RICE ENGINEERING

Electrical and Computer Engineering

2024-2025

MECE & MS/PhD Handbook

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Welcome Letter from the Chair

Welcome to the Electrical and Computer Engineering (ECE) Department at Rice University! We are globally known for extensive reach across disciplines, including designing next-generation wireless networks, nanophotonics, terahertz laser spectroscopy, nanophotonics, terahertz laser spectroscopy, digital systems processing, neuroengineering, machine learning and data science, healthcare devices and analytics, and a plethora of other interests. Regardless of your areas of interest and goals, you will find others that share your passion.

Our faculty rank among the top 10 most productive in the USA, from the amount of funding they receive as well as the number of publications and accolades attributed to them. In turn, they inspire productive, happy students. Our programs are carefully designed to allow students to explore and engage in a wide variety of interdisciplinary research and foster a close, nurturing relationship with the faculty. We are committed to providing you with a sound foundation of engineering, as well as experiential learning and soft skills to be successful scientists and engineers. Our students have gone on to become successful in diverse professional careers, including academia, government research institutions, large corporations, and fast-growing startups, in fields as diverse as energy, health care, IT, oil and gas, electronics, consulting, education, and more.

Our location in Houston, the fourth-largest city in the United States and one of the most diverse, provides unique opportunities for collaboration. Particularly, our proximity to Texas Medical Center, the world's largest medical center, allows students to work directly with the top researchers in TMC and provides access to their facility.

At Rice ECE, we challenge you to redefine your own limits. We invite you to stay in touch with ECE by finding us on social media and checking our website frequently to stay in the know about the exciting and groundbreaking achievements that happen daily in our community.

Once again, welcome to Rice. I wish you success as a Rice ECE graduate student.

Ashok Veeraraghavan
Chair, Electrical and Computer Engineering
Professor, Electrical and Computer Engineering

About the MECE & MS/PhD in the ECE

Welcome to the Rice University Department of Electrical and Computer Engineering (ECE). Your admission to Rice is the latest milestone in an exemplary academic career. At Rice, researchers and faculty members at the forefront of their fields will guide you. You will think creatively, join a network of knowledge, and redefine your limits.

This handbook provides general guidelines for ECE MECE & MS/PhD students. All degree plans and graduate student matters must conform to the Rice University General Announcements (GA) and the ECE course plan and be approved by the ECE Graduate Committee or ECE Professional Master's Committee.

The MECE at Rice University is a course-based program; no thesis is required. It is intended to enhance the education of those who have a BA or a BS in an engineering or science discipline and increase a student's mastery of advanced subjects. The Rice MECE program will prepare you to succeed and advance rapidly in today's competitive technical marketplace, and can be completed on a full or part-time basis.

The MS-Thesis program is a research thesis-based Masters program. It is intended to provide both a mastery of advanced subjects while also providing a practical introduction to original research conducted under the guidance of a faculty advisor.

The PhD program prepares students for research careers in academia and industry. The program consists of formal courses and original research conducted under the guidance of a faculty advisor, leading to a dissertation. Students in the PhD program either already have completed a Master of Science (MS) degree earlier or have completed a Master of Science (MS) degree as part of their program.

General Announcements

Rice University publishes its "General Announcements" (GA) each year. The GA is Rice's official catalog of courses, degrees, policies, and curricular requirements. In the event that there is a discrepancy between the GA and any other websites or publications, the GA shall prevail as the authoritative source. In addition, it is the student's responsibility to become familiar with the contents of this handbook and to comply with all regulations, policies, procedures, and deadlines, including the Rice University Honor Code.

Two sections of the GA are of particular importance to graduate students in ECE. The first is titled "Graduate Degree Programs". This outlines the basic rules and expectations for all graduate students at Rice University.

The second, titled "Programs of Study," is the department-specific information. Further information can be found at ga.rice.edu.

Honor Code

The Honor System is one of the longest-standing traditions at Rice University. Conceived and created together by Rice faculty and students, our Honor System has played a key role in helping us build and maintain an ethical academic culture. It features strong student engagement in communicating our values and the principles surrounding the Honor Code and, more broadly, emphasizes academic honesty and integrity as core values of our community. More information can be found at honor.rice.edu.

Code of Student Conduct

The Office of Student Judicial Programs (SJP) oversees the judicial system and enforces the Code of Student Conduct. Students are expected to govern their conduct by standards of considerate and ethical behavior so as not to harm or discredit themselves, the University, or any other individual. Moreover, just as the learning environment does not end at the classroom door, neither is the exercise of individual responsibility, civility, and honor limited to the academic domain.

More information on this can be found on the Rice University Student Judicial Programs page here sjp.rice.edu/code-of-student-conduct.

Administration

ECE graduate students are welcome to ask for assistance when it is needed. ECE administrative staff are all available to answer questions. A directory can be found at the back of this book.

Mail

Students who have offices in Duncan Hall or O'Connor Building may use Mail Stop 366 and pick up their mail from the ECE department on the fourth floor of O'Connor Building. A staff member will notify you when mail is received. Students who have offices in Brockman Hall have mailboxes in Brockman Hall. Students in BRC may receive mail via advisors.

FedEx and UPS Packages are received at the Mail Stop location of each building. Recipients will be notified by one of the staff members when packages arrive. The campus has only one address: 6100 Main Street,

Houston, TX 77005, therefore, Mail Stop should be indicated in the address. Below are the Mail Stop for ECE in each building.

Duncan Hall/O'Connor Building: MS-366 Brockman Hall: MS-378 (Mailboxes on 3rd floor of Brockman Hall) BRC: MS-656

ESTHER

ESTHER is a web application for students, faculty, and staff. Students will use this application to register for classes and retrieve certain data, such as grades and account information.

Using ESTHER, students can indicate confidentiality preference, update contact information, register, add and drop courses, access final grades, view holds on accounts, etc. See registrar.rice.edu/students/esther_FAQs for information about how to use ESTHER.

Student Health Services

Student Health Insurance: Rice University requires all degree-seeking students to have health insurance. Students electing to enroll in the Rice Student Health Plan may opt to be billed annually or semiannually. Contact the Student Health Insurance office for enrollment information and payment options at studenthealthinsurance.rice.edu. You must complete an insurance waiver form to forego the Rice health plan.

Health Data Form (HDF): All new graduate students are required to submit a properly completed HDF to Student Health. Two MMR vaccines are required for all students. In addition, students under the age of 22 years, regardless of classification, must provide documentation of vaccination against meningococcal disease. See health.rice.edu for more information.

International Student Health Information: All Rice-sponsored F-1 and J-1 international students must enroll in either 1) Aetna (Rice's Student Health Insurance Plan) or 2) SAS (Rice's Approved Alternate Health Insurance Plan for Internationals). Visit oiss.rice.edu/studenthealth for more information.

Technology Support

From creating websites and paper publication citations to research collaboration, the department has a plethora of technology resources available, as well as policies users must adhere to. See https://oit.rice.edu/ for more information.

International Student Information

International Student Newsletters are found at oiss.rice.edu/news. See oiss.rice.edu for details on international student internships with regard to Optional Practical Training (OPT) and Curricular Practical Training (CPT).

Graduate Studies Form Library

The Office of Graduate and Postdoctoral Studies (GPS) keeps a very useful library of commonly needed forms for everything from leave of absence to candidacy petitions to thesis submission. Visit graduate.rice.edu/forms for more information and a full list of available forms and documents.

Employment

All students must complete an I-9 form before starting work at Rice.

MECE students working for more than 20 hours per week are not normally eligible for full-time status, and special permission is needed. See the ECE Graduate Program Administrator for more details.

MS/PhD students receiving grad support may accept employment only with the approval of their home academic department. Students working for more than 20 hours per week are not normally eligible for full-time status. See the ECE Graduate Program Administrator for details.

International students must obtain the appropriate work authorization from OISS before starting to work. If you work even one day before or after your authorized dates, you may lose your status. See oiss.rice.edu/studentwork for additional information.

Organizations for Grad Students

Graduate Student Association: The Graduate Student Association (GSA) is comprised of degree-seeking graduate students at Rice University. The GSA mission is to enrich the graduate student experience and to represent, support, and promote graduate student interests and values. Visit gsa.rice.edu to learn more.

ECE GSA: The ECE GSA exists to augment the organizational, educational, professional, and social aspects of the graduate student experience. It serves as a connection to Rice's overall GSA to voice larger concerns and gain supplementary support.

ECE GW+: ECE GW+ is a network of women and other gender

minorities in the ECE Department at Rice University that aims to provide community, mentoring, and cultural enrichment for students. This network also serves to promote career opportunities and cultivate female leadership. In addition, they hope to improve the visibility of women in engineering and to advocate the importance of diversity in ECE.

Grades and Academic Status

According to university guidelines, students must achieve at least a B-(2.67) grade point average (GPA) in courses counted toward the graduate degree. The ECE Department requires a B (3.0) and adds the requirement that only courses in which a grade of C (2.0) or above for MECE students or B- or above for PhD students earned will count towards the graduate degree. Students whose cumulative GPA falls below 2.67 or whose semester GPA falls below 2.33, will be placed on academic probation by the university. Students whose GPA falls below 3.0 will be placed on academic probation by the ECE Department

All grades and academic status information can be found on the ECE website at the following links:

https://www.ece.rice.edu/academics/graduate-programs/phd- program

https://www.ece.rice.edu/academics/graduate- programs/mece- program

Help Available

When you or a friend are in need of help, there are many resources available to you on the Rice campus:

Professional Mater's Committee Chair & Administrator for MECE: Co-Chairs Dr. Michael Orchard and Dr. Joseph Young, and Aki Shimada, the Graduate Program Administrator, are available to help students with academic and personal needs.

Michael Orchard: orchard@rice.edu Joseph Young: jy46@rice.edu

Aki Shimada: as115@rice.edu

Graduate Program Chair & Administrator for MS/PhD: Dr. Santiago Segarra, the Graduate Program Chair, and Aki Shimada, the Graduate Program Administrator, are available to help students with academic and personal needs.

Santiago Segarra: segarra@rice.edu Aki Shimada: as115@rice.edu

Wellbeing and Rice Counseling Center: wellbeing.rice.edu

The Wellbeing and Counseling Center supports student development and

success by providing a good first point of contact for students who want to talk to someone about solutions to their well-being and mental health concerns. Should you like to speak to someone but are unsure who you need to talk to, please feel free to drop in during walk-in hours, and they will make sure you are matched with the Office that best meets your needs.

Graduate and Postdoctoral Studies (GPS) office: gps.rice.edu For questions concerning the graduate program as a whole, contact GPS at graduate@rice.edu.

Language and Communications: capc.rice.edu

The Center for Academic and Professional Communication is located in the Fondren Library. They offer coaching for oral presentation delivery, assistance with preparing professional talks and materials, communication workshops, and feedback on presentation materials. They also offer UNIV 601/602, which are courses designed to improve professional communication and writing.

Fondren Library Resources: library.rice.edu
The library offers subject area specialists to assist students and act as liaisons to departments. There is an engineering librarian, Jun Qian (jung@rice.edu). They can answer reference questions, teach you how to use various electronic media, advise students on how to identify materials relevant to teaching and research, and prepare a printed or electronic library guide.

Title IX Information: safe.rice.edu
Rice encourages any student who has experienced an incident of sexual, relationship, or other interpersonal violence, harassment, or gender discrimination to seek support. There are many options available both on and off campus for all graduate students, regardless of whether the perpetrator was a fellow student, a staff or faculty member, or someone not affiliated with the university. Students should be aware when seeking support on campus that most employees are required by Title IX to disclose all incidents of non-consensual interpersonal behaviors to Title IX professionals on campus who can act to support that student and meet their needs.

The therapists at the Wellbeing and Rice Counseling Center and the doctors at Student Health Services are "confidential," meaning that Rice will not be informed about the incident if a student discloses it to one of these Rice staff members. Rice prioritizes student privacy and safety and only shares disclosed information on a need-to-know basis.

If you are in need of assistance or simply would like to talk to someone, please call Rice Wellbeing and Counseling Center, which includes Title IX

Support, at extension 3311 on the Rice campus or (713) 348-3311. Policies, including Sexual Misconduct Policy and Student Code of Conduct, and more information regarding Title IX can be found at safe. rice.edu.

Office of Multicultural Affairs: oma.rice.edu

The Office of Multicultural Affairs (OMA) strives to coordinate and implement comprehensive educational, cultural, and social programs designed to emphasize inclusiveness while promoting intercultural dialogue, awareness, and respect for diversity. OMA helps students understand and appreciate racial, ethnic, gender, and other differences while creating opportunities for students to challenge prejudice and expand their cultural knowledge and appreciation. OMA utilizes its programming and support systems to provide an optimum developmental environment where all members of the University community may reach their potential in an atmosphere free from harassment and bias, thereby ensuring Rice's standing as an intellectually and culturally vibrant community.

Important Links

Academic Calendar: registrar.rice.edu

Award Opportunities: engineering.rice.edu/academics/student- awards-scholarships/graduate-awards-scholarships

Wellbeing and Counseling Center: wellbeing.rice.edu/

Course Catalog: courses.rice.edu

Forms: registrar.rice.edu/online_forms

General Announcements: ga.rice.edu

Graduate and Postdoctoral Studies (GPS) Office: graduate.rice.edu

Honor System and Code of Student Conduct: honor.rice.edu

International Student Information: oiss.rice.edu

International Student Forms: oiss.rice.edu/forms

Library: library.rice.edu

Map of Campus: rice.edu/campus-maps

Multicultural Affairs: oma.rice.edu

Parking: parking.rice.edu

Recreation Center: recreation.rice.edu

Technology Support: oit.rice.edu/get-help

Refer to registrar.rice.edu for all academic calendar information.

ECE Areas of Study

The ECE MS/PhD and MECE programs have eight interdisciplinary areas of study that students can choose from:

Computer Engineering (MS/PhD and MECE):

Computer Engineering is about innovating, prototyping, and demonstrating hardware and software systems for computing, communication, sensing, and storage. Advancing the performance, efficiency, security, cost, and form factors of these systems is critical for enabling future information and health technologies. Our research program spans analog/digital/mixed-signal/mmWave integrated circuits, micro-systems, VLSI and FPGA acceleration, computer architecture, and hardware/software co-design. We are particularly interested in emerging technology platforms and application domains, including but not limited to bioelectronic medicine, mobile health, Internet of Things, analog and neuromorphic computing paradigms, AI and machine intelligence, neuro-engineering, and next-G wireless. Our courses cover a broad range of topics in custom VLSI integrated circuit design as well as computer architecture and hardware and software for embedded systems.

Data Science (MS/PhD and MECE):

Data Science integrates the foundations, tools, and techniques of data acquisition (sensors and systems), data analytics (machine learning, statistics), data storage, and computing infrastructure (GPU/CPU computing, FPGAs, cloud computing, security, and privacy) to enable meaningful extraction of actionable information from diverse and potentially massive data sources. Data scientists in ECE use digital signal processing and machine learning algorithms to collect and understand the structure of data, looking for compelling patterns that tell the story that's buried in the data. The understanding of how to analyze and restructure signals can be applied to a wide range of areas, including artificial intelligence (AI), signal and network analysis, computer vision, and computational neuroscience.

Wireless, Networking, Sensing and Security (MS/PhD and MECE):

Rice ECE is a global leader in wireless networking, ranging from fundamental theory to city-scale testbeds, and at-scale field trials. Topics of study include information theory, massive antenna arrays, autonomous drone networks, diverse spectrum access, distributed sensing and wireless security. New emerging technologies include Terahertz communications, programmable metasurfaces, machine learning frameworks and methods for network optimization, and open-source development for software-defined wireless networks.

Digital Health (MS/PhD and MECE):

Digital technologies hold the potential for changing healthcare from episodic care to continuous care paradigms. Simultaneously, they can be uniquely scalable to deliver healthcare to people not possible today and to provide a framework for more equitable healthcare. Our mission is to invent and translate novel sensors, new care systems, and AI-based intelligent tools to realize equitable healthcare for the future.

Neuroengineering (MS/PhD and MECE):

Neuroengineers exploit engineering principles to understand, manipulate, and repair the activity of the nervous system. At Rice we develop methods to decipher and manipulate the neural code based on signal processing, machine learning, and information theory. We also develop physical devices that integrate with living tissue to precisely measure and manipulate neural activity. Rice is uniquely positioned to lead this field thanks to the broad, interdisciplinary research performed in conjunction with the Texas Medical Center, steps away from the Rice University campus.

Optics and Photonics (MS/PhD):

The focus of this program is the improved understanding of electronic, photonic, and plasmonic materials, along with the application of that knowledge to develop innovative nanophotonic devices and technologies based on advanced light-matter interaction engineering. The specific areas of interest cover a broad range, including *Sensing:* Imaging and image processing, including multispectral and terahertz imaging; nanometer-scale characterization of surfaces, molecules, and devices; photonic cavities for studying exotic light-matter interactions; ultrafast spectroscopy and dynamics. *Communication:* Photonics for quantum systems and advanced techniques for optical communications. *Energy harvesting:* Electromagnetic energy harvesting for photothermal applications, including light-driven chemistry and desalination, nanophotonic devices for renewable energy technologies, and charge transport in photovoltaic materials. *Biomedical:* Development of optical nanosensors and nano-actuators, applications of nanostructures in biomedicine, biochemical sensing technologies, and photoacoustic tomography.

Quantum Engineering (MS/PhD and MECE):

Quantum mechanics has been studied for nearly a century, providing

rules that explain physical processes in atoms, molecules, and solids, leading to the invention and commercialization of lasers, MRI, transistors, and nuclear power generation. The field is now undergoing a second revolution based on genuinely quantum, nonintuitive concepts such as superposition and entanglement that could enable even more powerful applications. We are utilizing cutting-edge photonic, electronic, and magnetic technologies to control quantum particles and quasi-particles such as spins, photons, excitons, phonons, plasmons, magnons, and polaritons in quantum materials and devices for applications in computing, simulation, sensing, and networking.

Computer Vision (MECE):

Computer vision is at the heart of some of the most exciting technological developments that we are seeing today. Fully autonomous cars and drones were once a dream that would take an infinite amount of time and expense to become a reality. Today, such vehicles are actively under development and may be realized to a large degree by the end of the current decade. Computer vision is the key area underlying such advancements in autonomous systems. Furthermore, computer vision is driving fundamental shifts in augmented reality and healthcare systems through advanced object recognition and 3D reconstruction. Advances remain to be done through algorithm design, hardware development, and system integration.

MECE Specific Information

Degree Works

Degree Works is a degree-auditing tool that assists students in tracking their academic progress toward graduation. Degree Works can be accessed through ESTHER.

The MECE degree is a non-thesis master's degree. For general university requirements, please see Non-Thesis Master's Degrees in the GA.

Students are generally admitted to the MECE degree program in the fall semester. MECE students are to consult with their assigned academic advisor (usually a member of the MECE Committee) each semester in order to identify and clearly document their individual curricular requirements or degree plans to be followed. An MECE degree planning form and current requirements may be found on the ECE website.

MECE Academics

The MECE is a terminal, non-thesis degree intended primarily for students who wish to strengthen their academic background through three or four semesters of coursework. The MECE program is a bridge to industry, designed to provide advanced learning and training in the applied aspects of ECE technology beyond the typical undergraduate electrical and computer engineering degree program.

Upon matriculation, the MECE students are assigned a faculty advisor in their primary area of interest (See "ECE Areas of Study"). The advisor will counsel the student in developing a degree plan consistent with the student's career objectives.

Students will work on capstone projects for two semesters by enrolling in an area-specific capstone course each of those two semesters.

The MECE may be pursued on a part-time or full-time basis. Full-time students must register for at least 9 credit hours. Students must maintain continuous program enrollment and involvement unless granted an official leave of absence. For more information, see the GA ga.rice.edu.

Academic Advisors

Each incoming MECE student is assigned an academic advisor, usually a member of the MECE Committee, to help with course selection and other initial academic concerns. Final course selection does not need to be completed until after the start of classes but must be completed before the ADD deadline, typically the Friday of the second week of classes.

Students should submit their approved degree plans to the Graduate Program Administrator at least one week before the deadline.

ELEC 698 Seminar

The ELEC 698 seminar course broadens an MECE student's exposure to activities and opportunities in all fields of electrical engineering, both in industry and research settings. All MECE students are required to take and successfully complete ELEC 698 for each semester in residence at Rice University. The course requires registered attendance at three (3) ECE-sponsored or co-sponsored seminars per semester and at the featured departmental events described in the following paragraph.

In addition to the attendance at three seminars, ELEC 698 requires that each student attend and sign in for the following events: ECE Corporate Affiliates Day, the Brice Distinguished Lecture, and the Chapman Distinguished Lecture in the years they are held. These featured departmental events provide each MECE student excellent opportunities to expand their professional network by interacting with alumni and industrial affiliates of the ECE department. Exceptions must be approved and signed off by the ECE Graduate Administrator. Reasonable exceptions include work obligations, travel for job interviews, etc.

Details of seminars are notified by email and posted on the Rice events website (events.rice.edu). Please check with the ECE Graduate Program Administrator for a list of approved seminars. Students are responsible for signing in during the first 10 minutes of the seminar. Attendance logged after that time will not be counted. If there are any difficulties with signing in, students should contact the ECE Graduate Program Administrator within 24 hours of the seminar.

Guidelines for Independent Study

ELEC 590 - Graduate Non-Thesis Research Projects is intended for MECE students who wish to undertake specific research projects under the direction of a faculty member. The parameters of the research, as well as a brief abstract for the project and grade determination, should be discussed with the faculty member and submitted to the student's academic advisor prior to enrollment in the course. A maximum of two semesters of ELEC 590 (three credit hours each semester) can be applied to the MECE degree as an elective course.

ELEC 591 - Vertically Integrated Projects (VIP) at Rice University. This program unites graduates and undergraduate education and faculty research in a team-based context. Students interested in VIP should meet

and consult with the faculty lead of that project. Please visit the ECE website for more information. A maximum of two semesters of ELEC 591 (three credit hours each semester) can be applied to the MECE degree as an elective course.

MECE Degree Requirements

- A minimum of 10 courses (30 credit hours) to satisfy degree requirements.
- A minimum of 30 credit hours of graduate-level study (coursework at the 500-level or above).
- A minimum of 27 credit hours must be taken at Rice University.
- A minimum residency enrollment of one fall or spring semester of part-time graduate study at Rice University.
- A minimum of 3 courses (9 credit hours) from the Capstone Requirement.
    * 1 course (3 credit hours) to fulfill the Capstone Foundations requirement.
    * 2 courses (6 credit hours) to fulfill the Capstone Experience Project requirement.
- A minimum of 1 course (3 credit hours) from the Engineering Communications Requirement.
- A minimum of 2 courses (6 credit hours) from the Engineering Software Development Requirement.
- The requirements for one area of specialization (see below for areas of specialization). The MECE degree program offers seven areas of specialization or focus areas:
    * Computer Engineering, or
    * Data Science, or
    * Computer Vision, or
    * Neuroengineering, or
    * Quantum Engineering, or
    * Wireless Systems, or
    * Digital Health.
- A minimum of 2 courses (6 credit hours) from the Elective Requirements
- ELEC 698 each semester in residence at Rice University.
- A maximum of 1 course (3 credit hours) of graduate-level coursework as transfer credit. For additional departmental guidelines regarding transfer credit, see the Policies tab of the GA.
- A minimum overall GPA of 2.67 or higher in all Rice coursework.
- A minimum GPA of 3.00 or higher in all Rice coursework that satisfies

requirements for the non-thesis master's degree with a minimum grade of C (2.00 grade points) in each course.

MECE Timeline

Semester 1

Your first semester at Rice will begin with Orientation Week (or O-Week) where you will learn about Rice and ECE. The major events of this week will include presentations by several of the faculty with whom you will become familiar. You will meet your advisor, discuss your career objectives, and select your courses for your first semester.

In consultation with your advisor, you will determine a degree plan and timeline for completion. This must be submitted to the ECE Graduate Program Administrator.

MECE students are to consult with their assigned academic advisor (usually a member of the MECE Committee) each semester in order to identify and clearly document the individual curricular requirements in their degree plan to be followed. A degree plan must be submitted for each semester in residence, but degree plans may be revised, re-approved, and resubmitted at any time.

An MECE degree planning form with the current requirements may be found at https://eceweb.rice.edu/student-resources.

Semesters 2 and 3

Students should consult their Degree Works audit through ESTHER to evaluate how they are meeting the university and departmental degree requirements. In the final semester of MECE studies, an "Application for Degree" must be completed by the student before the deadline shown on Rice's academic calendar for that semester. The pre-printed form can be found on ESTHER and is submitted to the Office of the Registrar.

The MECE program must be completed within 5 years.

MS/PhD Specific Information

Students are admitted to the MS/PhD program primarily in the fall semester. ECE PhD students move through the program in stages, starting as first-year students, advancing to MS candidates, PhD-qualified students, and PhD candidates; each advancement requires the approval of the ECE Graduate Committee.

Students entering with previous graduate work may follow a hybrid program developed in consultation with the faculty advisor and the Graduate Committee. In particular, students who have a prior approved MS degree do not have to obtain another MS degree at Rice but can move directly to the PhD program upon successful completion of their 599 and PhD qualifiers.

The first academic year concentrates on foundation coursework and developing a research area as well as taking and passing ELEC 599. A candidate for the PhD degree must demonstrate independent, original research in ECE. After successful completion of all coursework, a student is eligible for PhD candidacy.

The student then engages in full-time research, culminating in the presentation of the PhD research proposal and then the completion and public defense of the PhD dissertation. Details of the PhD program requirements, the phases of study, and a timetable may be found on the ECE website.

Each incoming PhD student will be assigned one seasoned ECE graduate student. Mentors will assist first-year students in academic matters, including preparation for ELEC 599 and social interaction with members of ECE and other departments.

Learning Outcomes

Upon completing the PhD degree program in Electrical and Computer Engineering, students will be able to:

- Identify and define relevant research topics in Electrical and Computer Engineering and conduct independent research with results that advance the state of the art in the field.

- Lead research and design groups by communicating innovative ideas effectively.

- Solve real-world problems by integrating knowledge gained in courses and through research.

ELEC 592

All students who matriculate in the Fall semester must register for ELEC 592: Pre-Thesis Project Exploration course. The course gives an opportunity to introduce students to different research areas in ECE, meet with the faculty and visit the labs through the short rotations.

The course consists of short research talks by faculty, development classes, and lab visits. Each student must receive a Satisfactory grade by attending classes and completing the assignments. Students are asked to submit the draft abstract and timeline for ELEC 599 at the end of the course.

In the Spring semester, students will start doing research in the lab of their top choice. If the match is good, they formally join the lab in the summer after completing ELEC 599. If the match is not good for one reason or another, the students will keep research rotation in another lab during the summer until they find the lab with the best fit. In almost all cases, this lab becomes the research home for their PhD program.

ELEC 599

Each student must successfully complete a project course, ELEC 599, in their chosen area of research. In addition to enabling the faculty to evaluate the student's research potential, the project encourages timely completion of the MS degree when applicable.

The student must complete a master's thesis and successfully defend it in an oral examination. Students who have already acquired a master's degree elsewhere must also complete the ELEC 599 project, after which acceptance of their previous master's degree will be determined by the Graduate Committee.

ELEC 599 serves two purposes: It allows students to begin research early in the Ph.D. program. Projects selected often serve as catalysts for publications and thesis work. It also crucially serves as the vehicle to identify the PhD thesis advisor.

At the end of the fall semester of the first year, students select a research project. It is the student's responsibility to meet with faculty in the first semester and secure an advisor for ELEC 599. Students must pass ELEC 599 with a grade of A- or better to remain in the PhD program.

ELEC 599 requirements consist of two parts: Research, which is self-scheduled, with regular meetings with the student's advisor, and communications seminars, which are 1.5 hours weekly.

Early in the spring semester, students submit the selection of two project

committee members in addition to the advisor. At least two committee members must have their primary appointment in ECE as assistant, associate, or full professors. Other committee members may be adjunct faculty selected from ECE as well as faculty from ECE-related interdisciplinary departments. A spring midterm progress evaluation will be conducted with the advisor to ensure the student's project is on track. Any problems will be referred to the ECE Graduate Committee for intervention.

In late April or early May, the ECE Graduate Administrator will schedule oral presentations for all ELEC 599 students. The written project reports must be submitted to committees and the ECE Graduate Administrator by mid-April. Reports should be formatted in 11 pt. font and according to the LaTeX or MS Word templates given in the IEEE transaction style. Visit https://www.ieee.org/publications/index.html for guidelines.

It is the student's responsibility to follow up with all committee members prior to the scheduled presentation to confirm all logistics of the ELEC 599. Following presentations, project committees will meet to provide written evaluations, which are then submitted to the ECE Graduate Committee for final evaluation and grade.

The ELEC 599 grade is based on:
1. Overall performance on the research project
2. Overall performance in communications and professional development
3. Identification and support from MS/PhD thesis advisor
4. Motivation and enthusiasm for graduate work
5. Quality of written presentation
6. Quality of oral presentation
7. Quality of research
8. Prospects for PhD success

Visit https://bit.ly/3yMTiCn for the grading rubric and more information.

The Graduate Committee meets to determine final ELEC 599 grades, after which individual evaluation letters will be provided to students.

Students who pass ELEC 599 will be officially associated with the advisor. They will switch from Graduate Fellow to Graduate Research Assistant and be paid from the advisor's funding unless they have another funding source.

Students who do not pass ELEC 599 with a grade of A- or better will not be permitted to continue in the MS/PhD program. However, they may be retained until the end of the summer.

ELEC 699 Seminar

The ELEC 699 Seminar Course is intended to foster the development of breadth among all graduates at all phases of study in ECE. The requirement is registered attendance at three (3) ECE-sponsored or co-sponsored seminars per semester. Additionally, each student is required to attend and sign in for the following events: ECE Corporate Affiliates Day, the Brice Distinguished Lecture, and the Chapman Distinguished Lecture, in the years they are held. Exceptions must be approved and signed off by the Graduate Program Chair. Reasonable exceptions include travel for conference attendance, internships, etc.

All MS/PhD students are required to take and earn an "S" (Satisfactory) in ELEC 699 as a part of their degree requirements for each semester in residence at Rice University.

Details of seminars are notified by email and posted on the Rice events website (events.rice.edu). Please check with the ECE Graduate Program Administrator for a list of approved seminars. Students are responsible for signing in during the first 10 minutes of the seminar. Attendance logged after that time will not be counted. If there are any difficulties with signing in, students should contact the ECE Graduate Program Administrator within 24 hours of the seminar.

ELEC 591

Vertically Integrated Projects (VIP) at Rice University. This program unites graduates and undergraduate education and faculty research in a team-based context. Students interested in VIP should meet and consult with the faculty lead of that project. Visit the ECE website for more information.

Graduate Student Appointments (Grad Pay)

All enrolled full-time PhD students are supported with full tuition and grad pay. All first-year PhD students are appointed as Graduate Fellows and receive a stipend. After successful completion of ELEC 599, students in good standing will be supported as Graduate Assistants by their research advisors. Compensation is calculated and paid biweekly throughout the year. Graduate Assistants are Research Assistants by default, but they also work as Teaching Assistants during the semesters they are assigned to this role, and the department will support part of their compensation.

Many PhD students obtain fellowships in addition to what is provided by Rice. See graduate.rice.edu/fellowship-opps for info.

Summer Support - Students should discuss their summer plans well in advance with their advisors. In order to be paid by Rice for the summer, students must register for at least 9 hours of their advisor's section of ELEC 800. Students planning a summer internship off-campus, with the advisor's approval, must inform the Graduate Program Administrator by May 1 in order to complete the financial arrangements required.

Vacation/Time Off

Graduate students often receive financial support in the form of graduate stipend/salary and tuition waivers. The termination of financial support to a graduate student, while not equivalent to dismissal, is a serious action that could deprive students of their financial ability to continue graduate studies.

Active participation in required academic activities (for example, laboratory work in certain science and engineering programs) is a basic condition for continued financial support. Students who are absent from such required activities for a continuous two weeks without permission and without mitigating circumstances may be subject to termination of financial support. Such absences may be taken as an indication that inadequate academic progress is being made. Thus, if absences have to occur, they must be pre-arranged with the student's supervisor, except for medical and family emergencies, in which case timely notification is required.

Graduate advisors and programs should be aware of unexplained student absences and must provide immediate written warnings when students are not present and carrying out required academic activities for more than one week. The nominal vacation periods are appropriate and must be discussed with the student's graduate advisor.

Departmental Responsibilities

In most research degree programs, students must undertake a limited amount of teaching or perform other services as part of their training. ECE students may be asked to take some kind of course assistant responsibilities, such as Teaching Assistant (TA) and/or MECE Course Assistant, for up to 6 semesters throughout their program. Assigned duties are expected to entail an average of 6 hours per week and should not exceed more than 10 hours per week, averaged over the semester. As an exception to this rule, MECE students who are part of the TA-based tuition waiver program are expected to work up to an average of 20 hours per week. These assignments are made at the beginning of each semester. TA responsibilities include grading coursework for the instructor and

possibly delivering one or two lectures for practice and/or to fill in while the instructor is away on university business.

For TA, mandatory training is provided by the Dean of Engineering's office each fall, and additional training opportunities are provided by the Center for Teaching Excellence. For students interested in pursuing a career in academia after graduation, the TA program provides an excellent opportunity to practice developing and delivering instructions.

Master of Science (MS) Program

The MS degree requires at least 30 graduate semester hours of study at the 500 level and above beyond the bachelor's degree (typically 24 hours of course credit, which includes ELEC 599 and 6 hours of ELEC 800 research credit). Twenty-four of the 30 required hours must be completed at Rice.

The MS program requires original research work reported in a thesis and a public oral presentation, evaluated by a master's thesis committee consisting of a thesis advisor and at least two other faculty members. Barring a written exemption from the Graduate Committee, the MS must be completed within 3 years of entering the program.

Previous Master's (Non-Rice)

Students admitted with a previous MS degree are required to complete a minimum of 18 hours of course credit in addition to ELEC 599 and 48 hours of research credit. Previous MS degrees are approved or denied upon completion of ELEC 599 in the first year. Twenty-four of the 30 hours required for the MS must be completed at Rice.

Doctor of Philosophy (PhD) Program

The Doctor of Philosophy (PhD) degree program prepares students for a research career in academia or industry. The PhD degree program consists of formal courses and original research conducted under the guidance of a faculty advisor, leading to a thesis. Students in the PhD program either complete a Master of Science (MS) degree as part of their program or have already completed a Master of Science degree at another institution before enrolling in the PhD program. The Electrical and Computer Engineering department occasionally does admit students for a terminal MS degree.

The PhD program is full-time only, with a minimum of 9 credit hours per semester. Students must maintain continuous program involvement and enrollment unless granted an official leave of absence. It requires the completion of at least 90 semester hours of graduate study and the conclusion of an original investigation that is formalized in an approved thesis. As final evidence of preparation for this degree, the candidate must pass a public oral presentation and submit the approved thesis to the Office of Graduate and Postdoctoral Studies. Each student is also required to take and earn an "S" (Satisfactory) in the seminar class, ELEC 699, as part of their coursework.

The PhD from BS is expected to be completed within 6 years of entering the MS/PhD program. Barring a written exemption from the Graduate Committee, it must be completed within 7.5 years of entering the MS/PhD program.

Academic and Research Advisors

Each incoming PhD student is initially assigned an academic advisor, usually a member of the ECE Graduate Committee, to help with course selection and other initial academic concerns. Final course selection does not need to be completed until after the start of classes. The course plan must be approved by a member of the ECE Graduate Committee and submitted to the Graduate Program Administrator by the end of the first week of class.

During their first year, PhD students will have opportunities to meet with several faculty and make lab visits to select a research advisor, who will then take over the student's advising. Usually, the research advisor will be derived from the ELEC 599 research project undertaken in the second semester of the program. Upon passing ELEC 599 at the end of the first year, the advisor will begin providing financial support for the graduate student.

Some students in the ECE PhD program have a thesis director/research advisor whose primary appointment is not in the ECE department. In such cases, the student's program will still be governed by the program requirements of the ECE department as listed in this handbook and online and in accordance with the guidelines of the General Announcements.

Students above the second year should also submit course plans before the start of the Fall semester each year. The course plan should include the course history of previous years and the plans for the upcoming academic year. The course plan forms can be found on the department website (https://eceweb.rice.edu/student-resources)

Annual Review

All MS/PhD students in ECE complete an annual review in conjunction with their thesis advisors. The purpose of this review is to:

1. Evaluate progress towards the degree;

2. Communicate your objectives for the coming year to your advisor;

3. Ensure a shared set of expectations between student and advisor as to what defines satisfactory progress for the coming year.

Each MS/PhD student will be asked to complete a self-evaluation each summer and discuss the year's progress with the advisor. Following this review conversation, it is the student's responsibility to ensure that the annual review is submitted to the Graduate Program Administrator. Students who do not complete this may not be considered in good academic standing.

If a student has not met the goals from the previous year and/or is not demonstrating satisfactory progress toward the degree, the academic advisor will prepare a written plan, including goals and deadlines, that includes clearly stated consequences of not meeting the goals. A copy of the plan will be placed in the student's academic file.

MS/PhD Timeline

Year 1

Your first semester at Rice will begin with Orientation Week (known as O-Week) where you will learn about Rice and the Department of Electrical and Computer Engineering. The week will include presentations by several of the faculty you will become familiar with. You will meet your academic advisor, discuss your career objectives, and select your courses for your first semester.

The first academic year concentrates on foundation coursework, followed by a focus on a research area. The year consists of a minimum of 18 hours of coursework as follows:

Any variance to this plan requires a written petition to and approval from the ECE Graduate Committee.

Fall (1st semester):

By the end of the first week of class, the student must develop a degree course plan approved by a member of the ECE Graduate Committee. It is then submitted to the Graduate Program Administrator for the student's file. Course plans may be revised, re-approved and resubmitted at any

time over the course of the degree program. A minimum of 9 credit hours of core coursework is required.

Spring (2nd semester):

ELEC 599 (6 credit hours) and 3 credit hours in core or breadth courses

Year 2 and Thesis Defense

The second year consists of research credits (ELEC 800) and the remaining core and breadth course credits. We recommend that students register for 3 credit hours of core or breadth courses every semester beginning their third semester until the core/breadth course requirements are met.

Summer:

ELEC 800 (at least 9 credit hours) unless students go on internships and are not engaged in research in their lab any part of the summer.

Fall (3rd Semester):

At least 3 credit hours in core or breadth course and ELEC 800.

MS Candidacy must be obtained by the end of the 4th semester (second year). Once the student has completed the requisite hours and established a committee, the student must submit the Petition for Approval of MS Candidacy to the Graduate Program Administrator.

Once the student has performed research, written a thesis, and is ready to defend, the student will schedule their oral presentations with their committees. See graduate.rice.edu/boundaries for time boundaries and graduate.rice.edu/candidacy for candidacy information.

Years 3-8

In year 3 and beyond, the student will perform their additional coursework and ELEC 800, totaling at least 30 hours for the MS and 90 hours for the PhD. We recommend that students register for 3 credit hours of core or breadth courses every semester beginning their third semester until the core/breadth course requirements are met. Students are expected to achieve PhD candidacy by the end of 7th semester. All Rice PhD students must petition for PhD candidacy before the start of the 9th semester (fifth year).

Students are expected to defend their PhD thesis by the end of the 11th semester and no later than the end of the 14th semester (seventh year). All Rice graduate students must defend before the end of the 16th semester (eighth year). See graduate.rice.edu/boundaries for time boundaries.

Candidacy and Defense

MS Candidacy

The Petition for Approval of MS Candidacy form is submitted to the ECE Graduate Program Administrator along with a copy of their final actualized course plan. The Department Chair's signature is required on the petition, which is then submitted along with the transcript and course plan to the Office of Graduate and Postdoctoral Studies (GPS) for approval. See graduate. rice.edu/candidacy for more information. MS Candidacy must be obtained by the end of the 4th semester (second year).

MS Defense

Two weeks prior to defending, the student must submit the following information: the date of defense, time, location, title, and abstract, as well as the names, titles, and departments of committee members. This must be submitted to GPS on the Rice Events Calendar (events.rice.edu/rgs) and to the ECE Graduate Program Administrator, who will make an email announcement to the department listservs. See graduate.rice.edu/thesis for more information.

The MS student receives an initialed Approval of Candidacy form from GPS, which is signed by members of the student's committee upon passing the MS defense. Within a week after the final oral examination in which the defense of the thesis is passed, the student must upload to thesis.rice.edu a PDF copy of the thesis and the Approval of Candidacy form, signed and dated by the thesis committee. The student has six months from the date of defense to submit their signed thesis to GPS, at which time the student becomes a Master's Degree Candidate.

Additionally, if a student plans to defend and submit a thesis for the next degree conferral, the student must submit the application for the degree to the Office of the Registrar by the deadline stated in the academic calendar. Typically, this is in September for the December conferral, in January for the May conferral, and in June for the August degree conferral.

Students are expected to defend their MS thesis by the end of the 5th semester and no later than the end of the 6th semester (third year). MS thesis must be submitted within 6 months of the defense. In addition, the defense must be completed and the thesis submitted prior to the deadline found on the registrar's calendar. See registrar.rice.edu/calendars for more information.

PhD Qualifier

PhD students are required to complete a PhD qualifier. The PhD qualifier consists of an oral exam and a written document that summarizes their research problem and the progress they have made in tackling the problem. For students who are obtaining a Rice MS-Thesis degree on the way to their PhD, their MS-Thesis oral defense and the MS-Thesis can (with the permission of their MS-Thesis committee) be used to satisfy the requirements of the PhD qualifier. Students who enter the PhD program with a prior MS-Thesis degree will need to schedule and defend their PhD qualifiers within two years of their entry into the program.

PhD Candidacy

In order to petition for PhD degree candidacy, a student must have completed 45 semester hours of advanced studies as described on the course plan and approved by the Department. While having achieved a grade of B- or above in each of these courses, successfully completed ELEC 599, and earned a Master of Science degree from Rice University, or have an equivalent Master of Science degree, as decided by the ECE Graduate Committee. See graduate.rice.edu/candidacy for more information.

The Petition for Approval of PhD Candidacy form is then submitted to the ECE Graduate Program Administrator along with a copy of his/her course plan before the start of the 9th semester (fifth year). The Department Chair's signature is required on the petition, which is then submitted along with the transcript and course plan to GPS for approval. PhD Candidacy must be obtained by the end of the 8th semester (fourth year).

PhD Thesis Proposal

After a student petitions for candidacy, but before defending their thesis, the student must present a thesis proposal. This is done after a research direction has been decided upon and after preliminary results are achieved, but with enough time remaining to include any redirections recommended by committee members. This usually occurs over one year before the PhD Defense and is an oral presentation to the thesis committee. No written proposal is required. The student may only defend their thesis after successfully presenting the thesis proposal and upon approval of the committee members.

One week prior to the presentation of the thesis proposal, the student must submit the following information to the ECE Graduate Program Administrator to make an email announcement on the department listservs: proposal date, time, location, title, and abstract, as well as the names, titles, and departments of committee members. The ECE Graduate

Program Administrator will generate a letter for the student's committee members to sign in approval of the thesis proposal following the presentation.

PhD Defense

Three weeks prior to defending, the student must submit the following information: defense date, time, location, title, and abstract, as well as the names, titles, and departments of committee members. This information must be submitted to GPS on the Rice Events Calendar (events.rice.edu/rgs) and to the ECE Graduate Program Administrator, who will make an email announcement on the department listservs. Visit graduate.rice.edu/thesis for more information.

The PhD student receives an initialed Approval of Candidacy form that is signed by the student's committee members upon passing the PhD defense. Within a week after the final oral examination in defense of the thesis is passed, the student must upload to thesis.rice.edu a PDF copy of the thesis and the Approval of Candidacy form, signed and dated by the thesis committee. The student has 6 months to submit a signed thesis to GPS, at which time the student becomes a Doctoral Degree Candidate.

Additionally, if a student plans to defend and submit a thesis for the next degree conferral, the student must submit the application for the degree to the Office of the Registrar by the deadline stated in the academic calendar. Typically, this is in September for the December conferral, in January for the May conferral, and in June for the August degree conferral.

Students are expected to defend their PhD thesis by the end of the 11th semester and no later than the end of the 14th semester (seventh year). PhD thesis must be submitted within 6 months from the defense. In addition, the thesis must be submitted prior to the deadline found on the registrar's calendar in order to qualify for a specific degree conferral date. See registrar.rice.edu/calendars for more information.

Grievances and Problem Resolution

The basic path for problem resolution within the department is to consult with the Graduate Program Chair, followed by the Department Chair. If no resolution can be found at this level, the process from the general announcements found in the GA Graduate Student Rights and Responsibilities section: bit.ly/300pwIQ will be followed.

Changes in Research Group, Program, or Department

Rice recognizes research interests may change after a student enters a graduate program. If a student feels their interests and talents could be

better served working with a different advisor or in another research group or department, a change can be accommodated.

Although each case is unique, the following are guidelines for making an advisor, research group, or department change:

1. Discuss issues with the current advisor. Often, an adjustment of the research topic may resolve the problem.

2. If issues are insurmountable, speak with faculty members whose research interests are more in line with the student's interest and who have the funding for support.

3. When an alternate faculty member agrees to replace the current advisor, obtain permission from the Chair of the ECE Graduate Committee and proceed to the ECE Graduate Program Administrator, who will process the documentation required for the exchange to be used towards earning the degree.

4. An MS/PhD student who transfers from their program to the MECE program may be responsible for reimbursing the cost of tuition for courses taken while in the MS/PhD program.

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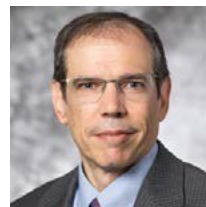Assistant Professor
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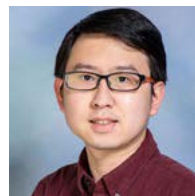Professor
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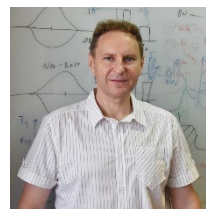
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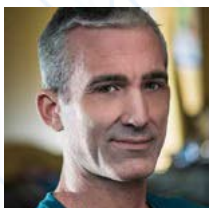
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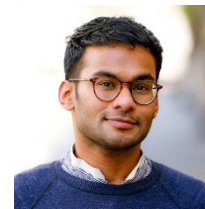Karl F. Hasseelmann Professor in Engineering
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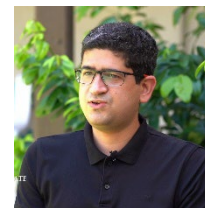
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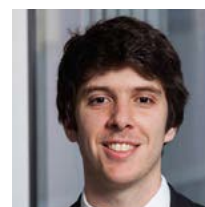
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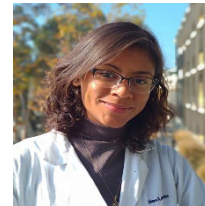McNair Scholar Assistant Professor
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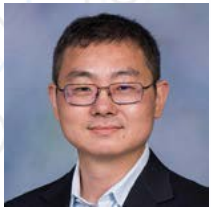kevin.slagle@rice.edu
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