the research is to advance the body of knowledge in one of the technology areas in the ECE program.

**Prerequisites**: Completion of all other courses applicable to the ECE graduate degree or post-master's certificate and approval of the ECE program chair. The thesis option is appropriate for highly motivated students with strong academic records.

**Course Notes**: Students accepted into this course will have off-hours access to ECE facilities at the Applied Physics Laboratory, as needed. A limited amount of support for research materials is available.

**Instructor**: Member of ECE Research Faculty

Revision History

| Date | Changes |
|---|---|
| 7-29-2024 | Removed requirement of ECE Leadership being in the research committee<br><br>Added Research and Travel Funds section |
| 8-5-2024 | Added note in section 1 re: 801/802 & 803/804 |