October 2023

UW ECE

10-YEAR SELF STUDY

ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY of WASHINGTON

ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY of WASHINGTON

Date of submission:
October 16, 2023

UW ECE
10-year self study

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ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY of WASHINGTON

Department of Electrical & Computer Engineering
College of Engineering
University of Washington, Seattle

Department Chair: Professor Eric Klavins

Department Administrator: Aleesha Wiest

Date of submission: October 16, 2023

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Degrees offered

Bachelor of Science in Electrical Engineering (BSEE)
Bachelor of Science in Electrical and Computer Engineering (BSECE)

Combined BS-MS Degree

Master of Science (MSEE)
(one degree title covers our traditional full-time program, and one covers our part-time evening Professional Master's Program)

Electrical Engineering and Law Concurrent Degree (JD/MSEE)

Doctor of Philosophy (Ph.D.)

Graduate Certificates offered

Certificate in Machine Learning and Deep Learning
Certificate in GPU-Accellerated Computing and Visualization
Certificate in Applied Cybersecurity Engineering

Graduate Data Science Option (DSO)

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EXECUTIVE SUMMARY

In the past 10 years, the University of Washington Department of Electrical & Computer Engineering (UW ECE) has experienced dramatic change and significant growth, coinciding with the change of our Department name from Electrical Engineering to Electrical & Computer Engineering in 2018. As of fall 2023, our undergraduate enrollment is 767 students, up from 472 in 2013, making us the fifth largest producer of ECE/EE degrees in the nation. Our Professional Master's Program, which started in 2007 with less than 50 students, now serves more than 250 students per year, attracts students worldwide, and is a significant source of revenue for our Department. Our research and entrepreneurial efforts continue to flourish, with roughly $20M to $25M of research expenditures per year and the largest number of spinout companies of any department at the University of Washington for over ten consecutive years. And ECE faculty serve as leaders of centers and initiatives across campus, the region, and beyond. Now, especially with the recent enactment of the CHIPS and Science Act, UW ECE is experiencing unprecedented interest from industry and the government in its students and research.

Despite the more than 60% growth in undergraduate enrollment alone, the number of tenure-track faculty and staff in ECE has not changed significantly, nor has the amount or quality of space available for teaching and research. Furthermore, ECE as a discipline continues to lack diversity. Over the past 10 years, our average percentage of enrollment of women has been just shy of 23%, to take one example metric, which mirrors a stubborn worldwide trend across ECE that stunts the growth of the field. Thus, to ensure the continued success of UW ECE, and maximize our potential to serve our community, we believe the following key issues should be addressed:

- The College of Engineering, the University of Washington, and the state of Washington must recognize UW ECE as a key economic driver, educator, and research powerhouse, allocating additional faculty lines, more startup package assistance, and increased staffing to support our growth.

- Our teaching support staff, teaching lab equipment, and teaching lab spaces, in our Department and in the Washington Nanofabrication Facility, must be modernized, expanded, better staffed, and better funded to train our students, match the needs of our industry partners, and reach or exceed parity with our peer institutions. We currently lack a sustainable financial model for undergraduate teaching support staff, teaching lab equipment, and spaces. An engineering program fee would be a good start, as would state investment in educational support staff.

- Relative to our peer departments, our building is also outdated and not suited to our current needs. As it stands currently, only 64% of the building's gross area is usable space, due to poor architectural choices dating back to the building's design in the late 1990s. No significant updates have been made since then. Students consistently request additional space for meetings, tutoring sessions, and student-run engineering clubs. Our capstone projects, student-run engineering clubs, and even some scheduled courses are forced to use our hallways to perform lab work due to the lack of suitable spaces.

- UW ECE should realize that embracing diversity, equity and inclusion is a fundamental challenge in our field, and lead a national effort by reimagining our curriculum, hiring practices, and mentorship programs. Hiring faculty and developing course sequences in engineering education, and providing training and assessment support to our current faculty, are clear next steps.

This report describes the current state of the Department and its current trajectory. We discuss our culture, research, education, DEI program, organization, as well as our Department's finances and overall health. The report then returns to the above points in the "Unit-defined Questions" section, expanding upon each to give a clear picture of where we believe we should be headed over the next 10 years.

PART A: REQUIRED BACKGROUND INFORMATION

1. OVERVIEW OF THE ORGANIZATION

1.1 Mission

UW ECE leverages the vitality of the Pacific Northwest, striving to create an inclusive, diverse, innovative, and creative space to learn and perform research with truly international impact. We take our responsibility to humanity seriously, and are driven to develop beautiful, inclusive and impactful technologies that contribute to society both economically and socially. UW ECE faculty and students conduct research in all the traditional areas of ECE as well as in new and emerging fields. Building on the ubiquity of ECE technology, we take leadership roles in multidisciplinary centers around the UW campus and across the nation. Our research activities are translated into cutting-edge educational offerings in our undergraduate, graduate, and professional programs. We are leaders in entrepreneurship, collaborating with and contributing to the rich and deep technology scene in the Pacific Northwest.

1.2 Culture

A key strength of UW ECE is our culture of interdisciplinary collaboration, leadership, and mentorship. We take an extremely intentional approach to these aspects of our culture. Interdisciplinary collaboration is encouraged through co-advised students, seed grants for new initiatives, and support for our faculty and students to lead or participate in the UW and regional centers. Leadership is cultivated at all levels through workshops, progressive service roles, and other incentives. And mentorship is not only encouraged through activities such as our monthly assistant professor workshops, it is also actively tracked, discussed, and taught at a variety of levels. The result is a group of outstanding faculty, staff, and students who support each other, are continually improving, and who have created an outstanding environment for creativity, inclusivity, and overall excellence.

1.3 Role of ECE in the University

UW ECE plays a central role at the UW and within the College of Engineering. With 47 tenure track faculty members, 5 teaching professors, 32 staff, more than 1,000 students, and $20M to $25M in annual research expenditures, we are the second largest department in the College, after the Paul G. Allen School of Computer Science & Engineering. We support a broad range of research and teaching efforts ranging from traditional areas of ECE such as circuits and signal processing, to cutting-edge areas such as quantum information science, brain-computer interfaces, and sustainable energy systems. Many of these areas cut across the entire University, with our faculty taking leadership roles in multi-department centers such as QuantumX, the UW+Amazon Science Hub, The Center for Neurotechnology, the Clean Energy Institute, and several NSF-funded AI/ML institutes. Furthermore, many of our 47 tenure-track faculty members have joint (voting) appointments in other departments including the Allen School, Physics, Bioengineering, Applied Math, and Rehabilitative Medicine (resulting in a net of 37 FTEs in ECE). Our students benefit not only from strong core ECE courses, but also from cross-listed courses in computer engineering, control and robotics, biotechnology, and quantum technology.

1.4 History

UW ECE was founded in 1905 as the University's Electrical Engineering Department. Over the decades, our faculty have been involved in developing many revolutionary technologies, such as the transistor, microchip, deep neural networks, brain-computer interfaces, and quantum computers. Our Department has also contributed considerably to the foundation of two other departments: Computer Science and Engineering (now the Allen School) in 1974 and Bioengineering in the 1980s. In 2018, after many years of negotiations, the Department name was changed from "Department of Electrical Engineering" to "Department of Electrical & Computer Engineering" to better reflect the breadth of its educational offerings and research activities and acknowledge that engineering computers in their many forms is a core aspect of what electrical engineers do.

The Department manages several degree programs. In addition to our undergraduate, Ph.D. and MSEE degrees, we

launched a Professional Master's Program in 2008. In 2022, the Department introduced the BSECE degree that will fully replace its BSEE degree by 2025. While the courses offered as part of the two degrees are mostly the same, the requirements for the new degree are substantially more flexible to increase accessibility and to allow students to tailor the program to their interests.

Today, the Department is young. 29 of our 47 tenure-track faculty members were hired within the last 10 years. Twelve of our professors are at the assistant level. The number of teaching professors has grown from two to five. After significant upheaval during the pandemic, almost 75% of our staff were hired in the last three years.

1.5 Organization and Governance (details in Appendix)

Faculty

Many of our 47 tenure-track faculty are joint with other departments, and thus the Department has 37 net FTE at the tenure-track level. We have five open tenure-track positions to be filled in the 2024-25 Academic Year. UW ECE has five teaching professors, with four of them teaching full time for the Department, and one teaching in a different unit. Details about faculty ranks, disciplines, and recent hires are found in Appendix C.

The Department is led by the Department Chair (Klavins), the Associate Chair for Research (Li), the Associate Chair for Education (Arabshahi), the Undergraduate Program Coordinator (Lin), the Ph.D. Coordinator (Anantram), the MSEE Coordinator (Hauck), the Associate Chair for DEI (Wilson), and the Associate Chair for Professional Programs (Smith). Together, this group forms the Executive Committee for the Department. A number of other service roles are defined as well, with almost all faculty serving in some capacity. Committees include: Hiring, Core Curriculum, Electives, Graduate Curriculum, Computing, Space, Building Safety, and Competitiveness and Public Relations. Additional service roles include representation on the Faculty Senate, College Council, College Promotion and Tenure Committee, and the College Council on Educational Policy.

Staff

The ECE Department currently employs 32 staff members, broadly grouped into teams led by the department administrator. Details on the organizational structure and staff leadership can be found in Appendix A. The staff groups consist of Facilities, Advising, Events & PR, Chairs Office, HR, Department IT and Fiscal. Select staff members are invited to participate in ECE Department Committees. Over the last five years, the Department has seen significant staffing turnover, with nearly one-third (10) staff members joining the Department in 2023. Rapid staffing turnover has led to opportunities for restructuring teams, allowing us to address staff morale, team functionality, and overall support for faculty and students.

Advising Staff

UW ECE Advising is led by the Director of Academic Services (daytime programs) and a Director of Industry and Professional Programs. The Director of Academic Services (daytime) supervises two lead advisers (graduate programs and undergraduate programs). The Director of PMP supervises one Assistant Director. As both programs grow, the level of managing up and delegating has become more complex for all these roles. At this time, a restructuring of Advising is being discussed with the two Directors and the Administrator. We have recently hired two student peer advisers for mentoring students who are currently being trained.

Our Advising team is currently seeking a staff member for the role of Undergraduate Program Coordinator (UPC). Currently the many tasks of the UPC, many of which are time consuming, such as handling the time schedule, are distributed to other team members. Our Department has grown tremendously in the last five years, in the number of both faculty members and students. Continuing such an arrangement is becoming unsustainable.

External Advisory Board

UW ECE maintains an external advisory board, which currently consists of 13 members, most of whom are alumni, and many of whom represent our industry partners, including Micron, Boeing, Apple, Intel, T-Mobile, Amazon, and NASA JPL. Typical programming for our advisory board is a once yearly in-person meeting along with occasional touch points on specific topics, such as curriculum changes.

Student Advisory Council

The UW ECE Student Advisory Council (SAC) consists of approximately 10 students representing all of our degree programs. The SAC meets at least quarterly with the department leadership. Their main responsibility is to run one or

two town hall meetings each academic year to collect feedback from students on all aspects of the student experience. The council then prepares a report and a presentation for the leadership. The SAC is also involved in various events, such as our end-of-the-year barbecue and student orientations, with the goal of making relationships with as many students as possible to better represent our student body.

1.6 Relationship of ECE to COE

According to U.S. News & World Report, the Department's graduate program in ECE is ranked 16th in the country and is the third highest-ranked engineering department at the UW, after the Paul G. Allen School for Computer Science & Engineering and Bioengineering. Our size, research expenditures, and general operating fund are the largest after the Allen School (which is arguably not an engineering department). UW ECE offers the most popular engineering degree at the UW, graduating approximately 250 BS students per year. Most of those students enter the college as freshmen through the Direct to College (DTC) program, which started in 2018. After a year, they apply for admission to a department, and those that get in start with us in their sophomore year. We also admit transfer students from many community colleges and interest changers from the UW who were not admitted into DTC as freshmen. However, with the growth of the DTC program, we have fewer slots available for such students, which we see as unfortunate as many of our best and most diverse students have come from these directions.

UW ECE is one of the oldest departments in the college at 118 years. We thus have a substantial alumni population that is actively involved in supporting our department through donations and other activities such as speaking and industry mentorship. In the last 10 years, with the help of the College, we have grown our alumni outreach efforts and have gone from just one endowed professorship to seven, have added a number of new endowed scholarships and fellowships, and generally grown the ECE Excellence fund. These advancement efforts must continue for UW ECE to begin to approach the endowment levels enjoyed by many of our peers. Recently, the college has reoriented their Advancement team toward raising funding for the new Undergraduate Interdisciplinary Engineering Building, and they have seen several departures. We are hopeful that when the building funding is settled and new advancement officers have been hired, our advancement effort will continue to thrive.

The College of Engineering's Industry Sponsored Capstone program was started in ECE. Last year, we had more than 50 industry sponsored projects, which is over half of the entire College's capstone program. The College has been a great ally in supporting this program as well as other industry relationships through their corporate and foundation relations team. As a result, UW ECE has strong relationships with a variety of industry partners, including Amazon, Meta, Microsoft, Boeing, Intel, Micron, and many others.

1.7 Unusual Characteristics

For historical reasons, the Department is authorized to offer bachelor's degrees in Electrical Engineering and in Electrical and Computer Engineering, but not in Computer Engineering. The Computer Engineering degree is offered and managed by the Allen School, even though the ECE department teaches many of the courses required for this degree.

As a department heavily engaged in foundational research and teaching in computation and data science, UW ECE is often mistaken for the Allen School externally and internally. We commonly experience that the Allen School – a considerable force on campus with twice as many faculty, students and even buildings as ECE – dominates most discussions about anything related to computation and data science at the University and state levels.

1.8 Budget and Funding

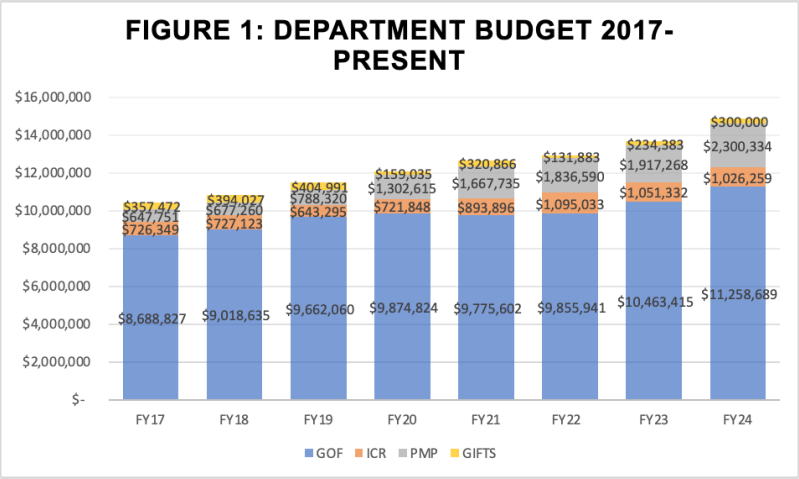
1.8.1 Department Budget Summary

Teaching activities and overall Department operations are funded primarily by the following sources:

- General Operating Funds (GOF)
- Indirect Cost Returns (ICR)
- Revenue from the self-sustaining Professional Master's Program (PMP)

Figure 1 shows the ECE Core Teaching and Operating budget from 2017 to present, with the majority of the budget allocated to faculty, TA and staff salaries, representing approximately 90% of the total budget expenditures.

[1] The Allen School of Computer Science and Engineering offers a small computer engineering degree, but its more popular computer science degree is contained within the College of Arts and Sciences.

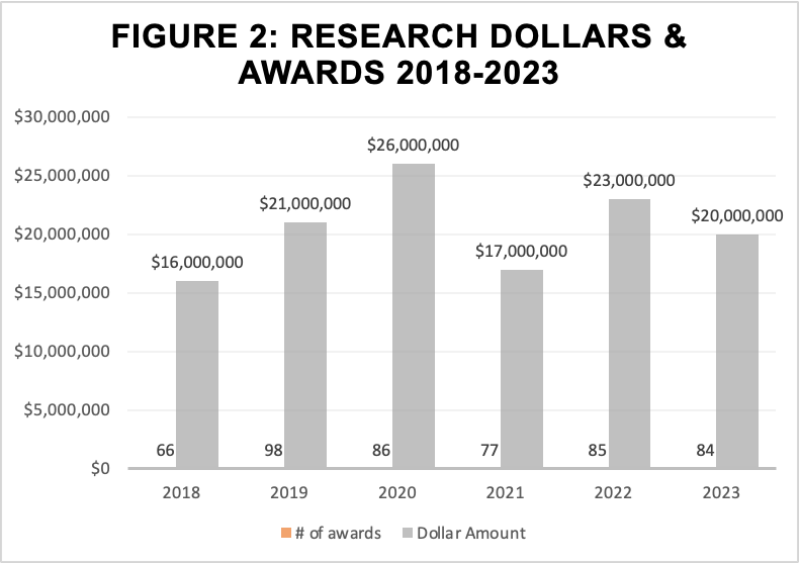


As Figure 1 shows, the total teaching and operations budget has increased from $10.8M to $13.6M between 2018 and 2023. We anticipate our total FY2024 budget to be $14.6M with the recent net PMP revenue returns. Part of the annual budget increase has been from additional state funds in the form of legislative proviso funding to increase undergraduate degree production as well as an increase in the indirect cost returns to the department from research grants. The primary and most significant source of budget growth, however, has been revenue from our Professional Master's Program.

As Figure 1 shows, the self-sustaining PMP net revenue has increased by nearly 340% from $647,751 in Fiscal Year 2017 to $2,300,334 revenue in the present Fiscal Year 2024 (June 2023 – July 2024.) Historically, PMP net revenue funds have been used to offset department operating deficits during years where the annual GOF and ICR budget allocations did not cover the total expenditures. In more recent years, due mostly in part to staff and faculty departures as well as the growth in PMP, the ECE department has accumulated more funding reserves. Department reserves have been used recently to cover new department initiatives mainly focused on renovations to the building, instructional labs, and capstone spaces. The careful accumulation of revenue in recent years (2021–present) has been a catalyst for department growth and has allowed the department to recruit new faculty positions.

Over the last several years there have been approximately one to two faculty departures or retirements each year. Refilling vacant faculty lines takes a significant amount of resources from the ECE Department to provide a startup package along with potential space and lab renovations that are also covered by department funds. Startup commitments will have the biggest impact on overall budget health over the next five to 10 years. Leveraging PMP revenue, along with identifying potential new streams of revenue to cover the increase in startup packages over time, will be essential for ensuring a sustainable financial plan over the next 10 years.

1.8.2 Research Awards and Expenditures



The increase of faculty hired over the last several years has directly impacted the amount of ECE research funding. From 2018 to 2023, the ECE Department's research dollars increased by 25%.

As Figure 2 shows, the number of research awards per year increased by 27% from 66 awards in 2018 to 84 awards in 2023. The total number of research dollars also increased by 25% from approximately $16M in 2018 to $20M awarded in 2023.

1.8.3 Fellowships, Scholarships, Professorships

The ECE department actively participates in fundraising activities to specifically support the increase of student fellowships, scholarships, and endowed Professorships. Current ECE endowments include:

- Faculty Endowed Professorships: 7 funds totaling $8,000,000
- Graduate Student Fellowships: 12 funds totaling $670,082
- Undergraduate Student Scholarships: 28 funds totaling $143,089

1.9 Space

Most of the Department is located in the ECE building and the CSE building. The Department also occupies some individual rooms in a few other locations on campus, such as the Nanoengineering & Sciences Building and the Molecular Engineering & Sciences Building. While the ECE building has a gross area of 273,295 square feet, only 175,627 square feet is usable area. As it stands currently, only 64% of the building's gross area is usable space, due to poor architectural choices dating back to the building's design in the late 1990s. No significant updates have been made since then. For example, several floors on the north side of the building are divided into very small rooms, many of which have no windows. Most of the building (not counting the space managed by classroom services) is dedicated to research activities, office space, and teaching labs. Students consistently request additional space for meetings, tutoring sessions, and student-run engineering clubs. Our capstone projects, student-run engineering clubs, and even some scheduled courses are forced to use our hallways to perform lab work due to the lack of suitable spaces for these activities.

After ECE's last 10-year review in 2012, we commissioned a thorough Space Study (included in the Appendix), which concluded that the ECE building suffers from an excess of unusable, compartmentalized, opaque, and uncomfortable spaces making our building non-conducive to interaction and collaboration. The study included a number of suggestions that – given our growth – are even more relevant today. These include: removing walls and partitions separating small spaces, reducing corridor width so that it can be absorbed into lab spaces, putting in windowed or glass doors, improved lighting, restructuring entrances and stairways. We believe a renovation along these lines is well overdue. Especially given the amount of wasted space in the building, a modest investment by the UW into the ECE building would translate into a very cost effective increase in usable space and would have a massive impact on the health of our Department.

1.10 Faculty Hiring

In 2021, UW ECE revamped its faculty hiring process to incorporate best practices in diversity, equity and inclusion, moving away from a more traditional, research-area focused committee structure. In the new model, the hiring committee represents the good of the Department as a whole, screening applicants for leadership, DEI activities, and teaching excellence. Faculty, in groups or individually, screen applicants for research quality and strategic fit, sending short-lists to the committee. The committee takes the intersection of their list and the faculty lists to create a list of pre-interview candidates. The College of Engineering vets the resulting list with a DEI lens. After making any requested changes, the committee conducts pre-interviews with each candidate that include at least one committee member and one faculty expert, usually outside the committee. Based on the pre-interviews, the committee determines whom to invite for full interviews. The full interview process is standardized and evaluation of the candidates follows an agreed-upon rubric. The hiring committee includes a student representative, and students are engaged in the interview process and report their findings to the faculty before voting. Using this new process we have successfully hired eight new tenure-track and two teaching faculty. Faculty hiring continues to be a major focus of the Department. The College approved four assistant and one associate level positions for AY 23-24.

1.11 Academic Unit DEI

Electrical and computer engineers make up over 350,000 and nearly 17% of the approximately 2.1 million working engineers (excluding software engineers) in the U.S (**https://swe.org/research/2023/employment/**). With the CHIPS act, this number is likely to increase by two to three times. Of all the major engineering professions, electrical and mechanical engineering are the most male dominated, with only 9-10% of working engineers identifying as female. Black, Native American, Hispanic and other racial and ethnic minorities as well as students from lower socioeconomic backgrounds and first-generation college students are also underrepresented. Thus, it is an important goal to increase the racial, ethnic, and socioeconomic diversity of UW ECE. Doing so benefits everyone by increasing the breadth of ideas and experiences and role models that all students are exposed to. Such diversity is also clearly correlated to greater productivity and by extension, better learning outcomes.

In this section we describe some of the programs we have in place to improve DEI in UW ECE. However, we would like to stress that we do not believe these programs to be enough. In Section B of this document under "Unit Defined Questions," we describe steps we would like to take to more comprehensively address our DEI goals.

DEI Infrastructure

Associate Chair and Committee for DEI: In 2020, UW ECE created the Associate Chair for DEI position, which is now occupied by Professor Denise Wilson. She chairs a DEI committee that includes faculty, staff and students. Together, they have initiated a number of new programs and sustained several others.

Small Grants: Each year, UW ECE welcomes proposals for new DEI Initiatives in four major areas: (a) collaborations with MSIs (minority-serving institutions); (b) enhancing and strengthening civility and community; (c) understanding DEI issues within ECE; and (d) raising awareness of contemporary DEI issues. Proposals with budgets of up to $5,000 and up to one year in duration can be submitted to the ECE DEI Committee annually.

Raising awareness of challenges to diversity, equity, and inclusion in ECE

Sex, Gender and Engineering Course: A new undergraduate course called "Sex, Gender and Engineering" was taught for the first time with 50 students by professor Denise Wilson in the Spring of 2023. The course explores professional issues faced by women as well as sexual and gender minorities (LGBTQ+) in the engineering workplace and in school. It is based on a book of that title, co-authored by Professor Wilson, which is arguably the most comprehensive academic text on the subject.

ECE DEI Book Club: The DEI Book Club, established in the summer quarter of 2022, is open to UW ECE doctoral students, faculty and staff who are passionate about creating inclusive and intentional spaces for historically underrepresented people in the field of electrical and computer engineering. The Club meets once a quarter to discuss a contemporary book that explores issues of diversity, equity, inclusion and justice. The Book Club meets at least once during the quarter to discuss each book and to explore how to apply it to work, studies and to UW ECE as a whole.

Building strong, inclusive community

Assistant Professor Mentorship: The chair's office runs a new assistant professorship mentorship program that consists of the following four components: (1) monthly group meetings with the chair and all assistant professors to discuss aspects of being a professor. (2) Two assigned mentors for each assistant faculty involving at least one confidential meeting per quarter. (3) A mentorship pool for common challenges. (4) regular mentorship exercises in faculty meetings.

Womxn at the Forefront of ECE Research (WAFER): This is a **workshop** run by UW ECE graduate students in which women and nonbinary researchers and engineers present their research and experiences. The event aims to cultivate an inclusive environment for participants and speakers alike to share and learn more about research in ECE, hear others' experiences in the field (at different stages of their careers), acquire strategies to address equity and inclusivity issues, and to ultimately leave the event feeling inspired and empowered to pursue a career in ECE or other tech-related fields.

Student-led DEI Programs: These events include coffee chats focusing on research diversity and DEI-related issues, an annual larger DEI event to raise awareness of contemporary DEI issues, allocation of space for larger groups of students to practice presentations and engage across research labs, and similar gatherings that build diversity and inclusion broadly across the entire student population in UW ECE.

Addressing equity issues

ECE Student Emergency Support Fund: This fund serves as an avenue of financial support for UW ECE students experiencing severe financial hardship. Students may submit requests for unexpected situations, such as health care costs, car repairs, legal fees, travel for family emergencies, stolen goods, and housing and food insecurity. The fund launched in autumn 2022 and is led by Whitney Thomas, Senior Academic Counselor for Undergraduate Programs.

ECE Student DEI Conference Travel Awards: ECE students (both undergraduate and graduate) who are planning or seeking to attend conferences that focus on underrepresented groups in engineering (Society of Women Engineers, Society Hispanic Professional Engineers, etc.) are encouraged to apply for travel assistance from the DEI travel award program. Students who are presenting DEI-related papers at or planning to attend substantive DEI activities at other conferences within ECE fields are also encouraged to apply for travel awards. This initiative is led by Stephanie Swanson, Director of Academic Services in UW ECE.

Building understanding for future DEI efforts

Engineering CAReS Workplace Study: The Competence, Autonomy, Relatedness Survey (CAReS) project seeks to understand how well basic psychological needs of working engineers are met in the engineering workplace. Funds provided by UW ECE support incentives to complete the survey associated with the study. In contrast to a majority of workplace surveys that emphasize barriers hindering the advancement of working engineers, the CAReS project focuses on met, unmet and thwarted needs at work. Diving deeper into underlying needs opens up a broader array of potential strategies to build belonging, persistence and productivity in the engineering workplace, especially for those who are underrepresented in engineering disciplines.

2. TEACHING AND LEARNING

2.1 Undergraduate Admissions

In planning for a graduation rate of 250 undergraduate students per year from our combined BSEE and BSECE degree programs, the department projects having approximately 280 students enter the program each year. Of those 280, approximately, 190 (75% of our 250 target graduation rate) enter through the Direct to College (DTC) placement process as sophomores after having spent their freshman year as Engineering Undeclared (ENGRUD) students in the College of Engineering, and approximately 90 students enter as juniors (entering during their third year of college) through a department-run admissions process for transfer students and UW students changing majors, who are known as "interest changers."

Of the approximately 90 students entering through the department-run admissions process (i.e., not DTC), the Department works to fulfill the desire of the College to have in-state transfer students comprise around 25% of each graduating class, amounting to approximately 63 students the Department intends to admit each admissions cycle. This leaves approximately 27 seats to be filled by either UW interest changers or other transfer students.

The resulting desired breakdown would roughly be as follows:

- 190 DTC Students (entering in their second year)
- 63 Washington State Residents Transfer Students
- 27 UW Interest Changers or Other Transfer Students
- TOTAL: 280 (with a hope to have 250 staying in the program through graduation)

The ratios will change from year to year, but the Department works to achieve those numbers as long as they can be fulfilled by qualified applicants who the Department believes can successfully complete the program.

Data on success rates for these various cohorts is still to be determined. With the first DTC placement entering in Autumn 2019, academic success of those and following DTC students, as well as the other students joining the program at the same time is likely distorted by factors related to many quarters of remote and hybrid learning required during the COVID epidemic.

FIGURE 3: NUMBER OF APPLICANTS - ALL DEGREE PROGRAMS 2014-2023

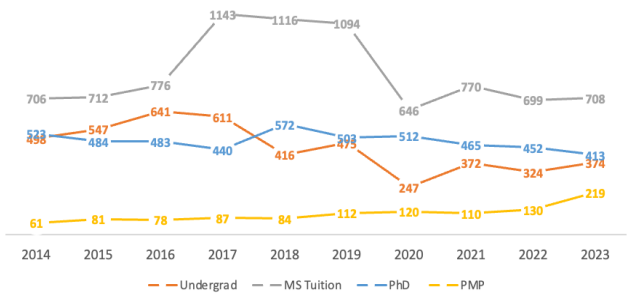
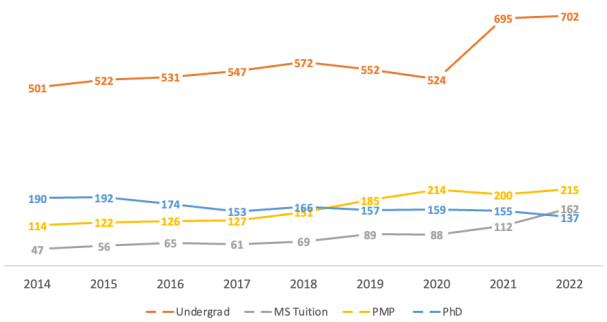
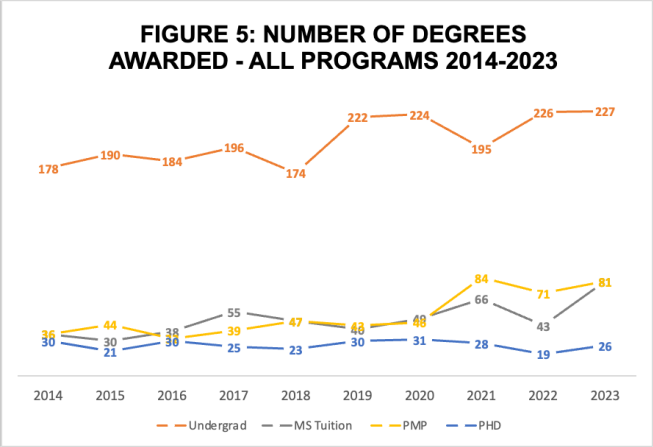


FIGURE 4: STUDENT ENROLLMENT - ALL PROGRAMS 2014-2022 AUTUMN QUARTER





Compared to other UW engineering departments, ECE's attractiveness to new students has improved, with growing numbers of DTC students requesting ECE as their first choice over the past couple of cycles. For example, of the 180 students placed in the Department through the Summer 2022 process, 161 had selected ECE as their first choice. This trend is probably the result of changes: the addition of the new Electrical and Computer Engineering degree which will soon fully replace the Electrical Engineering degree, and the decision of the Allen School to no longer take part in the DTC process, thereby removing Computer Engineering as an option for DTC students. The combination of these factors appears to have led to more DTC students choosing ECE as their first choice than will be placed in the department for the first time. Detailed data about the DTC placement process can be found at: https://www.engr.washington.edu/current/placement/data.

2.2. The New ECE Degree

In 2022, the Department introduced a new BEng degree in Electrical and Computer Engineering to replace our existing BEng degree in Electrical Engineering. While one of the motivations for introducing this new degree was to offer a degree that aligned with the new name of the Department and that reflected the full scope of its activities. Its design started with an in-depth study of how we could better serve our undergraduate students. In particular, we consulted our industry and outside academic advisers; studied similar programs at peer institutions (Berkeley, Michigan, Wisconsin, USC, UCSD, …); interviewed department chairs and advisers at these institutions; surveyed our current students; and leveraged the experience of our advising staff and faculty. Based on the information we gathered, we concluded that the structure of this new degree should be guided by the following principles:

Flexibility: Once they have mastered the fundamentals of electrical and computer engineering, our students should be able to choose whether to specialize in one of its many subfields or explore multiple areas.

Adaptability: Our ability to introduce new, advanced topics to reflect rapid changes in technology should not be unduly constrained by obsolescent degree requirements.

Inclusivity: About one third of our graduates start their higher education at a community college and many of them are from underrepresented minorities or are the first in their family to go to college. We want these students to have the same opportunities as the students admitted to our program through the Direct to College (DTC) route. Our new requirements make it easier for them to complete their degree in four years.

Efficiency: The structure of the degree should not force the Department to devote its limited resources to the teaching of classes with a low enrollment.

Guided by these principles, we concluded that to obtain an ECE degree, our students should complete the following requirements:

- 89 quarter credits of mathematics, sciences, and general education.
- 21 quarter credits of core material from electrical and computer engineering.
- 9 quarter credits of computer programming.
- 4 quarter credits of advanced technical communication.
- 36 quarter credits of 300 or 400 level ECE courses, with a minimum of 20 credits at the 400 level.
- Either the ENGINE capstone or one of the specialized capstones offered by the Department.

To help our students navigate the wide variety of advanced courses that we offer, we have defined 12 "pathways", which are ***suggested*** and flexible sets of courses that prepare students for a career in a specialized area. In addition to a list of advanced courses, each pathway describes potential career paths as well as complementary opportunities. Our current list of pathways (described in detail on our **webpage**) includes Computer Architecture, Computing, Control Systems, Embedded Systems, Machine Learning, Microelectronics and Nanotechnology, Neurotechnology, Photonics, Sensing and Communication, Sustainable Energy,VLSI, and Quantum Technologies. Students can select

one pathway, or combine courses from multiple pathways for a custom path through the BSECE degree program.

2.3 ENGINE Capstone

A distinctive feature of our undergraduate curriculum is the Engineering Entrepreneurial Capstone program (ENGINE) that we introduced in AY 2015-16. The program provides a unique opportunity for students to develop skills in collaborative systems engineering, project management, and most importantly, working in teams on real-world problems from industry-sponsored projects. The program is overseen by UW ECE faculty and students are guided by practicing engineers. The course culminates in a showcase of student projects, which is attended by industry sponsors and held at the end of spring quarter every year.

2.4 Service Courses

ECE offers the following service courses: **EE 205: Introduction to Signal Conditioning**, which is required for students from the Paul G. Allen School of Computer Science & Engineering who pursue the computer engineering degree. It is offered once per year; **EE 215: Fundamentals of Electrical Engineering**, which is essentially the first course on electric circuits. It is required for all ECE students as well as for all Mechanical Engineering and Industrial and Systems Engineering students. It is offered four times a year.

2.5 BS-MS Program

The Department offers a combined BS-MS (Bachelor of Science – Master of Science) program for top undergraduate students who plan to pursue graduate studies. With the Combined BS-MS program, students seamlessly transition from their undergraduate education into graduate education. Students begin the two-step application process in the summer between their junior and senior year and officially start in the Master of Science in Electrical Engineering (MSEE) program in the autumn quarter following completion of their bachelor's degree.

This program allows highly qualified students to start taking classes that count toward their graduate degree during their senior year. To be eligible for this program, students must have a GPA of at least 3.6. It also gives them peace of mind in knowing that they have been accepted to a top-ranked MSEE program much before they would hear if they applied through the traditional route. Finally, it makes it possible for students to carry on the research and educational relationships they have established with UW faculty.

2.6 Daytime Master's of Science Degree

The Daytime Master's Program (MSEE) provides advanced preparation for professional practice through a highly customizable, coursework-based, or thesis curriculum. The coursework option is typically selected by students who want to work at a higher level in industry, while the thesis option, which involves more in-depth research, is designed for students with a passion for pursuing a doctoral degree. A bachelor's degree in electrical engineering is not required for admission but students are expected to have a strong background in math, science, and programming.

2.7 Ph.D. Program

Our Ph.D. program produces graduates who are highly sought after by industry, national laboratories and academic institutions. Our students do cutting-edge research in all areas of electrical and computer engineering, as well as interdisciplinary work involving biology, neuroscience, and physics. They win a variety of best paper awards, prestigious fellowships, and dissertation awards. Recent graduates have obtained tenure-track positions at institutions such as Stanford, Rice, Cornell, Columbia, UCSD, and Johns Hopkins.

Each research area of the department selects a faculty member who does a preliminary review of all the applications for Ph.D. studies. This area chair screens these applications and assigns two faculty members to review those that are deemed viable. Research groups then huddle and agree on which students should be offered admissions. The area chairs working as the admissions committee review these recommendations and make final decisions on admissions. To attract top potential Ph.D. students, the Department guarantees four years of financial support in the form of fellowships, research assistantships, or teaching assistantships.

The Ph.D. coursework requirements involve both a depth requirement and a breadth requirement, satisfied by taking a variety of courses inside and outside of the student's specialty area. Among other reasons, the breadth requirement is perceived as helping foster interactions between researchers working in different research areas. In addition, three examinations are required for the Ph.D. program: A qualifying exam, a general exam, and the final thesis defense.

All Ph.D. students are reviewed quarterly for satisfactory progress based on the department's policy applicable to all graduate students and the additional requirements for Ph.D. students. In addition, Ph.D. students engage in an annual review during spring quarter with their faculty research adviser(s), the Graduate Program Coordinator (GPC) and/or Review of Progress Lead Faculty. The goal of this review is to assess progress toward their degree, including academic and research progress, milestones (Qualifying, General and Final Exam), awards, publications, Academic Student Employment (ASE) performance, and future goals. If a student is determined to have not made adequate progress toward their degree in the spring review, a warning letter or probation letter may be emailed to student, and a follow-up review takes place in autumn quarter.

Ph.D. students are given priority to serve as teaching assistants. Occasionally, senior Ph.D. students are put in charge of an entire course. In such cases, they become the instructor of record for this course, which is an extremely valuable addition to the CV of students who intend to pursue an academic career. To foster community within our graduate students, the department organizes biweekly grad student socials with beer and pizza.

2.8 Professional Master's Program

For the last 15 years, the Department has offered a fee-based Professional Master's Program leading to the same Master's degree as the conventional tuition-based MS program. While this evening program was originally intended for working professionals who want to pursue a degree part-time, admissions in recent years has been extended to full-time students. The current enrollment in the program consists of about 40% working professionals and 60% full-time students. About 90% of the full-time students are international on an F1 student visa. We believe that there is a huge unmet demand for this program and, while we don't feel capacity constrained, we are carefully managing its growth.

The program is also part of a partnership with the UW School of Law which offers a JD/MSEE concurrent degree. This program provides comprehensive education to students who seek to work at the intersection of electrical and computer engineering and law. The program format allows concurrent degree students to complete their law coursework during the day and ECE coursework in the evening.

To keep this program flexible, the curriculum avoids prerequisite chains as much as possible. Many of the courses focus on topics of great current interest to industry, in particular machine learning, cybersecurity, green energy, and autonomous vehicles. About 50% of the courses are taught by full-time faculty members from the Department and the rest by specialists from industry. While the PMP is intended to be coursework only, some of the enrolled students are interested in research and obtain independent study credits by working under the supervision of a faculty adviser. Some of these students end up applying to the Ph.D. program.

2.9 Graduate Data Science Option

The **Data Science Option** equips graduate students to tackle modern engineering challenges using large datasets, machine learning, statistical inference and visualization techniques. Building on ECE fundamentals of statistical signal processing and controls, the ECE DSO provides students with a strong foundation in the field of data science, developing critical knowledge and skills to apply a variety of modern data analysis techniques and tools to advance and accelerate ECE research and applications. This option is intended for students with little or no background in data science, computer science or codingand is based on a framework developed by the University of Washington **eScience Institute.**

2.10 Professional Certificates

Through the office of Professional and Continuing Education, the Department offers **short courses** and three certificates in **GPU-Accelerated Computing & Visualization**, **Machine Learning & Deep-Learning**; and **Applied Cybersecurity Engineering.**

2.11 Graduate School Certificates

The UW College of Engineering is developing an interdepartmental program of graduate school certificates. Under this program, students will be able to "stack" certificates offered by various engineering departments to obtain an interdisciplinary Master's Degree in Engineering. The ECE Department has not yet decided whether to take part in this program.

2.12 Postdoctoral Training

Postdoctoral training in ECE has grown in importance over the past decade, both in traditional ECE technical areas (e.g. circuits) where students on the academic path have pursued postdoctoral training to increase their competitiveness in the faculty hiring process, as well as emerging growth areas for ECE (e.g. data science, biomedical devices, quantum systems). In many of the latter areas, where many of our faculty have joint or adjunct appointments in other departments (physics, bio, math, etc.) postdoctoral training has long been the norm even for those not seeking a tenure-track position, so we expect that the demand for postdoctoral training will continue to increase in the coming years, especially in those areas.

The Department currently hosts 25 postdoctoral associates in technical areas including optical systems, biomedical devices, synthetic biology, cyber-physical systems, and energy systems. Postdoctoral mentees supported by NSF funding have a formal mentoring program in place. The Department does not currently require a formal mentoring program for postdoctoral trainees supported by other funding sources.

2.13 Teaching Infrastructure

Our main instructional lab (ECE 137) has recently been updated with newly donated equipment and newly purchased furniture. The labs for capstone projects (ECE 165 and ECE 159) are going through a major revamp, starting with some equipment, new furniture and storage. A couple of smaller instructional labs house specialized equipment, such as network analyzers. In terms of specialized instructional labs, currently we have **ECE 345: Digital Design Computing Lab** and **ECE 351: Imaging Computing Lab** for use by students enrolled in specific courses. ECE B053 is used for teaching power systems and robotics. Our students also have access to general-purpose computing labs. ECE 347 and ECE 351 house 35 Linux workstations, while ECE 361 and ECE 365 house 36 Windows computers and multiple docking stations for student laptops.

ECE is home to the Quantum Technologies Training and Testbed (QT(3)) lab, which is a unique combined teaching and user facility which performs research, develops instructional labs and provides state-of-the-art characterization tools for quantum information science and engineering. The mission of the lab is to provide hands-on access to quantum technology hardware to accelerate both research and training in this growing field. This lab is closely linked with the research activities of UW QuantumX and the NSF IMOD STC and their members. QT(3) lab's facilities can be used for teaching labs, capstone projects and undergraduate research.

Although these resources are substantial, and we have been able to make some incremental progress, they do not entirely meet the needs of our rapidly growing undergraduate population. We currently lack a sustainable financial model for growing our teaching infrastructure (both facilities and teaching staff). Additionally, we do not currently have a semiconductor fabrication experience for undergraduates. These issues are discussed in more detail in Part B under "Unit Defined Questions."

3. SCHOLARLY IMPACT

3.1 Theme, Plan, Strategy

Scholarship in the Department covers a broad area and has diversified beyond traditional electrical engineering topics. In particular, the Department is strong in quantum, optics, sustainable energy, robotics, neurotechnology and machine learning. The areas of expertise of faculty hired since 2021 underline this strategy:

- Serena Eley: superconductor physics, integrated quantum systems
- Akshay Gadre: wireless systems, mobile communications, cyber-physical systems
- Kim Ingraham: human mobility using assistive robotic devices
- Ang Li: interplay between classic and emerging computing technologies
- June Lukuyu: electrification in sub-saharan Africa
- Sara Mouradian: robust and scalable quantum systems for computing, communication, and sensing
- Hossein Naghavi: design of mm-wave and terahertz integrated circuits
- Rahul Trivedi: quantum information theory and quantum complexity theory

Since we share the word "computer" with the Paul G. Allen School of Computer Science & Engineering, it is important to discuss how we distinguish our activities from theirs and how we view this as a healthy dynamic. In short, we view ECE as being "closer to the metal" than CSE, meaning we are harnessing the laws of physics to create completely new computing, communication, and control systems. On the other hand, CSE is more focused on theory and software. Where CSE ventures into hardware, it is more on the high-level integration side for robotics, and distributed

[2]Additional information about Student Learning Goals and Outcomes can be found in Appendix M.

systems. Quantum Information Science and Technology, or QIST, is a good example of this distinction. The ECE faculty members working in QIST (Mouradian, Eley, Trivedi, Fu, Li, Majumdar, and Anantram) focus mostly on the hardware side, or low-level control of quantum systems. By contrast, CSE recently hired two theorists who mainly study computational complexity of quantum algorithms and associated problems. Nevertheless, there is overlap between the two departments and we have six faculty members with joint appointments who mostly work in the area of computer engineering, broadly construed. Both departments have activities in machine learning, but the focus in ECE is more about signals, controls, optimization, and applications.

The CHIPS Act represents a major opportunity for the Department, but one that will require significant investments. In 2023 we hired two faculty members with relevant expertise (H. Naghavi and A. Li) and we plan to hire more in 2023-24. We believe that we can leverage our strength in QIST and in artificial intelligence to take advantage of the opportunities offered by the CHIPS Act.

Research in the Department is also highly collaborative. ECE faculty lead several interdisciplinary research centers and institutes, which are listed later in this document. ECE faculty members also have strong research collaborations with colleagues in the medical school and neuroscience for work on brain-computer interfaces, exoskeletons and other biorobotics, and medical devices.

Many household-name companies from the Pacific Northwest, such as Meta, Microsoft, Google, and Boeing hire our graduates. This represents an opportunity for us to develop stronger connections with these companies. We maintain and enrich these connections through an ECE-specific career fair and by increasing the involvement of these companies in our ENGINE capstone.

3.2 Awards and Recognition

Awards for faculty are listed in Appendix C, Information about Faculty.

3.3 Impact of Research and Creative Work

At UW ECE, we cultivate innovation and inspire through high-impact research. We educate and develop tomorrow's leaders to solve the world's most pressing challenges. UW ECE's position as a top-ranked electrical and computer engineering department provides our faculty and student body with a vibrant learning culture. Students receive a robust education through a strong technical foundation, group project work and hands-on research opportunities. Our faculty work in dynamic research areas collaborating with academia, industry and government institutions.

UW ECE continues to lead in cutting-edge science and technology while advancing socially-responsible innovation. Our innovation ecosystem is critical in promoting an entrepreneurial mindset in our teaching, and is strengthened through diverse partnerships that address complex global challenges in health, energy, technology and the environment. The Department's research activities fall into several broad categories:

Electronic, Photonic, and Integrated Quantum Systems (EPIQS) research at UW ECE includes quantum electronics, nanoscale optics, novel photon sources, and optical metamaterials, with applications in quantum science, imaging, biomedical sensing, and other areas. Our faculty work closely with colleagues in the Department of Physics and several faculty hold joint and secondary appointments in Physics. Many UW ECE faculty are members of the Institute for Nano-Engineered Systems (NanoES), an NSF National Nanotechnology Coordinated Infrastructure (NNCI) node that hosts the Washington Nanofabrication Facility (WNF) to support academic institutions and companies throughout the Pacific Northwest and beyond in designing and fabricating nanoscale materials, structures, devices and systems.

Power and Energy Systems research at UW ECE includes interdisciplinary work at all energy scales, ranging from nanowatts to gigawatts. Our faculty are active in smart grid development, integration of renewable energy sources, grid security, energy economics, and solar and electromagnetic energy harvesting. UW ECE faculty are leaders in the Clean Energy Institute and work with local utilities and grid systems operators.

Computing and Networking research includes computer architecture and computer system engineering, VLSI, embedded computing, wireless networks, and wireless communication research. Several of UW ECE's Computing and Networking faculty hold joint and secondary appointments in computer science and engineering and teach jointly in the ECE and CSE departments.

Data Sciences are fundamentally transforming nearly every area of engineering, science, and society. The Depart-

ment's faculty are making fundamental contributions to many different areas of data sciences, including machine learning, AI, optimization, information theory, computer vision, and speech and natural language processing. Many of our data sciences faculty hold secondary appointments in applied mathematics, computer science and engineering, bioengineering, and other departments, and are active participants in cross-disciplinary institutes such as UW's eScience Institute, the Allen Institute of Artificial Intelligence and the Bloedel Hearing Research Center.

Robotics and Controls researchers are leaders in the areas of surgical and bio-robotics, haptics, smart cities, and network control systems. They collaborate with and hold secondary appointments in computer science and engineering, bioengineering, and the UW Medical Center, and are active participants in interdisciplinary research centers such as the Center for Neurotechnology at the UW.

Biosystems research in the UW Department of Electrical & Computer Engineering is a highly collaborative endeavor. Our faculty focus on four areas of Biosystems research: synthetic & systems biology, neural engineering, biomedical devices, and mobile health. Many of our faculty hold secondary appointments and work closely with collaborators from other departments including Bioengineering, Computer Science and Engineering, Biology, Genome Sciences, Applied Mathematics, and the UW Medical Center. Our Biosystems faculty work with many cross-disciplinary institutes such as the eScience Institute, the Center for Neurotechnology, the Institute for Protein Design, the Bloedel Hearing Research Center and the University of Washington Institute for Neuroengineering.

3.3.1 Impact by Students and Postdocs

Below is a sampling of groundbreaking research projects led by UW ECE graduate students. Many more examples can be found on our department website at: **https://www.ece.uw.edu/news-events/**.

Doctoral research by a Ph.D. student and his UW team has moved quantum technology development a significant step ahead. The group included the Ph.D. student's adviser, UW ECE Associate Professor **Arka Majumdar**, UW ECE Assistant Professor **Rahul Trivedi**, and another doctoral student in the physics department. In a **Nature Communications paper**, the team demonstrated that a new kind of silicon photonic chip could work as a solid foundation for building a quantum simulator, one with useful applications in the real world. Today, the Ph.D. student is a postdoctoral researcher at the National Institute of Standards and Technology.

Doctoral research by a UW ECE Ph.D. student (class of '22) and her UW team were the first in the world to experimentally demonstrate a passive wireless communication system that enables devices to send and receive data without relying on externally generated or ambient radio frequency signals. The team included the student's adviser **Josh Smith**, who holds a joint appointment in UW ECE and in the Paul G. Allen School of Computer Science & Engineering, in collaboration with Miguel Morales, a professor in the physics department. The group's findings were published in **a paper** in the Proceedings of the National Academy of Sciences. The student is now an assistant professor of electrical engineering at Stanford University working in low-power wireless communication, sensing and IoT systems.

As part of their doctoral and graduate student research, students working under the supervision of UW ECE Professors **Arka Majumdar** and **Karl Böhringer** described a new type of micro-optical device called a metalens in **Nature Microsystems & Nanoengineering** that is fully compatible with standard microfabrication processes. Today, one of the student researchers is now the director of optical design at Tunoptix, an optics, photonics, and computational imaging company, and the other student holds a research scientist position at Meta.

3.4 Collaboration and Interdisciplinary Efforts

Several UW ECE faculty members hold leadership positions in the UW and Pacific Northwest research centers and institutes. The following is a partial list:

Professor Chet Moritz is the Co-Director of **Center for Neurotechnology (CNT**). The CNT's mission is to develop innovative neural devices and methods for directing engineered neuroplasticity in the brain and spinal cord, to improve sensory and motor function for people with spinal cord injury, stroke and other neurological disorders.

Professor Maryam Fazel is the Lead PI of the **Institute for Foundations of Data Science (IFDS)**. Launched in September 2020 and funded by a $12.5 million grant from the NSF TRIPODS program, the Institute for Foundations of Data Science (IFDS) brings together researchers from the UW, University of Wisconsin-Madison, UC Santa Cruz, and University of Chicago. IFDS organizes its research around four core themes: complexity, robustness, closed-loop data science, and ethics+algorithms.

Professor Nathan Kutz is the Director of the **NSF AI Institute in Dynamic Systems.** The AI Institute in Dynamic Systems mission is to develop the next generation of advanced machine learning tools for controlling complex physical systems by discovering physically interpretable and physics-constrained data-driven models through optimal sensor selection and placement.

Professor Karl F. Böhringer is the inaugural director of **Institute for Nano-Engineered Systems (NanoES)** and the director/PI of the **Northwest Nanotechnology Infrastructure**, one of the 16 sites of the NSF NNCI network. Researchers at the NanoES are developing solutions to grand challenges in nano science and engineering: the scalable, high-yield manufacture of nano-engineered systems in information processing, energy, health, and interconnected life. Focus areas at NanoES include Photonic & Quantum Devices, Augmented Humanity, and Scalable Nanomanufacturing. NanoES infrastructure includes the **Washington Nanofabrication Facility (WNF)**, a full-service micro and nanotechnology user facility focused on enabling basic and applied research, advanced R&D, and prototype production.

Professors Kai-Mei Fu and **Arka Majumdar** are leads in the **NSF Center for Integration of Modern Optoelectronic Materials on Demand (IMOD)**. Professor Fu is also the Center's Associate Director of Quantum Workforce Development. The IMOD mission is to transform conventional and quantum optoelectronics through the development of atomically-precise semiconductor materials and scalable manufacturing processes, and to educate a diverse generation of scientists and engineers..

Professor Payman Arabshahi is the UW lead of the **NSF Center for Soil Technologies (SoilTech)**. SoilTech is a joint research effort between the University of Washington, the University of Southern California, Iowa State University, and the University of Connecticut. SoilTech is the first of its kind to develop in-situ and remote sensing and analysis tools that can share real-time soil dynamics data with the scientific community and the nation at-large.

Professor Kai-Mei Fu is a co-chair, along with Professor Charlie Marcus in MSE/Physics, of the Steering Committee of **QuantumX**. QuantumX was established as an interdisciplinary institute that seeks to advance and integrate quantum information science and engineering (QISE) research, education, and commercialization across the UW community and its partners.

Professor Baosen Zhang serves on the Faculty Advisory Board of the **Clean Energy institute (CEI)**. The CEI's mission is to accelerate the adoption of a scalable and equitable clean energy future that will improve the health and economy of our state, nation, and world. To accomplish this, CEI supports the advancement of next-generation solar energy and battery materials and devices, as well as their integration with systems and the grid.

Professor Josh Smith is the UW Director of the **UW+Amazon Science Hub.** The Science Hub supports a broad set of programs – including fellowships for doctoral students, collaboration among researchers and support for collaborative research events – designed to accelerate artificial intelligence (AI), robotics and engineering in the Seattle area.

3.5 Entrepreneurship

Entrepreneurship is a key strength of UW ECE, and the Department has long been recognized for its entrepreneurial faculty and students. According to CoMotion (UW Tech Transfer Office) data, the Department's 49 UW spinoffs with ECE investigators rank #1 in startup production across all UW departments. The Department's highly entrepreneurial faculty include multiple faculty inventors having more than 80 issued patents. Despite not being the largest department on campus, ECE ranks #2 in disclosures filed and #3 in patents filed across the UW, with 396 active patents filed by ECE investigators, resulting in over $4.2M in royalties returned to the Department. ECE students are also highly entrepreneurial, with numerous ECE spin-out companies led by our faculty and students. Recent spinout companies include: **Proprio Vision, ThruWave, Wibotic, Parse Biosciences,** and **A-Alpha Bio.**

Within the Department, recognition for entrepreneurship among our undergraduate and graduate students comes in the form of the **Vikram Jandhyala and Suja Vaidyanathan Endowed Innovation Award.** For 2023, the award was presented to a Master's student in recognition of his innovations in COVID response during the early phases of the pandemic, citing specifically "During COVID, [the student's] swift response in providing face shields for healthcare workers demonstrated his ability to develop practical solutions in times of crisis".

UW ECE has historically had a strong relationship with UW CoMotion and the Washington Research Foundation, which are key facilitators of entrepreneurship across campus. In addition to CoMotion's support of 396 ECE-led patent filings, numerous students and postdocs have been supported by CoMotion Innovation Fellowships, which provide salary support for student/postdoc entrepreneurship activity. The Washington Research Foundation has

directly supported ECE faculty-led startups including **WiBotic, ThruWave, A-Alpha Bio, OneRadio,** and **Olis Robotics.**

4. FUTURE DIRECTIONS

4.1 Continued Growth

As stated throughout this document, enrollment in UW ECE programs, especially our undergraduate program, is growing. Simultaneously, research opportunities and industry programs for ECE nationally are experiencing rapid growth. Our first Unit Defined Question, in Part B of this report, describes several key ways the College, University, and the state can support UW ECE's growth to meet these demands.

4.2 Growing Research Impact

UW ECE enjoys a high-impact research program in terms of publications, patents, technology transfer, and placement of Ph.D. students in key academic and industry positions. Many of our faculty lead large multidisciplinary initiatives. However, staff support for these efforts, which is supported mainly through indirect cost return, is fairly low. Only three grants managers support our entire department, compared to approximately 16 for the Allen School, which is less than twice the size of UW ECE. We are currently expanding this team, hiring a new senior level grants manager, and discussing whether and how to support several other positions such as: a grant writer, shared research IT support, and a research-focused events coordinator.

4.3 Industry Engagement

In addition to the many industry collaborations managed by individual faculty, the department engages industry through its Industry-Sponsored Capstone Program (ENGINE), its External Advisory Board, its Professional Masters Program Advisory Board, and its Undergraduate Mentorship Program. Specific relationships with key industry partners such as Boeing, Amazon, Paccar, and Lockheed Martin are supported by broad university wide agreements that facilitate funding and collaboration. UW ECE's career fair, which was managed by the College until recently, will provide another avenue for industry interactions.

4.4 Faculty Recruiting / Retention

Since 2021, we have recruited 10 new assistant professors, and in the 2023-2024 academic year we aim to hire five more. With this many new professors, it is crucial for retention purposes that we build a strong and intentional culture of mentorship. The assistant professor mentorship program established by the current chair is a good start. Programming for mid-career professors on leadership is a key next step.

4.5 DEI

A lack of diversity in ECE nationally and in our own program at the UW continues to be a challenge. In Part B of this document, one of our Unit Defined Questions is focused on substantially increasing UW ECE's efforts in DEI through specific programs as well as faculty and staff hires.

4.6 Improvements to Education Programs

A key change with the introduction of the new, flexible ECE degree, we have restructured our curriculum committee into a **Core Committee,** an **Electives Committee**, and a **Graduate Curriculum Committee**, each with a different focus as indicated by their names. The following sections briefly describe the key improvement areas on which these committees are currently focused.

4.6.1 Undergraduate Program

Core courses: The consistency between offerings of the core courses by different faculty members must be improved. To this end, we have established a committee to supervise these core courses and we are strengthening the continuous improvement process overseen by the core curriculum committee. We also continue to build our team of Teaching Professors, increasing to five recently and actively searching for additional personnel in this area.

Capstone: While our ENGINE capstone is quite successful, we find that many students are not sufficiently prepared to engage in collaborative team work. Furthermore, it is clear that not enough hardware projects are being offered at

the sophomore and junior levels. Our new electives committee will address these issues of preparation by carefully curating the set of electives available.

Communication Skills: Our industry advisers stress the importance of improving the professional communication skills of our students. In order to graduate, our students currently have to take three writing/communication courses. The first one (English composition) is taught by the English department. The second one (ENGR 233) was organized by the college. However, due to staffing issues, the college will no longer offer this course. The third course (EE 393) is taught by faculty members from the Department. Finding instructors who are suitably qualified and willing to teach this course is challenging. Tying the writing requirements to engineering projects is an enticing option but would also require a considerable amount of qualified resources because of the requirement to give students feedback and get them to revise their submissions.

Hands-On Experiences: Our faculty members do cutting-edge research in many exciting areas, and students want to learn about faculty research and gain relevant hands-on experience. Our BSECE program offers a large selection of pathways, and many of our faculty members teach junior/senior level courses related to their specialized research areas. Currently many of these courses have limited or no lab components due to lack of lab resources. This new curriculum provides the opportunity to make changes and the program fee, described in Part B on Unit Defined Questions, describes how we can improve our infrastructure to support hardware courses.

4.6.2 Daytime Master's Program

While there is undoubtedly a strong demand for Master's-level qualifications in all the areas of ECE, the Department has no financial incentive to increase the enrollment of daytime Master's students. Furthermore, with the growth of our evening PMP program, teaching capacity is stretched thin. In some areas (e.g., VLSI), Master's students can quickly make contributions to on-going research projects while learning valuable skills. In other areas (e.g., systems), the research contributions of Master's students are marginal. A number of faculty members are therefore reluctant to supervise Master's theses. This leads to a situation where a significant number of students enroll in the daytime Masters program with the expectation of engaging in research but are unable to do so. The main option we are considering is limiting admissions to the Daytime Masters program to students who show a strong aptitude for research, who have a high probability to convert to Ph.D. students, and to whom a faculty member is willing to offer a research project. Qualified students more suited to a coursework-only program would be redirected to the Professional Master's Program (PMP).

4.6.3 Professional Master's Program (PMP)

Because the PMP is fee-based rather than tuition-based, the Department has a strong financial incentive to increase enrollment in this program. Enrollment in this program has therefore been growing at 12% per year. This growth has been fueled by a curriculum heavy on "hot topics", such as machine learning and cryptography. About 50% of the courses are taught by recognized industry experts who have the title of affiliate instructor or affiliate assistant professor and work for organizations such as the Allen Institute for Artificial Intelligence or NVIDIA. Growth must be managed carefully to maintain the quality of the program. In particular, we need to provide adequate support to the students; we must avoid overly large graduate classes and provide students with opportunities for social interactions.

As mentioned above, enrollment in this program consists of two somewhat different cohorts of comparable sizes. On the one hand, there are working professionals doing this program part-time. On the other hand, we have full-time students who have recently obtained their undergraduate degree and who were not admitted to the regular daytime program. These two cohorts have somewhat different expectations. Working professionals want more traditional electrical engineering courses, while full-time students are more interested in software engineering, data science, and related topics. For obvious reasons, working professionals want more hybrid delivery options while full-time students prefer in-person classes. At this point we are not considering offering a fully remote degree.

The Department is considering different ways of growing this program. These include offering more certificates (possibly stackable leading to a Master's degree); reinvigorating the current option of obtaining a current degree in patent law by extending it to technology policy; taking advantage of the funding provided by the Chips Act; and extending the offerings in the area of robotics.

4.6.4 Ph.D. Program

While our Ph.D. program is strong, we have identified a few areas of improvement. First, we currently guarantee every admitted Ph.D. student four years of funding as long as they make satisfactory progress. To facilitate the recruitment of top research students, we could extend this guarantee to five years. We have the financial resources to do that,

particularly if we require that every Ph.D. student be a teaching assistant for a certain number of quarters. Besides the financial justification, we believe that being a TA contributes to the professional development of our graduate students. Second, we do not currently have a single course that all our Ph.D. students have to take, irrespective of their specialization. Introducing one or more such courses would improve the cohesion of each cohort of Ph.D. students. We are currently working to make our departmental colloquium compulsory for all first year Ph.D. students and we have prototyped a course called "Hack the Ph.D.", which would teach soft skills such as teaching, writing, presenting, and networking. Third, Ph.D. students report that they are often mixed in with Master's students in various events and initiatives. We are developing ways to differentiate events such as graduate student orientation, our research showcase, and lunches with faculty to better focus on the needs and interests of Ph.D. students.

PART B: UNIT-DEFINED QUESTIONS

1. SUPPORTING UW ECE'S GROWTH

The national demand for graduates with bachelor's, master's, and doctoral degrees in ECE is growing. Locally, the College of Engineering has expanded its enrollment targets significantly over the last decade, with UW ECE carrying much of the increased load and without a commensurate increase in faculty lines and other resources. Our Professional Master's Program and our industry-led Capstone Program (ENGINE) have also expanded, with UW ECE's network of industry partners and affiliate instructors extended well beyond the region.

Simultaneously, research opportunities in most areas of the broad field of electrical and computer engineering are expanding, especially with the passage of the CHIPS and Science Act, which is already providing large injections of funding into our area on top of an already thriving research effort. UW ECE is the key department at the University of Washington and a central player in the region for attracting these resources to Washington state. To take full advantage of this situation, the College of Engineering, the University of Washington, and the state of Washington must recognize UW ECE as a key economic driver, educator, and research powerhouse, allocating additional faculty lines, startup package support, and increased staffing to support our growth. Key areas we believe need support are:

- Initiating state-sponsored cluster hires in all areas of ECE, and especially circuits, to fuel growth of the ECE tenure-track faculty to 45 net FTE (from today's 43 net FTE).
- Advocating for the state of Washington to invest in UW ECE research infrastructure, especially in the area of microfabrication and semiconductor characterization, to allow us to respond to the CHIPS Act and related opportunities.
- Expanding staffing in UW ECE to support grants management and research infrastructure such as computing and microfabrication.
- Assessing and reimagining UW ECE's building, which will not accommodate this growth without significant renovation to enable more shared lab and office space.

Given that Washington Senators Murray and Cantwell were sponsors of the CHIPS Act and hold important positions — Murray chairs the Committee on Appropriations, Cantwell chairs the Committee on Commerce, Science and Transportation — they are tremendously influential in the implementation of the CHIPS Act. The UW should rally their support in any national programs. Within Washington state, the UW should strongly raise awareness and advocate the CHIPS Act opportunities, the economic impact of semiconductor technology at the state and national levels, and STEM education to the government and legislatures, aiming to trigger investments to be competitive with those being made by other states.

It is important to realize that industry partnerships are crucial to building a robust training program in microfabrication. The PNW region is home to two semiconductor giants, Intel and Micron, although they are not located in Washington. However, in Seattle, companies such as Microsoft, Amazon, and Boeing also play significant roles in the semiconductor ecosystem by serving as major users and designers of chips for cloud computing, defense, and space systems. How should we expand our industry partnerships and reach out to other companies, such as Apple, Intel, and TSMC?

2. EDUCATIONAL INFRASTRUCTURE

UW ECE is the fifth largest producer of undergraduate EE degrees in the country and has a substantial graduate program as well, having seen significant growth in enrollment in the last 10 years. Yet UW ECE's undergraduate teaching infrastructure (both in terms of facilities as well as teaching support personnel) lags well behind its peers. Teaching ECE undergraduates is significantly more expensive than in other fields in terms of equipment, consumables, and non-instructional staff support. The instructional labs and staff support both impact student experience in UW ECE and their success in our program. UW ECE's lack of instructional infrastructure is especially problematic as we ramp up IC design and device courses to respond to the CHIPs and Science Act. Most top-10 departments include a "tape-out" course where students have one of their designs turned into a chip for them to characterize. More generally, best practice in ECE education is to support student demand for hands-on, capstone design experiences, and industry-relevant projects. Given our growth in enrollment, UW ECE now needs significantly more resources than it did 10 years ago to ensure that each student receives a cutting-edge experience. Specific additional resources we feel are needed to provide an educational experience comparable to our peers include:

- Availability of a microfabrication teaching facility for undergraduate courses that could handle at least 100 students per year
- Improved educational spaces to support electronics, microelectronics, communications, and robotics. Such spaces should be located in the ECE building and the new College of Engineering IEB.
- Expanding teaching assistant and tutoring resources
- Additional educational lab equipment and the IT staffing to support it
- Ability to recruit outstanding teaching faculty, including better and longer contracts, higher salaries, and vastly improved career advancement supported at the College and University levels for this class of employees. For example, many of our peers offer tenure to teaching faculty.

Sustained support for educational infrastructure for a department of our size is expensive and no current mechanism exists at the UW to enable it. Financially, the best way forward at the UW is to institute a program fee for all engineering majors. The College of Engineering is exploring such an option, and we wholeheartedly endorse it, especially if all the funding returns to the student's department and the department has significant leeway in how it is spent to best achieve our educational mission.

Specific note on the Washington Nanofabrication Center: Training the future workforce in semiconductor manufacturing is a critical direction under the CHIPS and Science Act. But our undergraduate students have not been able to directly experience microfabrication in our curriculum. More and more students and their future employers are asking for this opportunity. There is an ongoing effort on the UW campus involving leadership in the WNF and NanoES as well as PIs who utilize the WNF to request an increase in the University's annual financial support for the WNF such that adequate training to our students can be offered to meet the expected workforce demands in microfabrication. The Department of Electrical & Computer Engineering strongly supports this effort.

3. LEADING ECE DEI EFFORTS NATIONALLY

As discussed above, electrical and computer engineers in the United States make up 17% of all working engineers. With the CHIPS act, this number is likely to increase by 2X to 3X, potentially making our field the dominant engineering profession in the U.S. in the coming decade. Yet, of all the major engineering specialties, electrical and mechanical engineering are overwhelmingly male, with only 9 to 10% of working engineers being female. At the UW, our Department ranks low among engineering departments in terms of percentage of female students. Black, Native American, Hispanic and other racial and ethnic minorities are underrepresented, as are students from lower socioeconomic backgrounds and first-generation college students. Thus, despite millions of dollars of funding invested by federal agencies toward closing the gender gap and addressing racial, socioeconomic, and ethnic underrepresentation in engineering (e.g. through the NSF's broader impacts), the gap in electrical (and aeronautical and mechanical) engineering nationally remains stubbornly stagnant.

We believe it is a crucial goal in and of itself to increase the racial, ethnic, and socioeconomic diversity of the field. Doing so benefits everyone by increasing the breadth of ideas, experiences, and role models that all students are

exposed to, and increases access to a key job-growth area. Specifically, we must:

- Hire new and support existing instructors to create a uniformly welcoming environment; provide students with engaging and motivating instruction; and ensure that student workload is reasonable.

- Hire dedicated advising staff and tutors for disadvantaged students with poor high school preparation, lack of knowledge about college culture and norms (typical for first generation college students), or similar issues.

- Develop a dedicated educational and research pathway focused on Engineering for the Greater Good and ensure it meets the needs of students who are interested in engineering to benefit society more so than high-paying jobs.

- Hire at least one faculty member or research scientist in engineering education who understands the needs of underrepresented students and can facilitate the consideration of those needs into our daily teaching practice and pedagogy via faculty professional development programs and other continuous improvement and assessment processes.

Given international trends, we do not believe that an entirely local effort is sufficient. Most of the curriculum, textbooks, and approaches in undergraduate ECE education pull from a corpus of materials developed by the field in general that is clearly not working. The field of ECE needs to be reinvented, making ECE more attractive and appealing by overcoming the image of electrical engineering as a low level, application-agnostic "slog and grind" for students. We believe the above goals, therefore, must be pursued by faculty and staff specifically hired for the purpose and who are engaged in scholarship and best practices at the national level.

PART C: APPENDICES

APPENDIX A: ORGANIZATIONAL CHARTS

Faculty Leadership

Eric Klavins, UW ECE Department Chair
Mo Li, Associate Chair for Research
Denise Wilson, Associate Chair for Diversity, Equity, and Inclusion
Payman Arabshahi, Associate Chair for Education / Industry Liaison
Josh Smith, Associate Chair for Professional Programs

The UW ECE Executive Committee: Consists of the above individuals plus the Department Administrator and the Undergraduate and Graduate Program Coordinators. The Executive Committee meets quarterly during the academic year.

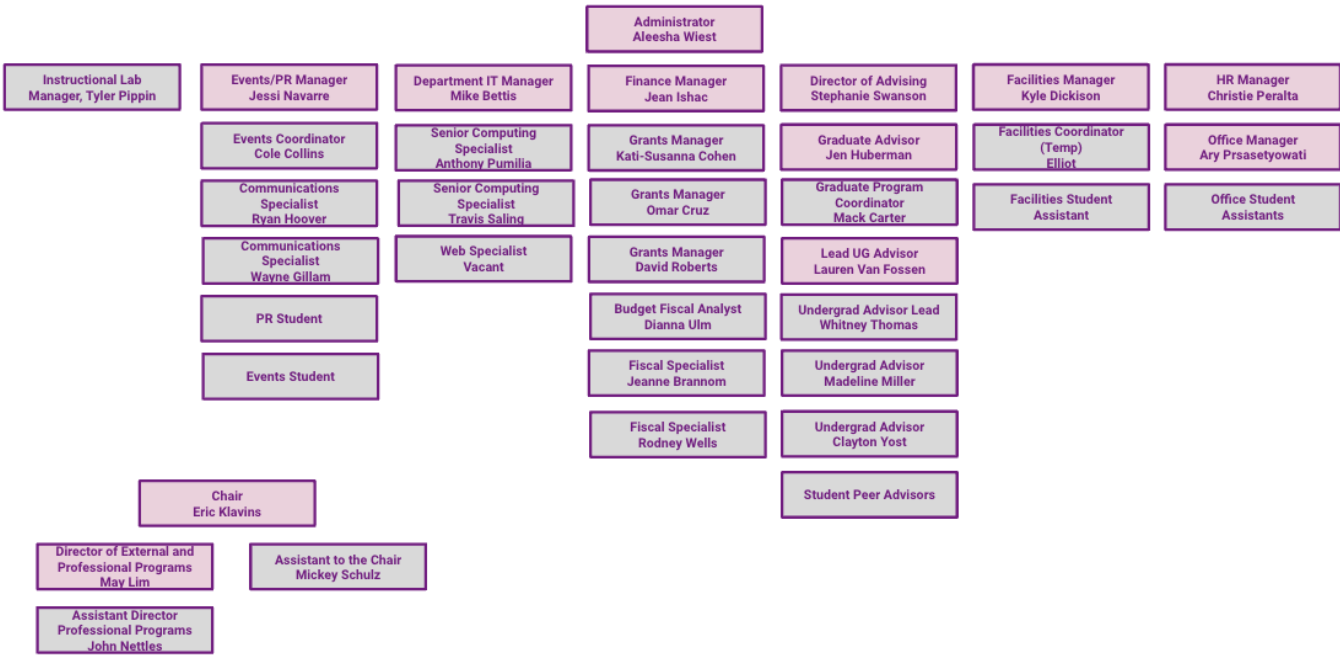
Additional significant faculty leadership roles:

Additional Significant Leadership	
Lih Lin	Undergraduate Program Coordinator
Tai-Chang Chen	ABET Coordinator
Anant Anantram	Ph.D. Program Coordinator
Scott Hauck	MS (Daytime) Coordinator
Kai-Mei Fu	Faculty Search Committee Lead
Denise Wilson	Core Curriculum Committee Lead
Mo Li	Graduate Committee Lead
Arka Majumdar	Qualifying Exam Coordinator
Les Atlas	Competitiveness Committee
Azadeh Yazdan	Graduate Review of Progress Coordinator
Karl Böhringer	Building Safety
Rania Hussein	Teaching Review Coordinator

Staff Leadership

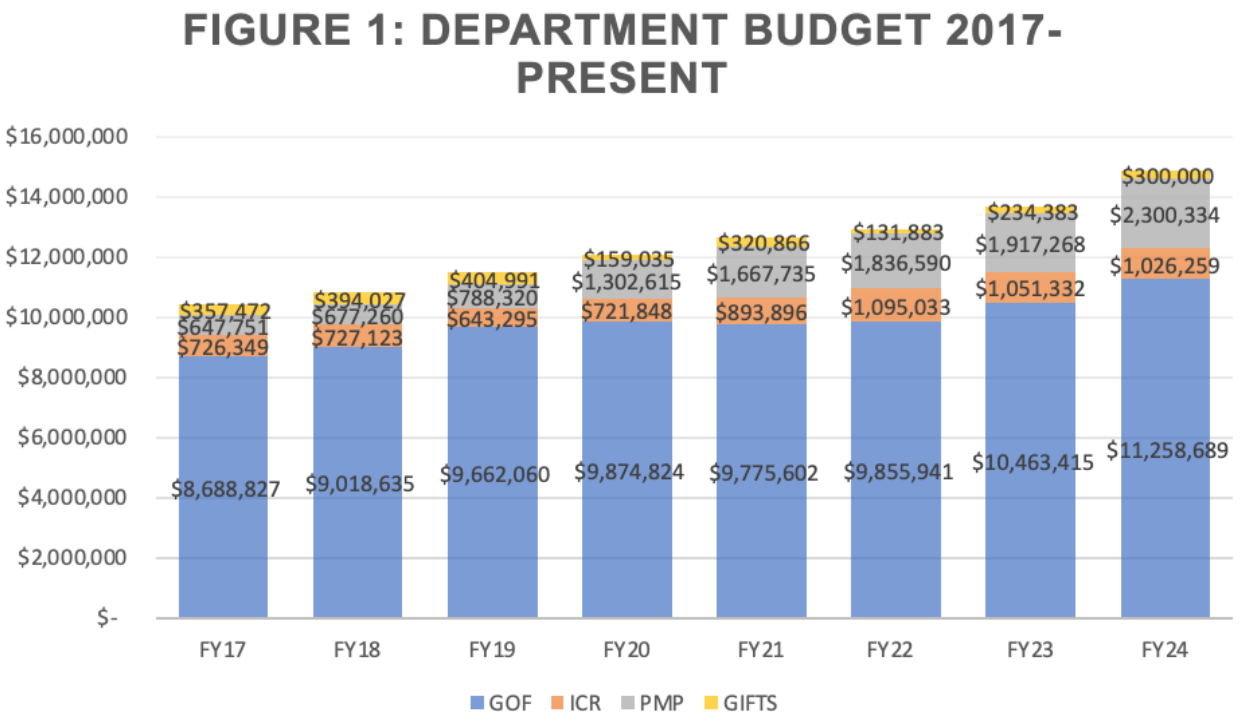
Aleesha Wiest - Department Administrator
May Lim - Director of Industry and Professional Programs
Stephanie Swanson - Director of Advising
Mike Bettis - IT Department Manager
Jessi Navarre - Events & PR Manager
Jean Ishac - Finance Manager
Christie Peralta - Department HR Manager

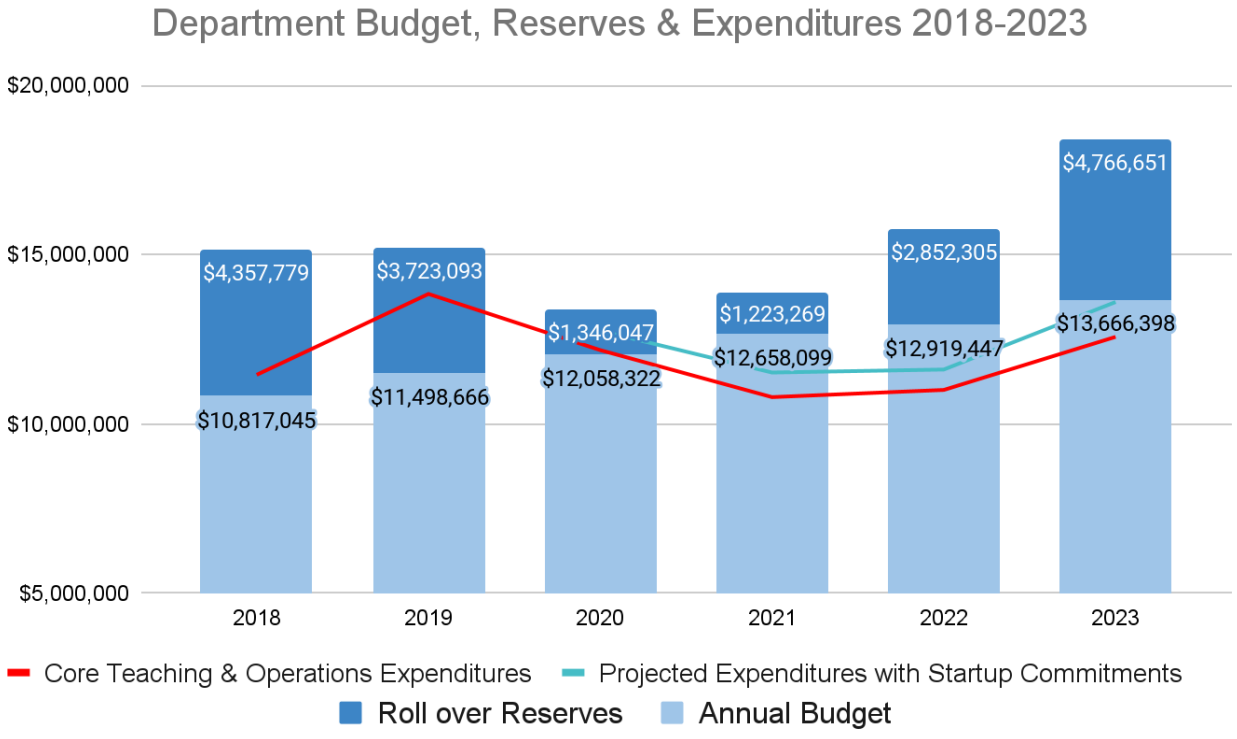
Current Staff Organizational Chart

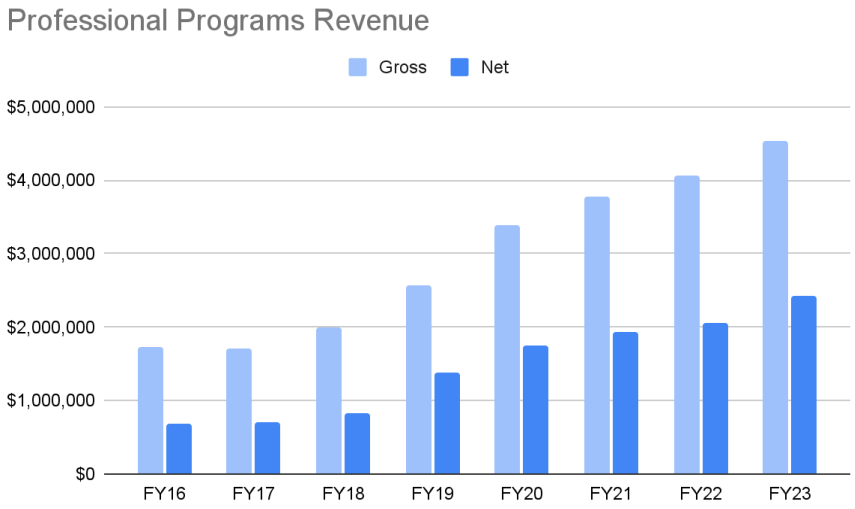


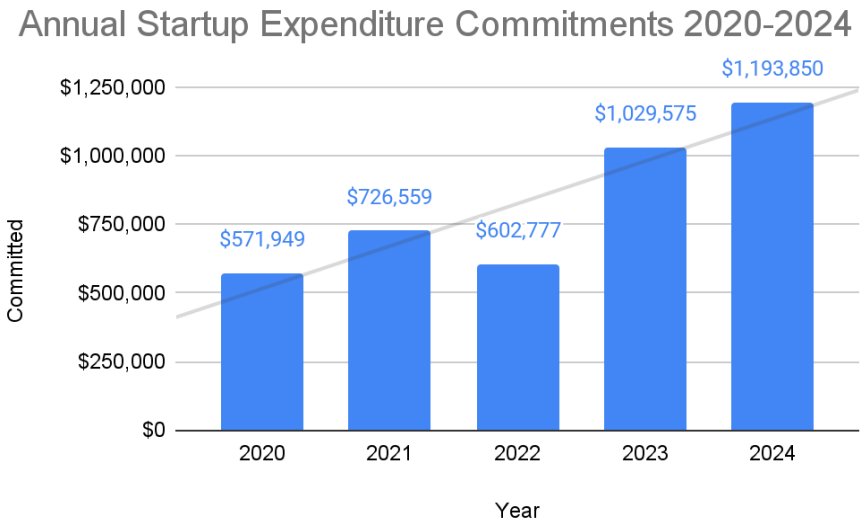
APPENDIX B: BUDGET SUMMARY

Department Operations Budget






Professional Programs Revenue
Gross
Net
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
FY16
FY17
FY18
FY19
FY20
FY21
FY22
FY23


Annual Startup Expenditure Commitments 2020-2024
Committed
$1,250,000
$1,000,000
$750,000
$500,000
$250,000
$0
$571,949
$726,559
$602,777
$1,029,575
$1,193,850
2020
2021
2022
2023
2024
Year

Research

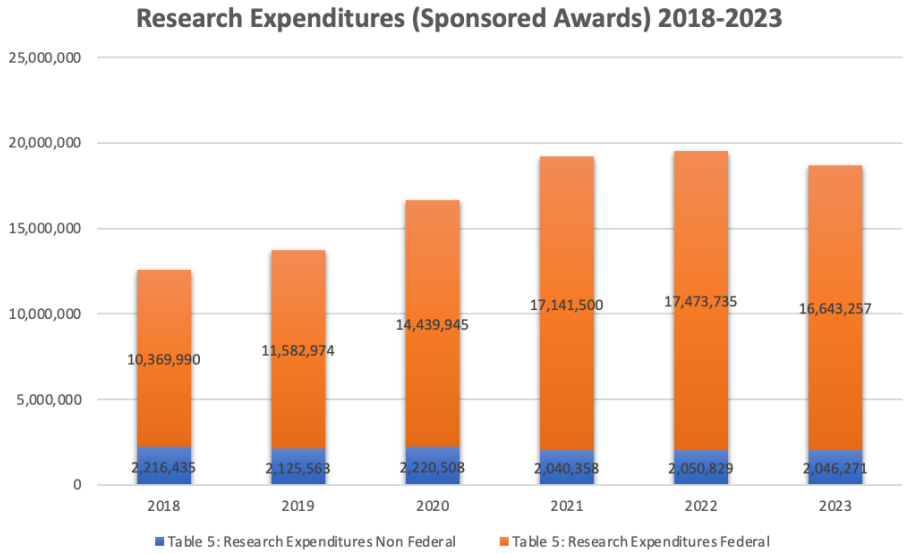
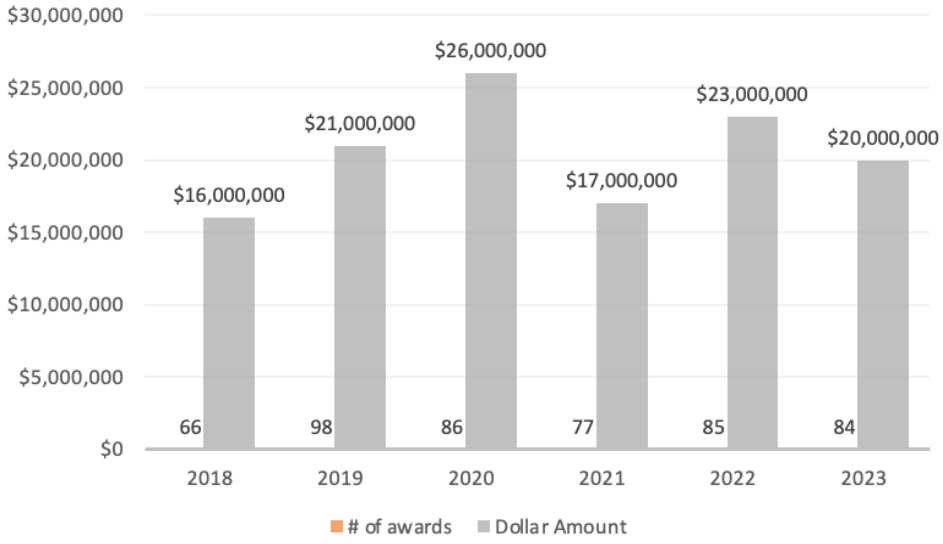

Research Expenditures (Sponsored Awards) 2018-2023
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
10,369,990
11,582,974
14,439,945
17,141,500
17,473,735
16,643,257
2,216,435
2,125,563
2,220,508
2,040,358
2,050,829
2,046,271
2018
2019
2020
2021
2022
2023
Table 5: Research Expenditures Non Federal
Table 5: Research Expenditures Federal

FIGURE 2: RESEARCH DOLLARS & AWARDS 2018-2023



APPENDIX C: INFORMATION ABOUT FACULTY

Current ECE Faculty

faculty hires since 2013

Current Faculty, September 2023			
Name	**Rank**	**Other Affiliations**	**Link to webpage**
M.P. Anantram	Professor		https://people.ece.uw.edu/anant/
Payman Arabshahi	Associate Professor	APL	https://people.ece.uw.edu/arabshahi/
Les Atlas	Profesor		https://people.ece.uw.edu/atlas/
Jeffrey Bilmes	Professor		https://people.ece.uw.edu/bilmes/
Karl Bohringer	Professor	Director, NanoES Institute	https://people.ece.uw.edu/karl/
Sam Burden	Associate Professor		https://people.ece.uw.edu/burden_sam/
Linda Bushnell	Research Professor		https://people.ece.uw.edu/bushnell/
Tai-Chang Chen	Teaching Professor		https://people.ece.uw.edu/chen_tai/
Jungwon Choi	Assistant Professor		https://www.ece.uw.edu/people/jungwon-choi/
Scott Dunham	Professor		https://people.ece.uw.edu/dunham/
Serena Eley	Assistant Professor		https://people.ece.uw.edu/eley_serena/index.html
Maryam Fazel	Professor		https://people.ece.uw.edu/fazel_maryam/
Kai-Mei Fu	Professor	Head, QT3 Quantum Center< Joint with Physics	https://people.ece.uw.edu/fu_kaimei/
Akshay Gadre	Assistant Professor		https://people.ece.uw.edu/gadre_akshay/index.html
Hannah Hajishirzi	Research Assistant Professor	Computer Science	University of Washington - Research Scientist
Mahmood Hameed	Assistant Teaching Professor		https://people.ece.uw.edu/hameed_mahmood/index.html
Blake Hannaford	Professor		https://people.ece.uw.edu/hannaford/

Scott Hauck	Professor	Adjunct CSE	https://people.ece.uw.edu/hauck/index.html
Rania Hussein	Associate Teaching Professor		https://people.ece.uw.edu/rhussein/
Jenq-Neng Hwang	Professor		https://people.ece.uw.edu/hwang/
Kim Ingraham	Assistant Professor		https://people.ece.uw.edu/ingraham_kim/
Daniel Kirschen	Professor		https://people.ece.uw.edu/kirschen/index.html
Eric Klavins	Professor	Chair	https://people.ece.uw.edu/klavins_eric/
Jose Nathan Kutz	Professor	Joint with AMATH	https://www.ece.uw.edu/people/jose-nathan-kutz/
Mo Li	Professor	Joint with Physics	https://people.ece.uw.edu/li_mo/
Lih Lin	Professor		https://people.ece.uw.edu/lin_lih/
June Lukuyu	Assistant Professor		https://people.ece.uw.edu/lukuyu_june/index.html
Arka Majumdar	Associate Professor	Joint with Physics	https://people.ece.uw.edu/majumdar_arka/
Sep Makhsous	Assistant Teaching Professor		https://people.ece.uw.edu/makhsous/
Alex Mamishev	Professor		https://people.ece.uw.edu/mamishev/
Sajjad Moazeni	Assistant Professor		https://people.ece.uw.edu/moazeni_sajjad/
Chet Moritz	Professor	Joint with Rehab Medicine	https://people.ece.uw.edu/moritz_chet/
Sara Mouradian	Assistant Professor		https://people.ece.uw.edu/mouradian_sara/index.html
Hossein Naghavi	Assistant Professor		https://www.ece.uw.edu/people/hossein-naghavi/
Amy Orsborn	Assistant Professor	Joint with BioEngineering	https://people.ece.uw.edu/orsborn_amy/
Mari Ostendorf	Professor	Vice Provost for Research	https://people.ece.uw.edu/ostendorf/
Shwetak Patel	Professor	Joint with Allen School	https://people.ece.uw.edu/patel_shwetak/
Radha Poovendran	Professor		https://people.ece.uw.edu/radha/index.html
John Raiti	Associate Teaching Professor	GIX	https://people.ece.uw.edu/raiti_john/
Lillian Ratliff	Associate Professor		https://people.ece.uw.edu/ratliff_lillian/
Matt Reynolds	Associate Professor		https://people.ece.uw.edu/reynolds_matt/
James A. Ritcey	Professor		https://people.ece.uw.edu/ritcey/
Sumit Roy	Professor		https://people.ece.uw.edu/roy/
J. Chris Rudell	Associate Professor		https://people.ece.uw.edu/rudell_chris/
Georg Seelig	Professor		https://people.ece.uw.edu/seelig_georg/
Linda Shapiro	Professor	Joint with Allen School	https://people.ece.uw.edu/shapiro/index.html
C.J. Richard Shi	Professor		https://people.ece.uw.edu/shi/
Eli Shlizerman	Associate Professor	Joint with AMATH	https://people.ece.uw.edu/shlizerman_eli/
Joshua R. Smith	Professor	PMP Faculty Coordinator	https://people.ece.uw.edu/smith_joshua/
Michael B. Taylor	Professor	Joint with Allen School	https://people.ece.uw.edu/taylor_michael/
Rahul Trivedi	Assistant Professor		https://www.ece.uw.edu/people/rahul-trivedi/
Denise Wilson	Professor		https://people.ece.uw.edu/wilson/
Azadeh Yazdan-Shahmorad	Associate Professor	Joint with BioEngineering	https://people.ece.uw.edu/yazdan_azadeh/
Baosen Zhang	Associate Professor		https://people.ece.uw.edu/zhang_baosen/index.html

Ang Li	9/16/2024	Assistant Professor	Electrical and Computer Engineering	Princeton - PhD Student

Recent Faculty Departures

Over the last five years there have been several faculty departures, averaging approximately one to two per year and primarily at the senior level. Seven tenure-track faculty members retired: Ming-Ting Sun, Howard Chizeck, Yasuo Kuga, Mani Soma, Richard Christie, Bruce Darling, and Eve Riskin. Three tenure-track faculty members relocated to another institution, start-up or industry: Brian Johnson, Visvesh Sathe, Sreeram Kannan.

Faculty Awards

Major Faculty Awards

MacArthur Fellow

- Shwetak Patek, WRF Endowed Professor in Computer Science and Electrical and Computer Engineering

Guggenheim Fellow

- Rajesh Rao, C.J. & Elizabeth Hwang Professor in Computer Science & Engineering and Electrical Engineering, joint Professor with the Paul G. Allen School of Computer Science & Engineering

National Academy of Engineering Members

- Mari Ostendorf, System Design Methodologies Professor
- Irene Peden, Professor Emerita
- Akira Ishimaru, Professor Emeritus
- Bishnu Atal, Affiliate Professor
- Henrique Malvar, Affiliate Professor

Sloan Fellow Award Recipients

- Arka Majumdar, Associate Professor
- Shwetak Patel, WRF Entrepreneurship Endowed Professor in Computer Science & Engineering and Electrical & Computer Engineering
- Scott Hauck, Gaetano Borriello Professor for Educational Excellence
- Shyam Gollakota, Adjunct Associate Professor
- Rajesh Rao, C.J. & Elizabeth Hwang Professor in Computer Science & Engineering and Electrical Engineering, joint Professor with the Paul G. Allen School of Computer Science & Engineering
- Hannaneh Hajishirzi, Adjunct Assistant Professor
- Eve Riskin, Professor Emerita
- Georg Seelig, Professor

IEEE Fellows

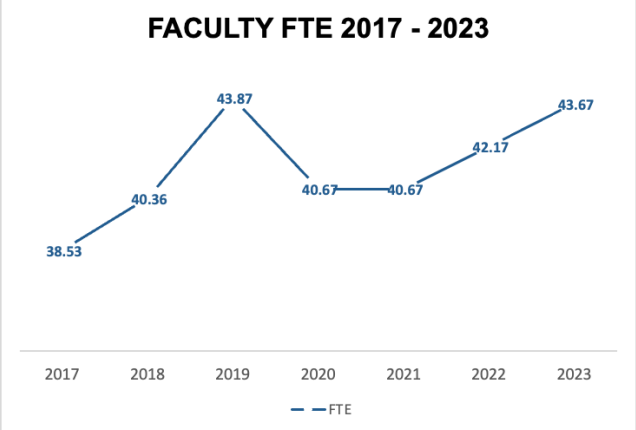
- Vishnu Atal, Affiliate Professor
- Les Atlas, Professor
- Linda Bushnell, Research Professor
- Blake Hannaford, Professor
- Scott Hauck, Gaetano Borriello Professor for Educational Excellence
- Karl Böhringer, Professor; Director NanoEs Institute
- Li Ding, Affiliate Professor
- Jenq-Neng Hwang, Professor
- Akira Ishimaru, Professor Emeritus
- Daniel Kirschen, Donald W. and Ruth Mary Close Professor
- Yasuo Kuga, Professor Emeritus
- Lih Lin, Professor
- Henrique Malvar, Affiliate Professor
- Mari Ostendorf, System Design Methodologies Professor
- James Peckol, Professor Emeritus
- Irene Peden, Professor Emerita
- Radha Poovendran, Professor
- Eve Riskin, Professor Emerita
- James Ritcey, Professor
- Sumit Roy, Integrated Systems Professor
- Linda Shapiro, Professor

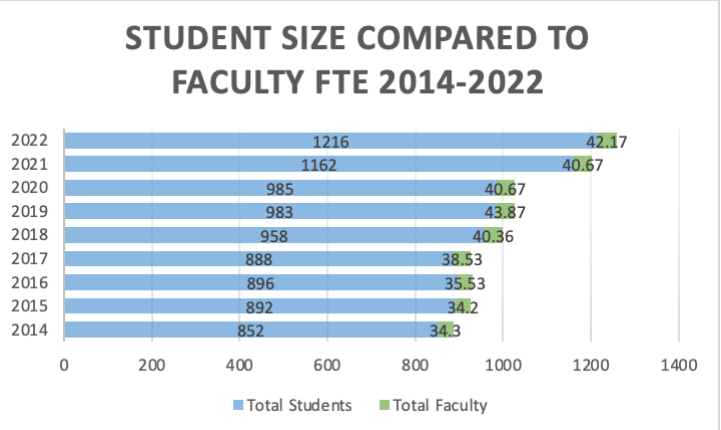
- Richard Shi, Professor
- Josh Smith, Milton and Delia Zeutschel Professor in Entrepreneurial Excellence
- Mani Soma, Professor Emeritus
- Robert Spindel, Profesor Emeritus
- Ming-Ting Sun, Professor Emeritus
- Rajesh Rao, C.J. & Elizabeth Hwang Professor in Computer Science & Engineering and Electrical Engineering, joint Professor with the Paul G. Allen School of Computer Science & Engineering
- Tadayoshi Kohno, Adjunct Associate Professor

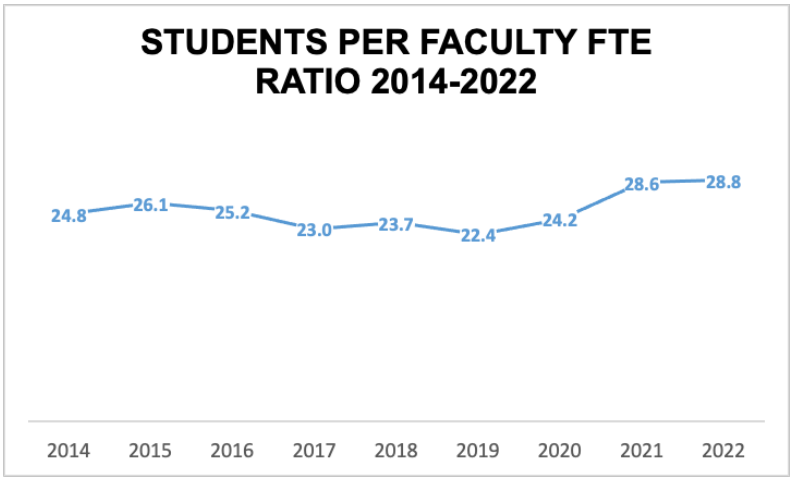
Award Name	Number of Recipients
Carnegie Institute of Technology Dean's Fellow	1
NSF iQuISE IGERT Fellow	1
NSF CAREER Award	14
Young Faculty Award - DARPA	5
Alfred P. Sloan Research Fellow in Physics	2
10-Year Impact Award, ACM Ubicomp	1
ACM SIGEnergy Rising Star Award	1
Forbes Magazine 30-Under-30 in Energy	1
Weill Neurohub Investigator	2
Fellow, Optica	2
Bloedel Scholar Award	1
New Engineering Educators Diversity Award	1
IEEE Region 6 Outstanding Engineering Educator Award	2
Fellow of the National Academy of Inventors	1
Fellow of the Institute of Electrical and Electronics Engineers	9
GlaxoSmithKline (GSK) Bioelectronics Innovation Challenge,	1
MIT Technology Review "Ten Breakthrough Technologies	1
Rozenberg Tulip Award in DNA Computing	1
Young Investigator Award - ONR	1
Member, National Academy of Engineering	1
Corresponding Fellow, Royal Society of Edinburgh	1
Fellow, Association for Computational Linguistics	1
IEEE James L. Flanagan Speech and Audio Processing Award	1
Fulbright Scholar	1
Francqui Chair at the Université Libre de Bruxelles	1
IFAC Fellow	1
American Heart Association Career Development Award	1
NIH Early Career Reviewer	1

IREK12, Interdisciplinary Rehabilitation Engineering Research Career Development Award, NIH	1
Office of Naval Research Young Investigator Award	1
NSF CISE Research Initiation Initiative Award	2
Young Investigator Program Army Research Office	1
NSF/NIGMS Initiative Award	1
Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring,	1
ACM Prize in Computing	1
ACM Fellow	1
Presidential Early Career Awards for Scientists and Engineers Award	1
National Academy of Engineering (NAE) Gilbreth Award	1
World Economic Forum Young Global Scientist Award	1
Sloan Fellowship	1
MacArthur Fellowship	1
Microsoft Research Faculty Fellowship	1
Washington Research Foundation Early Faculty Career Award.	1
Rising Stars in Electrical Engineering and Computer Science,	1
American Institute for Physics - NSBP Joseph A. Johnson Award for Excellence in Experimental Physics	1
Goddard Award for Best Research Contribution (NASA Academy GSFC)	1
NSF Graduate Research Fellowship	1
Grace Hopper Celebration Scholarship	1
NSF-FuSe award	1

Size of Faculty







APPENDIX D: EQUITY AND INCLUSION PLAN

ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY of WASHINGTON

Diversity, Equity, & Inclusion (DEI) Plan 2023-2024

Students, staff, and faculty in the UW Department of Electrical & Computer Engineering embody a variety of backgrounds, perspectives and lived experiences, and yet significant work is needed to create a department that: (i) represents the diversity of our state, country, and world; (ii) provides equitable access to education and research opportunities; and (iii) supports a sense of belonging and inclusivity among all who are a part of our ECE community. Oriented toward these goals are:

DEI Leadership Team

The DEI advisory committee supports the Associate Chair in making balanced and impactful decisions regarding DEI within UW ECE. The committee had five members in 2022-2023 including staff and faculty, and is currently being formed for the 2023-2024 year.

2023 - 2024 Initiatives

Sex, Gender and Engineering Course: A new undergraduate course called "Sex, Gender and Engineering" was taught for the first time with 50 students by Professor Denise Wilson in the Spring of 2023. The course explores professional issues faced by women as well as sexual and gender minorities (LGBTQ+) in the engineering workplace and in school.

ECE DEI Book Club: The DEI Book Club, established in the summer quarter of 2022, is open to UW ECE doctoral students, faculty and staff who are passionate about creating inclusive and intentional spaces for historically underrepresented people in the field of electrical and computer engineering. The Club meets once a quarter to discuss a contemporary book that explores issues of diversity, equity, inclusion and justice. The Book Club meets at least once during the quarter to discuss each book and to explore how to apply it to work, studies and to UW ECE as a whole.

Assistant Professor Mentorship: The chair's office runs a new assistant professorship mentorship program that consists of the following four components: (1) monthly group meetings with the chair and all assistant professors

to discuss aspects of being a professor. (2) Two assigned mentors for each assistant faculty involving at least one confidential meeting per quarter. (3) A mentorship pool for common challenges. (4) regular mentorship exercises in faculty meetings.

Womxn at the Forefront of ECE Research (WAFER): This is a **workshop** run by ECE graduate students in which women and nonbinary researchers and engineers present their research and experiences. The event aims to cultivate an inclusive environment for participants and speakers alike to share and learn more about research in ECE, hear others' experiences in the field (at different stages of their careers), acquire strategies to address equity and inclusivity issues, and to ultimately leave the event feeling inspired and empowered to pursue a career in ECE or other tech-related fields.

Student-led DEI Programs: These events include coffee chats focusing on research diversity and DEI-related issues, an annual larger DEI event to raise awareness of contemporary DEI issues, allocation of space for larger groups of students to practice presentations and engage across research labs, and similar gatherings that build diversity and inclusion broadly across the entire student population in UW ECE.

ECE Student Emergency Support Fund: This fund serves as an avenue of financial support for UW ECE students experiencing severe financial hardship. Students may submit requests for unexpected situations, such as health care costs, car repairs, legal fees, travel for family emergencies, stolen goods, and housing and food insecurity. The fund launched in autumn 2022 and is led by Whitney Thomas, Senior Academic Counselor for Undergraduate Programs.

ECE Student DEI Conference Travel Awards: ECE students (both undergraduate and graduate) who are planning or seeking to attend conferences that focus on underrepresented groups in engineering (Society of Women Engineers, Society Hispanic Professional Engineers, etc.) are encouraged to apply for travel assistance from the DEI travel award program. Students who are presenting DEI-related papers at or planning to attend substantive DEI activities at other conferences within ECE fields are also encouraged to apply for travel awards. This initiative is led by Stephanie Swanson, Director of Academic Services in UW ECE.

Engineering CAReS Workplace Study: The Competence, Autonomy, Relatedness Survey (CAReS) project seeks to understand how well basic psychological needs of working engineers are met in the engineering workplace. Funds provided by UW ECE support incentives to complete the survey associated with the study. In contrast to a majority of workplace surveys that emphasize barriers hindering the advancement of working engineers, the CAReS project focuses on met, unmet and thwarted needs at work. Diving deeper into underlying needs opens up a broader array of potential strategies to build belonging, persistence and productivity in the engineering workplace, especially for those who are underrepresented in engineering disciplines.

UW ECE Student Demographics

DIVERSITY

UW ECE exceeds the national average of women in the field for undergraduate and graduate degrees awarded and the number of women in tenured and tenure-track faculty positions. We continue to work to improve diversity, equity and inclusion to build a community that is welcoming, supportive and a safe place for all to learn and grow.

Diversity of Degree Recipients	B.S.	M.S.	Ph.D.	PMP
Women	19%	28%	23%	20%
Underrepresented Minorities*	9%	4%	1%	13%
Foreign Nationals	24%	70%	71%	27%
Washington Residents	68%	26%	11%	62%

** Underrepresented minorities include African American, American Indian/ Alaska Native, Latinx, and Hawaiian/Pacific Islander.*

UNIVERSITY of WASHINGTON

Enrollment Summary

Switch to Tables

Select Quarter
Fall

Select Unit / Major
Campus:
Seattle Campus

College:
College of Engineering

Department:
Electrical Engineering

Major:
All

Restrict Cohort
Student Level Sub-Group:
Undergraduate

Tuition / Fee-Based:
Tuition-Based

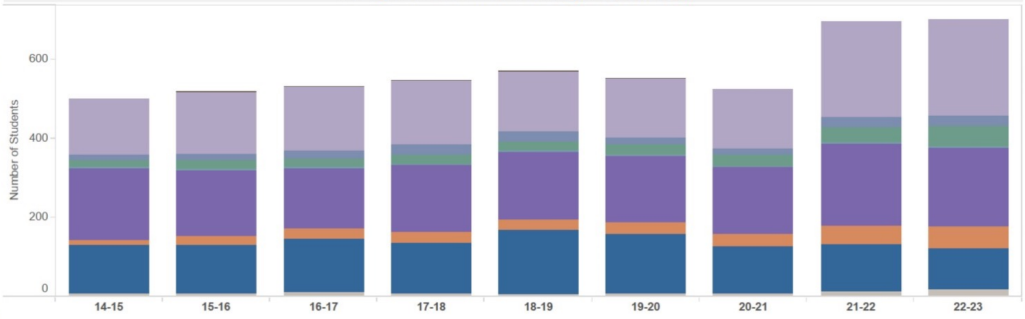
New to Level:
All

Full/Part-Time:
All

STEM Student:
All

Disability Status:
All

Fall Quarter Enrollment Trend by Race/Ethnicity

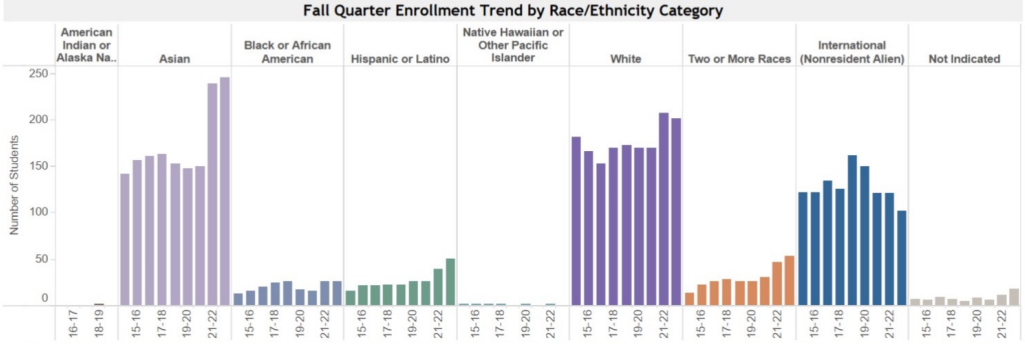


Select Breakdown
Race/Ethnicity

Select Measure
Number of Students

Legend
- American Indian or Alaska ..
- Asian
- Black or African American
- Hispanic or Latino
- Native Hawaiian or Other P..
- White
- Two or More Races
- International (Nonresident ..
- Not Indicated

Fall Quarter Enrollment Trend by Race/Ethnicity Category



UNIVERSITY of WASHINGTON

Enrollment Summary

Switch to Tables

Select Quarter
Fall

Select Unit / Major
Campus:
Seattle Campus

College:
College of Engineering

Department:
Electrical Engineering

Major:
All

Restrict Cohort
Student Level Sub-Group:
Graduate

Tuition / Fee-Based:
Tuition-Based

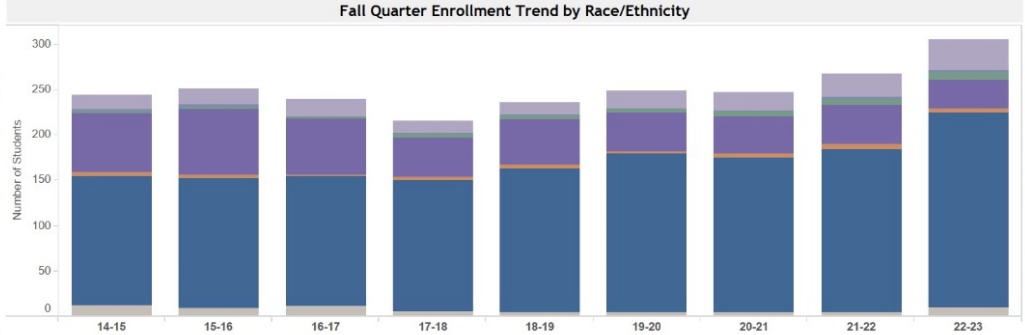
New to Level:
All

Full/Part-Time:
All

STEM Student:
All

Disability Status:
All

Fall Quarter Enrollment Trend by Race/Ethnicity

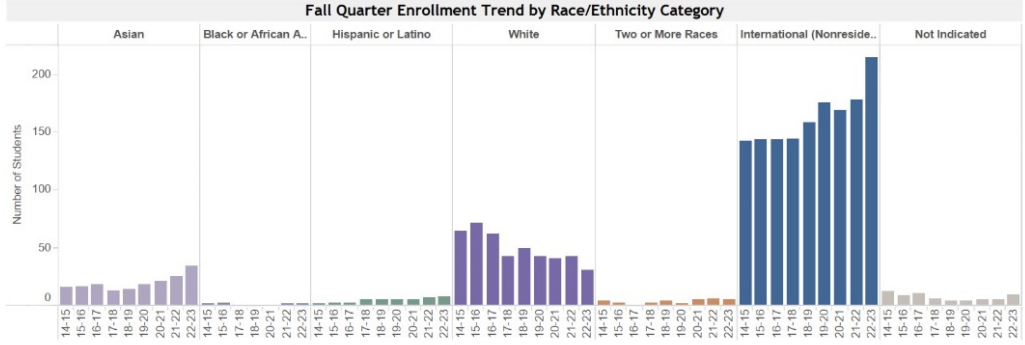


Select Breakdown
Race/Ethnicity

Select Measure
Number of Students

Legend
- Asian
- Black or African American
- Hispanic or Latino
- White
- Two or More Races
- International (Nonresident ..
- Not Indicated

Fall Quarter Enrollment Trend by Race/Ethnicity Category



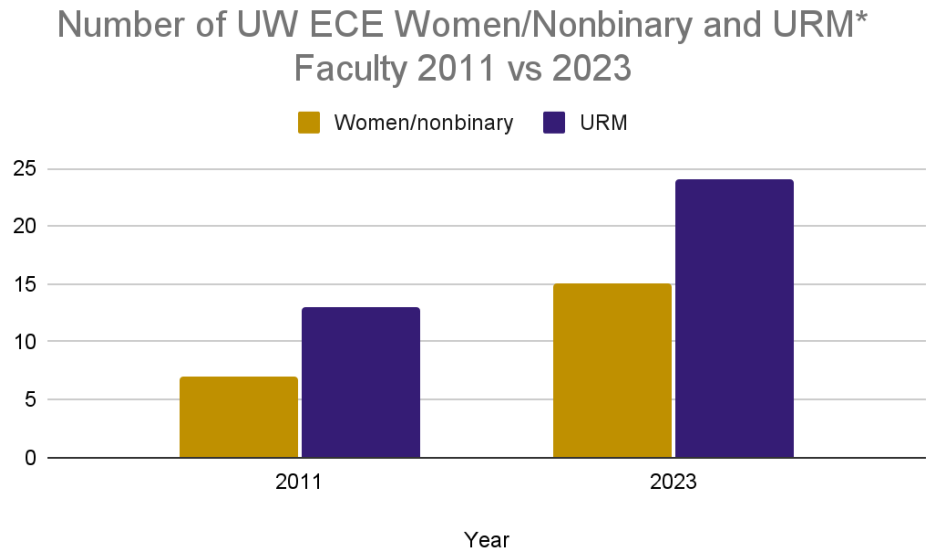
Daytime Graduate			Asian								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	16	17	19	13	14	19	21	26	35
		Number Of Students	16	17	19	13	14	19	21	26	35
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	6.60%	6.80%	7.90%	6.00%	5.90%	7.60%	8.50%	9.70%	11.40%
			Black or African American								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	2	3		1	1		1	2	2
		Number Of Students	2	3		1	1		1	2	2
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	0.80%	1.20%		0.50%	0.40%		0.40%	0.70%	0.70%
			Hispanic or Latino								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	2	3	3	5	5	5	5	7	8
		Number Of Students	2	3	3	5	5	5	5	7	8
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	0.80%	1.20%	1.30%	2.30%	2.10%	2.00%	2.00%	2.60%	2.60%
			White								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	65	72	62	43	50	43	41	43	31
		Number Of Students	65	72	62	43	50	43	41	43	31
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	26.60%	28.70%	25.80%	19.90%	21.10%	17.30%	16.50%	16.00%	10.10%
			Two or More Races								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	4	3	1	3	4	2	5	6	5
		Number Of Students	4	3	1	3	4	2	5	6	5
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	1.60%	1.20%	0.40%	1.40%	1.70%	0.80%	2.00%	2.20%	1.60%
			International (Nonresident Alien)								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	143	144	144	145	159	176	170	179	215
		Number Of Students	143	144	144	145	159	176	170	179	215
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	58.60%	57.40%	60.00%	67.10%	67.10%	70.70%	68.50%	66.80%	70.30%
			Not Indicated								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	12	9	11	6	4	4	5	5	10
		Number Of Students	12	9	11	6	4	4	5	5	10
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	4.90%	3.60%	4.60%	2.80%	1.70%	1.60%	2.00%	1.90%	3.30%

UNDERGRADUATE				American Indian or Alaska Native							
				15-16	16-17	17-18	18-19	19-20			
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc		1	1	1	2	1			
		Number Of Students		1	1	1	2	1			
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc		0.20%	0.20%	0.20%	0.30%	0.20%			
			Asian								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	142	157	161	163	153	148	150	240	246
		Number Of Students	142	157	161	163	153	148	150	240	246
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	28.40%	30.30%	30.30%	29.80%	26.70%	26.80%	28.60%	34.50%	35.00%
			Black or African American								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	13	17	21	25	26	18	17	26	26
		Number Of Students	13	17	21	25	26	18	17	26	26
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	2.60%	3.30%	4.00%	4.60%	4.50%	3.30%	3.20%	3.70%	3.70%
			Hispanic or Latino								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	17	22	22	23	23	27	27	40	51
		Number Of Students	17	22	22	23	23	27	27	40	51
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	3.40%	4.20%	4.10%	4.20%	4.00%	4.90%	5.20%	5.80%	7.30%
			Native Hawaiian or Other Pacific Islander								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	2	2	2	2	1	2	1	2	1
		Number Of Students	2	2	2	2	1	2	1	2	1
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	0.40%	0.40%	0.40%	0.40%	0.20%	0.40%	0.20%	0.30%	0.10%
			White								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	182	167	153	170	173	170	170	207	202
		Number Of Students	182	167	153	170	173	170	170	207	202
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	36.40%	32.20%	28.80%	31.10%	30.20%	30.80%	32.40%	29.80%	28.80%
			Two or More Races								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	14	23	26	29	26	27	31	47	54
		Number Of Students	14	23	26	29	26	27	31	47	54
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	2.80%	4.40%	4.90%	5.30%	4.50%	4.90%	5.90%	6.80%	7.70%

Undergraduate cont'd

			International (Nonresident Alien)								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	122	123	135	126	162	150	121	121	103
		Number Of Students	122	123	135	126	162	150	121	121	103
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	24.40%	23.70%	25.40%	23.00%	28.30%	27.20%	23.10%	17.40%	14.70%
			Not Indicated								
			14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23
Number of Students	Fall	Measure 06-10-11 Calc along Academic Year, Primary Breakdown 10-11 Calc	8	7	10	8	6	9	7	12	19
		Number Of Students	8	7	10	8	6	9	7	12	19
		Percent of Students along Academic Year, Primary Breakdown 10-11 Calc	1.60%	1.30%	1.90%	1.50%	1.00%	1.60%	1.30%	1.70%	2.70%

UW ECE Faculty Diversity



The graph above compares the number of self-identified women or nonbinary faculty members and underrepresented minorities in the ECE Faculty from 2011 to 2023.

2011 UW ECE faculty statistics

- 7 women faculty members
- 13 URM faculty members *(includes those of Asian descent*)*
- Out of 45 faculty members, total

2023 UW ECE faculty statistics

- 15 women / nonbinary faculty members
- 24 URM faculty members *(includes those of Asian descent*)*
- Out of 52 faculty members, total

** The UW's current definition for URMs (see below) does not include people from Asian descents, with the exception of Hawaiian/Pacific Islander.*

SUPPLEMENTAL APPENDIX

APPENDIX E: STUDENT SURVEYS AND FEEDBACK

Student Advisory Council

The UW ECE student population has created a Student Advisory Council (SAC) that meets regularly with the ECE Department Chair and holds town hall meetings.

SAC Mission Statement

The main goal of the ECE-SAC is to be a platform for students to voice concerns, serve as a communication channel between the student body and the department, and provide resources for building a better community in the whole UW ECE student body. Since UW ECE is a large department, we have yet to find an efficient way to (1) directly voice students' concerns to the Department, and (2) disseminate all resources available from UW ECE to students. The SAC differs from IEEE/HKN and the GSA in several aspects: SAC's main focus will be not only on professional development (IEEE/HKN – mainly undergrads) and social gathering (GSA – exclusive to grads) but also community building and creating a sustainably welcoming environment for the whole student body.

We have identified four initial primary areas of interest: diversity (creating a welcoming community for students from diverse groups — grads and undergrads; underrepresented minorities), accessibility (learning about and addressing student accessibility needs), student wellness (knowledge dissemination regarding health and wellness resources, communicating and addressing these concerns), and support for teaching (collecting feedback from students and TAs, addressing emergent issues). These issues have been shown to be of critical importance to general students' wellbeing. The SAC will hold monthly townhalls (discussion fora) for students to voice their concerns, and work with the department to address these issues. This approach follows a recent successful model from the SAC in the Allen School.

APPENDIX F: STUDENT COURSE EVALUATIONS

IASystem
The Course Evaluation Standard

University of Washington, Seattle
College of Engineering
Electrical & Computer Engineering
Autumn 2013 - Autumn 2023

Department Ratings Summary

	Electrical & Computer Engineering			College of Engineering			University of Washington, Seattle		
	No of Evaluations	Mean(SD) of Combined Medians	Mean(SD) of Adjusted Combined Medians	No of Evaluations	Mean(SD) of Combined Medians	Mean(SD) of Adjusted Combined Medians	No of Evaluations	Mean(SD) of Combined Medians	Mean(SD) of Adjusted Combined Medians
SUMMATIVE ITEMS:									**0 = Very Poor, 5 = Excellent**
Lower level, Faculty	141	4.0 (0.67)	4.0 (0.60)	835	4.0 (0.61)	4.1 (0.59)	13779	4.3 (0.61)	4.3 (0.54)
Lower level, TAs	645	4.0 (0.81)	4.0 (0.74)	1851	4.1 (0.73)	4.1 (0.69)	38173	4.2 (0.66)	4.2 (0.62)
Upper level	1337	4.1 (0.72)	4.0 (0.69)	7398	4.1 (0.73)	4.1 (0.70)	47515	4.2 (0.67)	4.2 (0.62)
Graduate level	1155	4.2 (0.63)	4.0 (0.60)	4787	4.2 (0.65)	4.1 (0.62)	44553	4.3 (0.66)	4.2 (0.63)
TOTAL	3278	4.1 (0.71)	4.0 (0.67)	14871	4.1 (0.70)	4.1 (0.67)	144020	4.2 (0.66)	4.2 (0.62)
Course as a whole was:									**0 = Very Poor, 5 = Excellent**
Lower level, Faculty	141	3.9 (0.70)	4.0 (0.62)	835	3.9 (0.60)	4.0 (0.58)	13776	4.2 (0.63)	4.2 (0.54)
Lower level, TAs	645	3.9 (0.84)	3.9 (0.76)	1851	4.0 (0.75)	4.0 (0.71)	38161	4.1 (0.68)	4.1 (0.63)
Upper level	1336	4.0 (0.72)	4.0 (0.69)	7397	4.0 (0.74)	4.0 (0.71)	47505	4.2 (0.69)	4.1 (0.64)
Graduate level	1155	4.1 (0.65)	4.0 (0.61)	4786	4.1 (0.67)	4.0 (0.64)	44544	4.2 (0.69)	4.1 (0.66)
TOTAL	3277	4.0 (0.72)	3.9 (0.67)	14869	4.0 (0.72)	4.0 (0.68)	143986	4.2 (0.68)	4.1 (0.64)
Instructor's effectiveness in teaching the subject matter was:									**0 = Very Poor, 5 = Excellent**
Lower level, Faculty	115	3.9 (0.85)	4.0 (0.78)	809	4.0 (0.74)	4.1 (0.72)	13697	4.3 (0.69)	4.3 (0.63)
Lower level, TAs	642	4.0 (0.91)	3.9 (0.85)	1844	4.1 (0.80)	4.0 (0.78)	38134	4.2 (0.73)	4.2 (0.69)
Upper level	1296	4.0 (0.81)	4.0 (0.79)	7297	4.1 (0.82)	4.1 (0.79)	47232	4.2 (0.74)	4.2 (0.70)
Graduate level	1152	4.2 (0.70)	4.0 (0.66)	4755	4.2 (0.74)	4.1 (0.71)	44408	4.3 (0.73)	4.2 (0.70)
TOTAL	3205	4.1 (0.80)	4.0 (0.76)	14705	4.1 (0.79)	4.1 (0.76)	143471	4.2 (0.73)	4.2 (0.69)
Expected grade relative to other courses you have taken:									**1 = Much Lower, 7 = Much Higher**
Lower level, Faculty	141	5.0 (0.55)		835	5.1 (0.68)		13668	5.1 (0.75)	
Lower level, TAs	644	5.1 (0.76)		1849	5.0 (0.77)		37953	5.0 (0.77)	
Upper level	1336	5.0 (0.68)		7385	4.8 (0.75)		46326	5.0 (0.74)	
Graduate level	1154	5.2 (0.79)		4782	5.0 (0.74)		42950	5.0 (0.74)	
TOTAL	3275	5.1 (0.74)		14851	4.9 (0.75)		140897	5.0 (0.75)	
Amount of effort to succeed relative to other courses you have taken:									**1 = Much Lower, 7 = Much Higher**
Lower level, Faculty	141	5.5 (0.55)		835	5.1 (0.75)		13668	5.2 (0.69)	
Lower level, TAs	644	5.5 (0.67)		1849	5.3 (0.84)		37953	5.2 (0.70)	
Upper level	1336	5.5 (0.85)		7385	5.3 (0.84)		46332	5.4 (0.76)	
Graduate level	1154	5.7 (0.76)		4781	5.4 (0.82)		42952	5.4 (0.85)	
TOTAL	3275	5.6 (0.78)		14850	5.3 (0.83)		140905	5.3 (0.77)	
Hours spent per week per credit including class sessions:									
Lower level, Faculty	134	2.3 (0.41)		789	2.1 (0.49)		12048	1.7 (0.64)	
Lower level, TAs	249	2.2 (0.60)		556	2.3 (0.86)		11673	1.8 (0.76)	
Upper level	1086	2.6 (0.87)		4898	2.6 (0.86)		35972	2.1 (0.95)	
Graduate level	1136	2.9 (1.28)		4599	2.7 (1.09)		40213	2.4 (1.30)	
TOTAL	2605	2.7 (1.06)		10842	2.6 (0.96)		99906	2.1 (1.09)	
Grade expected in this course:									**0.00 to 4.00**
Lower level, Faculty	141	3.5 (0.14)		834	3.6 (0.22)		13645	3.6 (0.29)	
Lower level, TAs	644	3.5 (0.27)		1848	3.5 (0.31)		37936	3.5 (0.33)	
Upper level	1336	3.6 (0.21)		7362	3.5 (0.25)		46228	3.6 (0.29)	
Graduate level	1150	3.7 (0.22)		4775	3.6 (0.25)		42847	3.7 (0.35)	
TOTAL	3271	3.6 (0.23)		14819	3.6 (0.26)		140656	3.6 (0.33)	

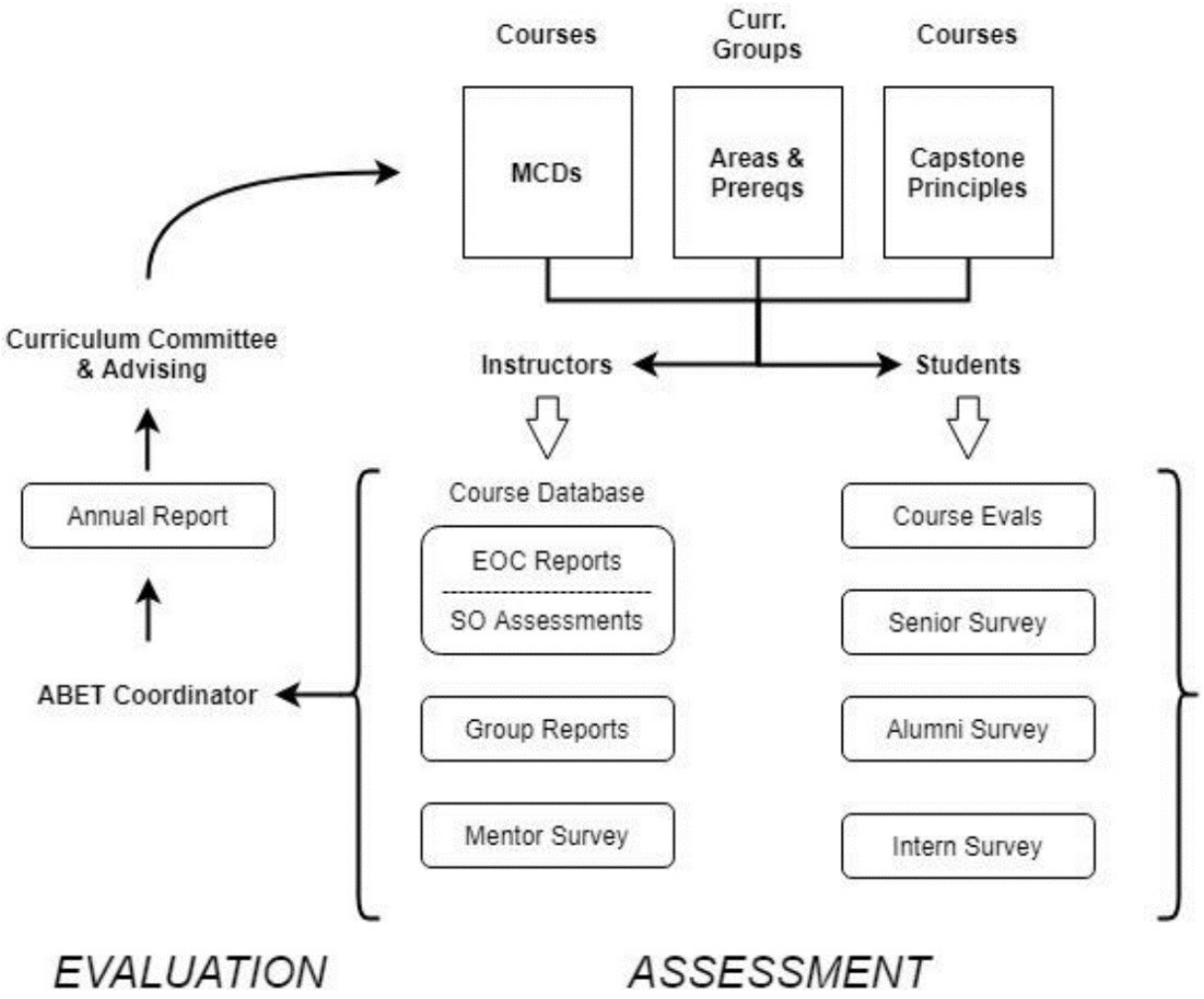
Notes: Means are calculated over all class level evaluation medians for the specified item and time period. Joint and co-taught course statistics are reported for highest course level and highest instructor rank.

Printed: 10/2/23
Page 1 of 1

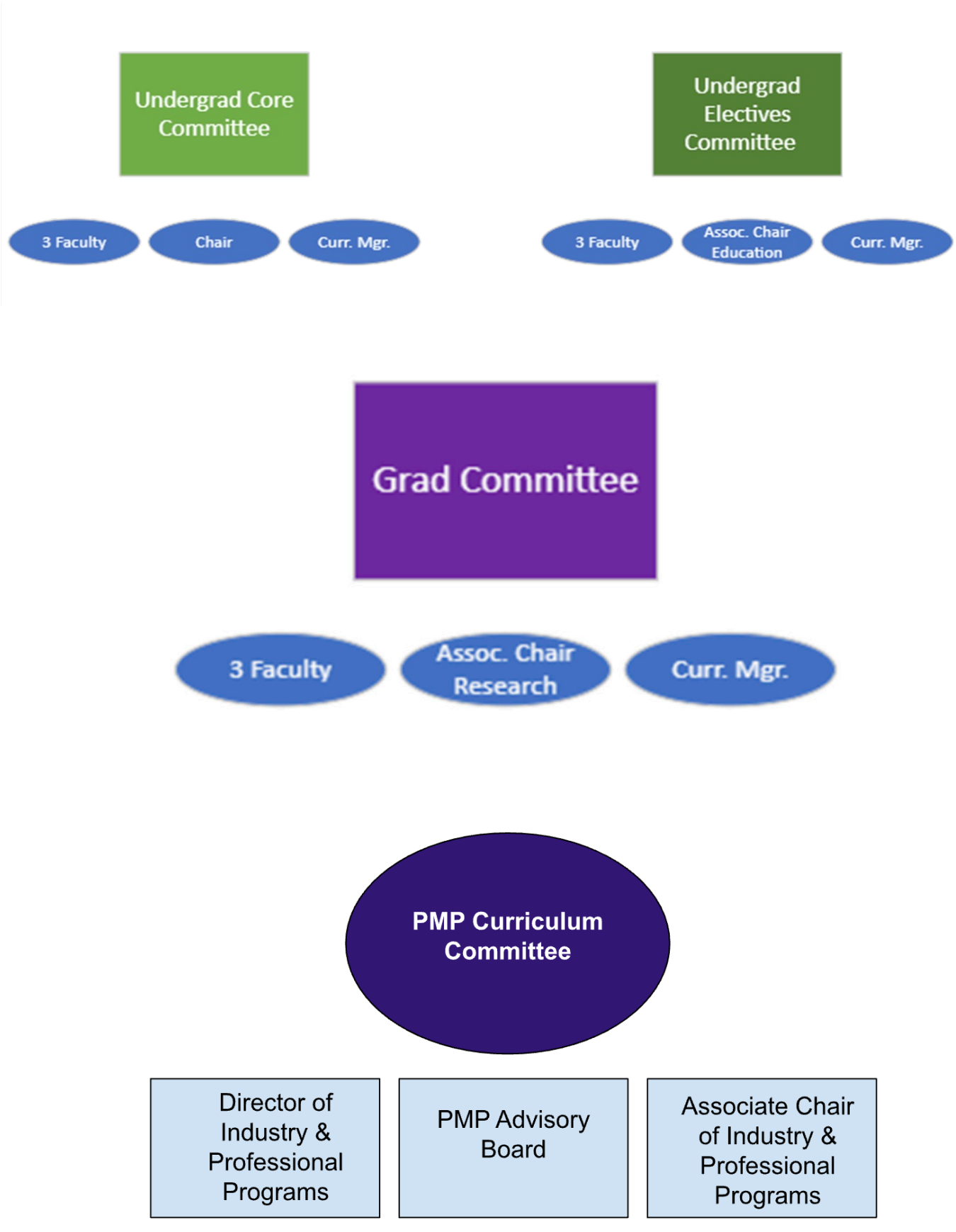
APPENDIX G: CORE CURRICULUM REVIEW PROCESS

Core Curriculum Review Process

The Core Curriculum Review Process is overseen by the UW ECE Curriculum Committee and Advising. The following flow chart shows the process for a continuous cycle of course evaluation and assessment of the class delivery and student experience.



Curriculum Committees



APPENDIX H: ADMISSIONS, ENROLLMENT AND GRADUATION DATA

FIGURE 3: NUMBER OF APPLICANTS - ALL DEGREE PROGRAMS 2014-2023

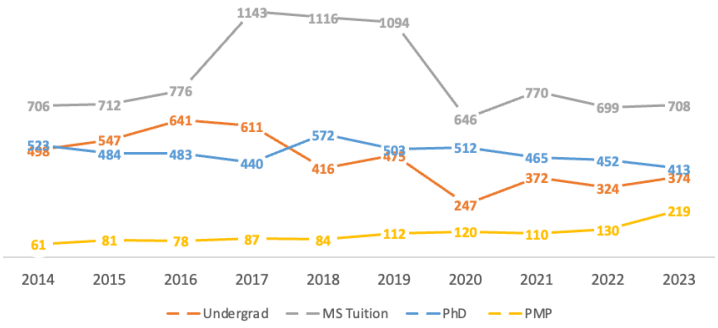


FIGURE 4: STUDENT ENROLLMENT - ALL PROGRAMS 2014-2022 AUTUMN QUARTER

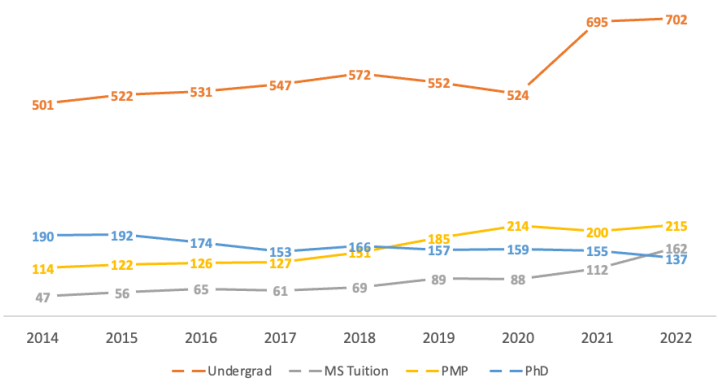
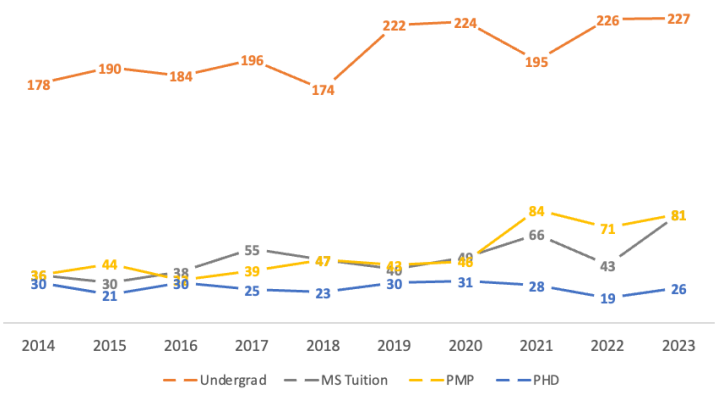
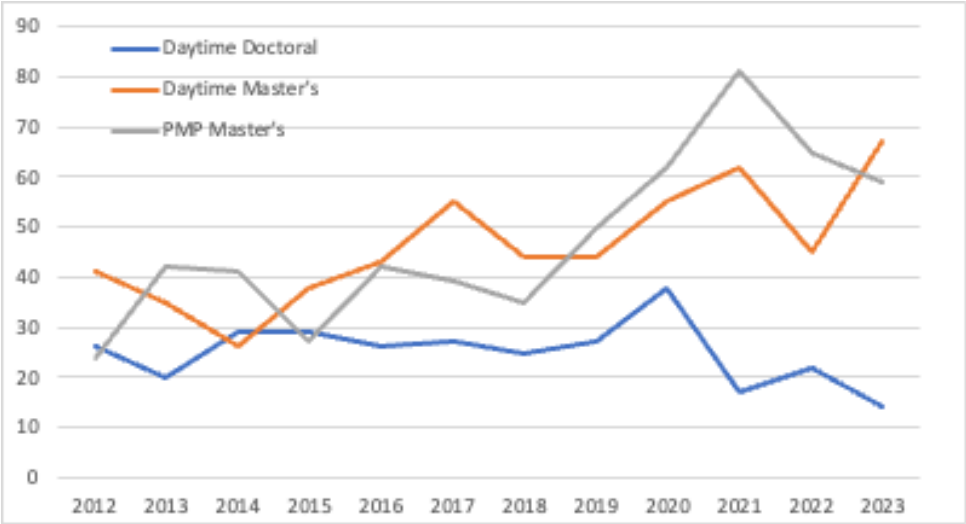


FIGURE 5: NUMBER OF DEGREES AWARDED - ALL PROGRAMS 2014-2023

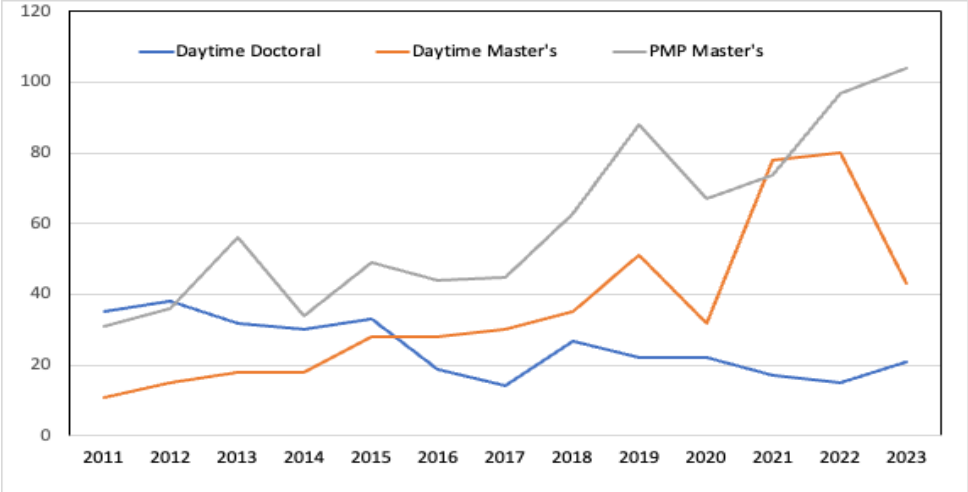


Graduate Programs

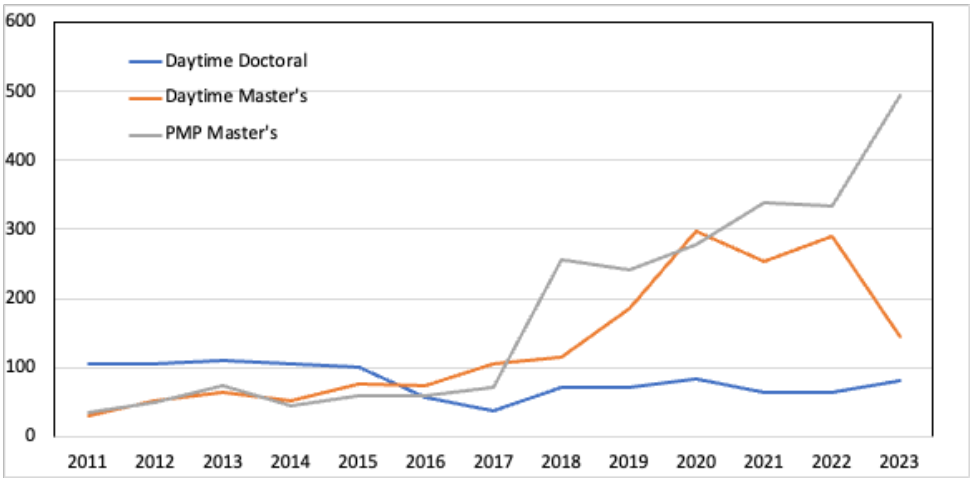
Graph 1: Graduate Degrees Awarded 2013- 2023



Graph 2: Admissions to the graduate programs



Graph 3: Offer of Admissions to the graduate programs



APPENDIX I: POST DOCS

Year	Post Doc Count*	Average Salary
2019-2020	16	$64,848.00
2020-2021	20	$66,600.00
2021-2022	18	$67,692.00
2022-2023	23	$71,520.00

*Post Doc count in October each year

Current Postdoctoral Scholars

Postdoctoral Scholar	Start Date	End Date	PhD Earned From	PhD Earned Date
LI, BINGZHAO	12/19/22	12/31/23	University of Washington	1/1/19
Kala, Abhinav	4/4/23	4/3/24	UT - Austin	1/1/22
Mukherjee, Saswata	4/22/21	4/21/24	UC Berkeley	1/1/23
Sommer, David	6/1/20	5/31/24	UC Berkeley	
Zhang, Carol	6/16/22	6/15/24	UW	1/1/19
Ma, Zixiao	6/16/23	6/15/24	UW	1/1/22
HUANG, LUOCHENG	6/16/23	6/16/24	Princeton	1/1/23
Shrivastav, Siddhi	6/23/23	6/22/24	Technische Universität München (Germany)	1/1/23
Fang, Jie	6/26/23	6/25/24	USC	1/1/23
Shanker, Aamod	8/16/21	8/15/24	Tata Institute of Fundamental Research (India)	1/1/23
Choi, Minho	9/1/22	8/31/24	Worcester Polytechnic Institute	
Bowers, Brant	9/1/22	8/31/24	Iowa State University	1/1/22
Voina, Doris	9/16/22	9/15/24	UW	1/1/22
Otto, Sam	10/1/22	9/30/24	UW	1/1/22
Niu, Luyao	1/1/21	12/31/24	Stanford	1/1/22
Oesinghaus, Lukas	2/1/23	1/31/25	Johns Hopkins University	1/1/19
Audhkhasi, Romil	4/1/23	3/31/25	Korea Advanced Institute of Science and Technology (KAIST)	1/1/22
SAHABANDU, DINUKA	6/19/23	6/18/25	UW	1/1/23

APPENDIX J: OVERVIEW OF RESEARCH AREAS

In this appendix, we provide a brief overview of the major research areas UW ECE faculty are currently engaged with.

Biosystems

Biosystems research in UW ECE is a highly collaborative endeavor. Our faculty focus on four areas of Biosystems research: synthetic and systems biology, neural engineering, biomedical devices, and mobile health. Many of our faculty hold secondary appointments and work closely with collaborators from other departments, including Bioengineering, Computer Science and Engineering, Biology, Genome Sciences, Applied Mathematics, and the UW Medical Center. Our Biosystems faculty work with many cross-disciplinary institutes such as the eScience Institute, the Center for Neurotechnology, the Institute for Protein Design, the Bloedel Hearing Research Center and the University of Washington Institute for Neuroengineering.

Computing and Networking

UW ECE's Computer and Network research includes computer architecture and computer system engineering, VLSI, embedded computing, wireless networks, and wireless communication research. Several of UW ECE's Computers and Networking faculty hold joint and secondary appointments in computer science and engineering and teach jointly in UW ECE and the Paul G. Allen School of Computer Science & Engineering.

Data Science

Data Sciences are fundamentally transforming nearly every area of engineering, science, and society. UW ECE faculty are making fundamental contributions to many different areas of data sciences, including machine learning, AI, optimization, information theory, computer vision, and speech and natural language processing. Many of our data sciences faculty hold secondary appointments in applied mathematics, computer science and engineering, bioengineering, and other departments, and are active participants in cross-disciplinary institutes such as UW's eScience Institute, the Allen Institute of Artificial Intelligence and the Bloedel Hearing Research Center.

Electronic, Photonic, and Integrated Quantum Systems (EPIQS)

Electronic, Photonic, and Integrated Quantum Systems (EPIQS) research at UW ECE includes quantum electronics, nanoscale optics, novel photon sources, and optical metamaterials, with applications in quantum science, imaging, biomedical sensing, and other areas. Our faculty work closely with colleagues in the Department of Physics and several faculty hold joint and secondary appointments in Physics. Many UW ECE faculty are members of the Institute for Nano-Engineered Systems (NanoES), a NSF National Nanotechnology Coordinated Infrastructure (NNCI) node that hosts the Washington Nanofabrication Facility (WNF) to support academic institutions and companies throughout the Pacific Northwest and beyond in designing and fabricating nanoscale materials, structures, devices and systems.

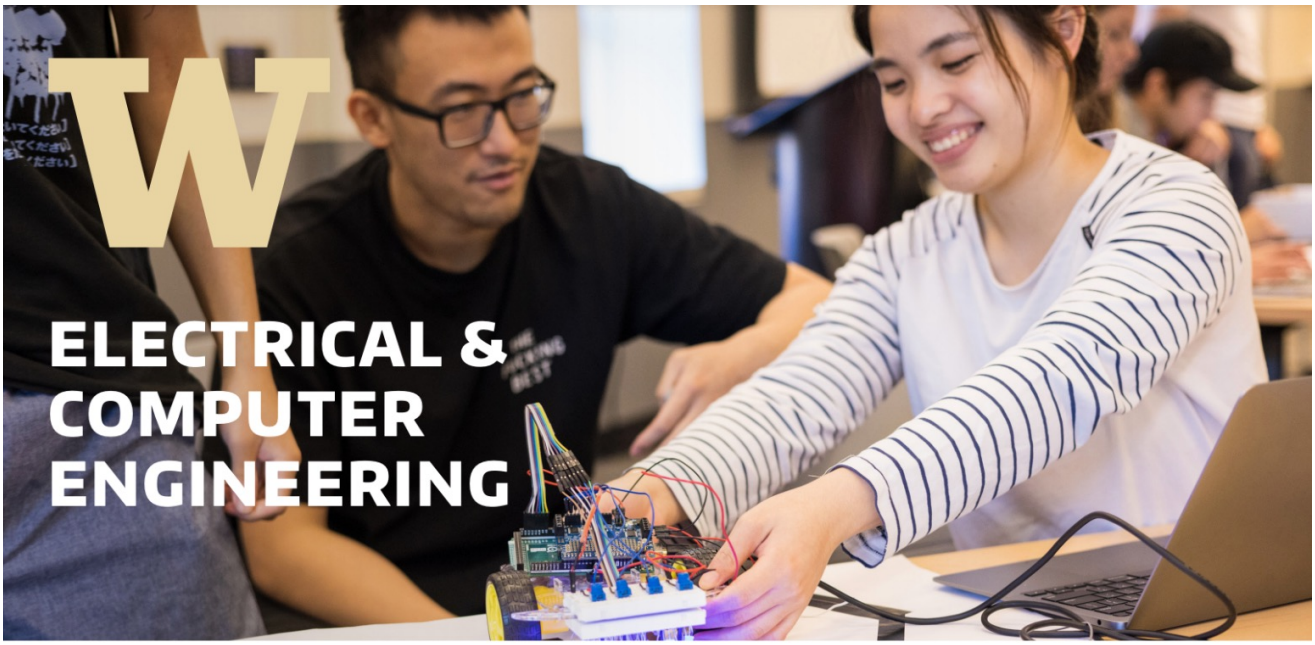
Power and Energy Systems

Power and Energy Systems research at UW ECE includes interdisciplinary work at all energy scales, ranging from nanowatts to gigawatts. Our faculty are active in smart grid, integration of renewable energy sources, grid security, energy economics, and solar and electromagnetic energy harvesting. UW ECE faculty are leaders in the Clean Energy Institute and work with local utilities and grid systems operators.

Robotics and Controls

UW's Robotics and Controls researchers are leaders in the areas of surgical and bio-robotics, haptics, smart cities, and network control systems. They collaborate with and hold secondary appointments in computer science and engineering, bioengineering, and the UW Medical Center, and are active participants in research centers, such as the Center for Neurotechnology.

APPENDIX K: 2023 ECE FACT SHEET



At UW ECE, we cultivate innovation and inspire through high-impact research. We educate and develop tomorrow's leaders to help solve the world's most pressing challenges.

Our position as a top-ranked electrical and computer engineering department provides our faculty and student body a vibrant learning culture. Students receive a robust education through a strong technical foundation, group project work and hands-on research opportunities. Our faculty work in dynamic research areas collaborating with academia, industry and government institutions.

UW ECE continues to lead in cutting-edge science and technology while advancing socially-responsible innovation. Our innovation ecosystem is critical in promoting an entrepreneurial mindset in our teaching, and is strengthened through diverse partnerships that address complex global challenges in health, energy, technology and the environment.

DIVERSITY

UW ECE exceeds the national average of women in the field for undergraduate and graduate degrees awarded and the number of women in tenured and tenure-track faculty positions. We continue to work to improve diversity, equity and inclusion to build a community that is welcoming, supportive and a safe place for all to learn and grow.

Diversity of Current Students *(Winter 2023)*	B.S.	M.S.	Ph.D.	PMP
Women	20%	30%	23%	20%
Underrepresented Minorities*	14%	3%	2%	8%
Foreign Nationals	14%	71%	61%	50%
Washington Residents	76%	17%	12%	39%

** Underrepresented minorities include African American, American Indian/*

DEPARTMENT HIGHLIGHTS

#1
STARTUP GENERATOR OF ALL UW DEPARTMENTS FOR OVER 10 YEARS
Source: *UW CoMotion, 2023*

#16
RANKED GRADUATE ECE PROGRAM IN THE U.S.
Source: *U.S. News & World Report, 2024*

18
FACULTY WITH RESEARCH PUBLICATIONS CITED OVER 1,000 TIMES

100%
OF ADMITTED PH.D. STUDENTS RECEIVE 4 ACADEMIC YEARS OF FUNDING

UW ECE is the **largest department** in the College of Engineering with **1,214 students.**

Electrical Engineering is the most popular graduate degree major for incoming UW students.
Source: *UW Office of the Registrar*

TOP-TIER EDUCATION

UNDERGRADUATE EDUCATION

Bachelor of Science in Electrical & Computer Engineering (BSECE) degree prepares students for the workforce with a strong grounding in fundamentals and opportunities for internships, leadership roles, and hands-on research with renowned faculty in one of 40 department labs.

The five-year combined B.S.-M.S. program provides ambitious undergraduates with a seamless transition to graduate studies following completion of their bachelor's degree.

STUDENT INNOVATION

The ENGineering INnovation and Entrepreneurship (ENGINE) capstone program helps undergraduate students build and strengthen their entrepreneurial and networking skills. Students are mentored by faculty and industry sponsors while learning about innovation readiness, startups and new ventures through exciting year-long, industry-sponsored projects.

PROJECT-BASED LEARNING: AIRCRAFT SOFTWARE CONFIGURATION TOOL

An ENGINE team partnered with Alaska Airlines on a web portal to efficiently load computer software onto airplanes. The tool will be implemented across Alaska Airlines' entire fleet.

Our graduates find employment at top companies in the region, including: Amazon • Apple • Boeing • Facebook • Google • Intel • Microsoft • T-Mobile

GRADUATE EDUCATION

UW ECE graduate education prepares students to address pressing challenges in healthcare, energy, the environment, communication and more. Students receive unique opportunities to interact with technology companies and a vibrant startup community.

The Ph.D. Program prepares students for work in academia or industry as independent researchers and scholars. It is the highest degree awarded in the field. Students work closely with distinguished faculty on research and pursue their own innovative projects, preparing them to make a difference in the world.

The Daytime Master's Program (MSEE) provides advanced preparation for professional practice through a highly customizable, coursework-based or thesis curriculum. The coursework option is typically selected by students wanting to work at a higher level in the industry, while the thesis option involves more in-depth research and is designed for students with the passion of pursuing a Ph.D.

The Professional Master's Program (PMP) leads to an MSEE and offers an exciting industry-responsive curriculum. PMP students include recent undergraduates seeking more technical depth, working engineers who want to advance their career, and professionals from other backgrounds seeking to enter the field. Students explore cutting-edge technical topics and university research, giving them the expertise to drive innovation.

- The Juris Doctorate and Master of Science in Electrical Engineering (JD/MSEE) program
- Graduate Data Science Option (DSO)
- The Certificate in Machine Learning and Deep Learning: Application Frontiers
- The Certificate in GPU-Accelerated Computing & Visualization

OUR STUDENTS *(data from Autumn 2022)*

700 Undergraduate students

232 Bachelor's degrees awarded

514 Graduate students

96 Master's degrees awarded

46 Professional Master's Program (PMP) degrees awarded

17 Ph.D. degrees awarded

UW ECE INNOVATION

With more spinouts than any other department at the UW (20% of the University's total over the past 10 years), UW ECE faculty and students have founded or been in leadership roles at nearly 60 startup companies, including:

A-Alpha Bio – Accelerating drug development with synthetic biology and next-generation sequencing

Jeeva Wireless – Reimagining connectivity with low-power backscatter technology

MicrobiomX – Providing rapid, personalized restorative gut therapy through microbiota transplants

Olis Robotics – Making robots smarter through progressive autonomy

OneRadio – Changing the way we access the radio-frequency spectrum

Parse Biosciences – Providing scalable single cell RNA-sequencing solutions

Proprio – Using computer vision and machine learning to enhance human and computer performance

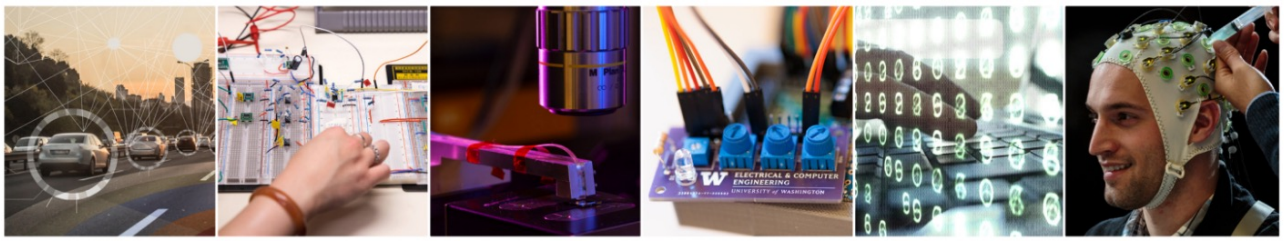
Tunoptix, Inc. – Tunable metasurface optics for machine vision and AR/VR applications

ThruWave – Providing state-of-the-art millimeter-wave (mmW) 3D imaging

WiBotic – Providing wireless power solutions for robotics

UW ECE since FY2013:

24% OF ALL UW ENGINEERING PATENTS	**748** NEW PATENTS FILED
57 COMPANIES THAT HAVE LICENSED ECE TECHNOLOGIES	**181** INDIVIDUAL LICENSED TECHNOLOGIES



RESEARCH

RESEARCH AREAS

Biosystems – Synthetic biology, neural engineering, medical devices, mobile health

Computing & Networking – Computer engineering and architecture, VLSI, embedded systems, wireless communication, cybersecurity

Data Science – Machine learning, statistical signal processing, speech and natural language processing, computer vision and image processing

Electronic, Photonic, and Integrated Quantum Systems (EPIQS) – Quantum electronics, nanoscale optics, materials and structure, MEMs, novel photon sources, and optical metamaterials

Power & Energy Systems – Smart Grid, integration of renewable energy sources, grid security, power system economics, energy harvesting

Robotics & Controls – Surgical biorobotics, smart cities, haptics, network control systems

In FY22, UW ECE received $23M in research awards.

EMERGING STRATEGIC RESEARCH AREAS

Quantum systems promises to solve data intensive problems regular computers can't handle by increasing the capacity of quantum computing systems from its current state of 100 qubits to 1,000 qubits, with applications in cybersecurity, drug development, traffic optimization, financial modeling and weather forecasting.

Sustainable energy systems focus on expanding the capacity of power grids to reliably integrate renewable energy from solar and wind into existing systems. In addition to our work on smart grids, we work on grid security, energy economics, and solar and electromagnetic energy harvesting.

Neuroengineering explores advanced brain-computer interfaces that help the body heal itself after serious injuries and conditions such as stroke, spinal cord injury and Parkinson's disease. UW ECE partners with surgeons in UW Medicine and ethicists in the UW College of Arts & Sciences for guidance on ethical considerations in neurotechnology.

FACULTY

Our department's reputation is based on the quality of our faculty and their contributions to education, research and leadership. UW ECE faculty are frequently honored nationally and internationally for excellence. Attracting, retaining, and rewarding faculty remains one of our highest priorities.

47 Core Faculty
5 Assistant Research / Teaching Faculty
104 Affiliate Faculty
38 Adjunct Faculty

FACULTY ACHIEVEMENTS

29 IEEE Fellows	**7** Sloan Fellows
1 MacArthur Fellow	**5** NAE members

CENTERS AND LABS

UW ECE faculty lead or participate in interdisciplinary research centers across campus, and direct laboratories at the cutting-edge of the field.

- AMP Lab – Amplifying Movement and Performance
- The UW Biofabrication Center (BIOFAB)
- Clean Energy Institute (CEI)
- Center for Neurotechnology (CNT)
- UW ECE Center on Satellite Multimedia and Connected Vehicles (CMMB Vision)
- eScience Institute
- Institute for Nano-Engineered Systems (NanoES)
- Molecular Engineering and Sciences Institute (MolES)
- Northwest Quantum Nexus (NQN)
- QuantumX Initiative
- U.S. Dept. of Energy PNW National Lab (PNNL)
- Washington Nanofabrication Facility (WNF)

TRAILBLAZERS

UW ECE trailblazers are honored for the work they do to effect positive change in the world. Our academic pioneers' far-reaching research has created important foundations for other electrical and computer engineering scholars to build upon, while our industry leaders' ground-breaking enterprises have provided important solutions that improve lives.

Elaine Chang (BSEE '93) has served in various leadership positions at Amazon China, including leading the launch of Amazon Prime in China. Now managing director for AWS Greater China, she is responsible for business strategies, and industry and government partnerships.

Keith Rattie (BSEE '76) has a 40-year-career in the oil and gas industry, serving as CEO of Questar Corp. and general manager of Chevron's international gas unit. He has helped shape utility, power and energy legislation representing industry at congressional hearings.

John MacLeod (BSEE '64) designed NASA's Apollo ground communications network, headed Sklylab's solar telescope operations and held a technical management role for the Space Shuttle communications and data systems. He later founded two companies that introduced nationwide and international text messaging.

Gabriela A. Gonzalez (BSEE '92) is the director of Intel's STEM Education Research Office and former deputy director of the Intel Foundation, focused on K-12 STEM education for underserved communities. As a program manager at Intel Labs, she steered program and curriculum development at research universities around the world.

Alanson Sample (Ph.D. '11) led The Walt Disney Company's work in robotics and artificial intelligence. As an associate professor at the University of Michigan, he applies novel approaches to electromagnetics, RF and analog circuits, and embedded systems.

Yael Hanein (Postdoc) is an associate professor and VP of NanoRetina, a startup company developing artificial vision. Yael designs electronic nanodevices that interface with the brain, novel materials for artificial retina applications, and skin electronics for electrophysiology.

Pamela Bhatti (MSEE '93) is an associate professor and associate chair at Georgia Tech. She researches hearing loss through focused neural stimulation and novel implantable sensors, as well as cardiac imaging to assess and monitor cardiovascular disease.

Alhussein Abouzeid (MSEE '99, Ph.D. '01) is the founding director of WiFiUS, an international NSF-funded virtual institute on wireless systems research. He builds dynamic wireless networks with applications in environmental sensing and disaster response.

"Electrical and computer engineering technology has become ubiquitous, defining how we work, how we live, and even what it means to be human. UW ECE means more than just exploring amazing new technologies; it means shaping the future of humanity."

— UW ECE Professor and Chair Eric Klavins

ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY of WASHINGTON

Box 352500, Seattle, WA 98195–2500 | ece.uw.edu | 206-221-5270

APPENDIX L: SPACE STUDY

An extensive space study of the Electrical Engineering Building was completed in 2013-2014. Materials that were published from this space study can be found on the following pages:

2013 Space Use Study - Full Building, Draft

https://drive.google.com/file/d/1Kr6LVOQjupos_hiiyPvQnnWHl3n996pH/view?usp=drive_link

2014 1st Space Study, Final

https://drive.google.com/file/d/1lRo54bWIEuUUrEaUdj-HkJkZvVpbnRli/view?usp=sharing

2014 2nd Floor Space Plans

https://drive.google.com/file/d/1LTV490sn6uerKP-I2ITF8URLyyWUnQ4C/view?usp=drive_link

APPENDIX M: STUDENT LEARNING GOALS AND OUTCOMES

Describe student learning goals and outcomes (i.e., what are the students expected to learn? What are the students expected to be able to do as a result of the education provided?)

The objective of the UW Department of Electrical & Computer Engineering is to produce alumni who contribute to our society and to the economic base of our region, our nation and the world to the best of their abilities. We recognize that our students have very diverse interests and talents, and although the majority may find employment in one of the many specialties or interdisciplinary activities in industry or academia to which electrical and computer engineers traditionally gravitate, we also expect some of our alumni to build careers in business, law, health care, government or other professions. Regardless of the intended career, our educational objective is to have them use the analytical discipline, problem-solving experience and collaborative skills of their undergraduate education in creative endeavors as professionals and to seize opportunities to learn new skills and advance their careers through continuing education. By the time of graduation, we expect our graduates to have demonstrated abilities in:

- **Problem Solving** — an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
- **Design** — an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental and economic factors
- **Communication** — an ability to communicate effectively with a range of audiences
- **Responsibility** — an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
- **Teamwork** — an ability to function effectively on a team in which members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
- **Experimentation** — an ability to develop and conduct appropriate experimentation, analysis, and interpretation of data; and use engineering judgment to draw conclusions
- **Learning** — an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Our undergraduate (BSEE and BSECE) Program Educational Objectives are to serve the needs of our students, faculty and regional industry by producing graduates who have acquired foundational knowledge and skills through a comprehensive curriculum and immersive educational and developmental experience. Within a few years post-graduation, we expect our graduates to:

- **Contribute** — to have successfully and smoothly transitioned into becoming a contributing member of the professional workforce
- **Master** — to have developed the skills, habits and professional expertise which will carry them through their life and career
- **Evolve** — to rapidly grow and adapt to their fast-changing world
- **Innovate** — to embrace change, challenge, growth, inquiry, creativity and diversity
- **Lead** — to rise to levels of leadership and impact in their chosen specialties that reflect a meaningful understanding of equality and inclusivity in the workplace
- **Steward** — to responsibly apply their problem solving, critical thinking, communication, and management skills to the benefit of themselves, their communities, their region and the world at large

Our graduate (MS and Ph.D.) programs prepare students to impact the future and address pressing challenges in

health care, energy, the environment, security, and more.

Our MS programs (daytime and PMP) provide advanced preparation for professional practice through a highly customizable, coursework-based, or thesis curriculum. The coursework option is typically selected by students who want to work at a higher level in industry, while the thesis option, which involves more in-depth research, is designed for students with a passion for pursuing a Ph.D.

The Ph.D. program prepares students for work in academia or industry as independent researchers and scholars. It is the highest degree awarded in the field. Students work closely with distinguished faculty on research and pursue their own innovative projects, preparing them to make a difference in the world.

In addition to these degrees, the Department also offers three graduate certificate programs:

- **Certificate in Machine Learning and Deep Learning**
- **Certificate in GPU-Accelerated Computing and Visualization**
- **Certificate in Applied Cybersecurity Engineering**

These are hands-on project-based programs, with the same learning outcomes, goals, and student evaluations of our Professional Master's Program courses. Details about their content can be found **here.**

Graduates with a degree in electrical and computer engineering find employment in industries such as computer software, embedded systems, digital design, computer manufacturing, power systems, communications, robotics, biotechnology, space, consumer electronics, and more. Positions can be found focusing on the research, design, and testing of new products; technical sales and marketing; business consulting; and intellectual property.

Provide an overview of the ways in which the unit evaluates student learning (e.g., classroom and/or performance-based assessment, capstone experiences, portfolios, etc.).

Across our undergraduate and graduate course offerings, evaluations of student learning are performed via assignments, projects, reflections, and examinations (performance-based assessment). Quarterly Student Evaluations of Teaching (SET) for every course, using the standardized forms (Instructional Assessment System, or IAS) provided by the Office of Educational Assessment also inform aspects of student performance and learning. Voluntary or recommended surveys and evaluations performed by the College of Engineering **Office for the Advancement of Engineering Teaching & Learning** are also performed by instructors.

In addition to these, for undergraduate courses, we perform annual assessments of student learning following ABET guidelines: this includes randomized selection and evaluation of student assignments and projects and assessing how well they meet **ABET outcomes**. These assessments are especially critical for hands-on courses such as senior design/capstones.

Our MS students who opt for the thesis option, as well as all Ph.D. students are also evaluated on independent and innovative research contributions and novelty and transformational nature of the produced work. These are typically reflected in peer-reviewed technical reports, conference publications, and professional society journal papers, alongside a Master's thesis or doctoral dissertation. MS students who opt for the thesis option go through an oral thesis defense at the end of their studies in front of a committee of examining faculty. Ph.D. students go through a series of evaluations culminating in a defense of their dissertation:

- **Qualifying exam:** Provides an early assessment of a student's preparation and aptitude for completing a Ph.D. degree. The exam requires work on a research project and completion of at least three courses in the student's specialty area.

- **General exam:** This is the second of three required exams and admits the student to Ph.D. candidacy. The purpose of the general exam is two-fold: to test a graduate student's capability to conduct independent research and to evaluate the technical merits and feasibility of the student's proposal for the Ph.D. dissertation. The exam is conducted by a committee of ECE faculty members with an external representative from the Graduate School.

- **Final exam, dissertation defense:** This is the oral defense of the student's dissertation. When the defense has been passed and the student's dissertation officially accepted by the Graduate School, the Ph.D. degree

is awarded. The exam is conducted by a committee of ECE faculty members with an external representative from the Graduate School.

The Department also conducts an annual graduate student review, requesting students to report on a summary of their research and degree progress over the past year, accomplishments, awards, publications, and goals for the next year. Students also have the opportunity to submit confidential comments to their graduate adviser and the Graduate Program Coordinator - these will not be shared with the student's faculty adviser(s). Once these are received, they are reviewed for completeness and then passed to the student's faculty adviser(s), who adds their own assessment to the review. Finally both the student and adviser will come to an understanding of past student performance, and future plans.

Describe methods used to assess student satisfaction. Additionally, articulate efforts to gauge the satisfaction of students from underrepresented groups.

Methods used to assess student satisfaction include regular engagement by Department leadership with the ECE Student Advisory Council (SAC), the IEEE Student Chapter, the ECE Graduate Student Association (GSA), and soliciting feedback from them. SAC conducts regular town halls, gathers feedback on issues of concerns, and brings it to the Chair's office to discuss and address in a timely manner. SAC also maintains an online anonymous feedback portal at all times, and monitors it for pressing issues brought about by students.

The Department also has student representatives on three committees dealing with the curriculum (core courses, electives, and graduate courses), as well as the DEI committee. These committees are vehicles for students to bring about concerns as well as their proposed solutions and suggestions dealing with academic issues at all levels (course content, prerequisites, structure, grading, labs, instructional effectiveness and faculty/TA support, etc.).

The Department also organizes regular biweekly socials for undergraduate and graduate students to interact in a more informal setting with faculty.

The Graduate School also requests all graduate students complete an **exit survey** upon graduation, which asks students for a candid evaluation of their graduate experience and a ranking of their satisfaction with the degree program along numerous metrics.

Describe how the unit has used findings to make improvements in the programs, effect curricular changes, and/or make decisions about resource allocation. If applicable, in what ways and were the intended improvements realized?

Feedback from every SAC town hall is summarized in a report provided to Department leadership. This is then discussed in a meeting between SAC and the Chair's office to find viable solutions to address concerns. These may include decisions by the Chair on resource/budget allocation, space renovations, student events, career support, study groups and mentorship programs, and the like.

Questions and concerns raised at the three curriculum committees and the DEI committee are discussed with students present and actively participating, and acted upon via established processes (e.g., the Department's Continuous Improvement Program which periodically assesses, evaluates, and improves important aspects of our degree programs). To provide two examples:

- Grading policy concerns were brought to committee last year by a student focused on a desire for clear and timely tracking of course performance at each point during the quarter. The Core Courses Committee invited the student to a meeting, drafted language for grading recommendations, and presented it at a faculty meeting.

- During the planning phase for our new BSECE degree, student surveys and meetings were conducted to directly solicit student feedback and ideas for the new degree.

Note the courses typically taken by undergraduates who will not be majors in any of the unit's programs, if applicable. Are there specific learning goals in those courses designed to accommodate "non-major" students? If so, how is student achievement in

reaching these goals assessed?

The Department offers two courses for non-majors:

- **EE 205: Introduction to Signal Conditioning**
- **EE 215: Fundamentals of Electrical Engineering**

There are no specific learning goals in these courses designed to accommodate non-major students. Please note that these courses are not meant to address larger learning goals (e.g. physics, chemistry, programming) which may be applicable across the wider campus.

INSTRUCTIONAL EFFECTIVENESS

Describe and discuss the method(s) used within the unit to evaluate quality of instruction, including the use of standardized teaching evaluation forms.

We conduct quarterly Student Evaluations of Teaching (SET) for every course, using the standardized forms (Instructional Assessment System, or IAS) provided by the Office of Educational Assessment.

We also conduct regular peer (collegial) evaluations of teaching (faculty reviewing other faculty in an instructional setting, during class). This is performed at all faculty levels (Assistant, Associate, Full).

The Department also supports one graduate student for the entire academic year as a "Lead Teaching Assistant" who provides training and workshops to other TAs on best teaching and grading practices, conducts regular surveys of TAs, organizes events for them, and serves as a resource for faculty in their interactions with their TAs.

Voluntary or recommended surveys and evaluations performed by the College of Engineering **Office for the Advancement of Engineering Teaching & Learning** are also performed by instructors.

Teaching effectiveness evaluations of faculty are also conducted by the Department Chair during annual faculty merit reviews every Spring.

All assistant professors in the Department are also assigned two senior faculty mentors who meet with them on a quarterly basis to listen, provide guidance, and help with various questions and issues of concern to new faculty, including teaching effectiveness. The Chair also meets on a monthly basis with new faculty for the same purpose.

Note all opportunities for training in instructional methods that are made available to any individuals teaching within the unit (including graduate students). For example, these may be opportunities that support teaching improvement, innovation, and/or best practices.

The Department supports and helps faculty develop an effective, learner-centered teaching practice via a variety of campus-wide resources. These include workshops on accessible teaching strategies, aligning courses around outcomes and objectives, designing for inclusive learning with universal design for learning, student engagement, and open pedagogy.

The Department also supports faculty development in teaching via external workshops such as those conducted by the National Effective Teaching Institute. NETI workshops provide participants information and hands-on practice in the elements of effective teaching, enhance teaching skills by introducing research-based best practices, and provide participants with opportunities for networking with other faculty who share an interest in effective teaching.

Teaching@UW provides additional strategies, resources, and connections for UW Faculty, which ECE faculty benefit from. Resources are also available for teaching assistants, and the Department regularly supports TA participation in campus workshops on inclusive teaching, active learning, accessibility, aligning lecture and section content (for quiz sections), backward course design (for those who teach as the sole instructor), teaching the first day of class, preparing for challenging moments, and fostering students' mental health and well-being. The Department also funds a Lead TA every year to help with training in instructional methods for TAs, among other duties.

Describe specific instructional changes that have been made by instructors in response to evaluation of teaching within the unit.

Based on feedback from students and instructors, prerequisite courses were reviewed to determine gaps in foundational knowledge, redundancy, or if they were barriers to course access. After review, changes were made to prerequisite content and prerequisites were removed or added, where necessary. This provided better time to degree with better aligned prerequisites and opened up courses for transfer students who have more limited options.

From the input we received for the new BSECE degree, we chose to remove concentrations, which were too restrictive for both students and instructors. Our **pathway** concept provides guidance on how to flex the courses in a way that can either hone in on a particular topic or broaden the coursework to be more complementary and interdisciplinary.

Students also indicated they would like more hands-on courses. The Department responded by piloting a new hands-on course in the summer which had very high reviews. We are using that class as a template to create a more permanent course within our curriculum. Two of our new assistant teaching professors also developed a new hands-on course on robotics, and significantly updated content in a regular electronics course we teach to provide more hands-on projects. The Chair's office has also consistently financially supported proposals by faculty to revamp courses, or develop new courses, especially for the new BSECE degree.

The Department also responded to feedback on a better focus for core courses by restructuring the Curriculum Committee to include a separate Core Courses Curriculum Committee to solely assess weaknesses and address consistency issues with the core classes. The goals of this new committee are to ensure a strong teaching cohort for core courses, ensure consistency across offerings, continuously improve the core courses, and provide archives of course materials and content, as well as training and support for new instructors.

The core courses committee is currently working on significant updates to two new BSECE courses, EE 280 (Exploring Devices) and EE 201 (Hardware Skills) to better align them with the rest of the curriculum and address instructional resource issues. Much of these updates are being informed by direct feedback from students and teaching assistants over the course of the past year.

TEACHING AND MENTORING OUTSIDE THE CLASSROOM

Describe how faculty members are involved in undergraduate and graduate student learning and development other than through classroom teaching (e.g., informal learning, independent studies, research involvement, specialized seminars or workshops, etc.).

ECE faculty strongly support students who wish to do research in their labs via formal advising (independent study or internship at the undergraduate level; thesis or dissertation research at the graduate level).

ECE faculty also lead study abroad programs. One faculty member has taken 30 students to Switzerland in late summer to teach a circuits class (EE 215) and visit schools and engineering research labs there (e.g, CERN). Two other faculty members have proposed a collaborative study abroad opportunity in Dubai for next summer focusing on smart cities.

The Department runs a weekly **research colloquium series** through the academic year, where ECE faculty and external guests from academia or industry are invited to give talks to our graduate students as part of a 1-credit class (EE 500). A similar weekly seminar series is conducted for our undergraduate students where ECE faculty and their graduate students give more technically accessible talks, as part of a 1-credit class (EE 200). The Department Chair conducts an undergraduate course annually as well where notable alumni and members of the Seattle tech community are invited to give weekly guest lectures on careers, presenting their workforce experience, and demonstrating the depth and breadth possible in the field and best practices (EE 492).

The Department organizes four large annual events (300+ participants) for our students:

- **WAFER: WomXn at the Forefront of ECE Research**, is a day-long event in November, which aims to cul-

tivate an inclusive environment for participants and speakers alike to share and learn more about research in ECE, hear others' experiences in the field (at different stages of their careers), and to ultimately leave the event feeling inspired to potentially pursue a career in ECE or other tech-related fields.

- **Lytle Lecture Series** in fall or winter quarter. This is the Department's premier annual event, featuring two talks, one for a general audience and one for a technical audience, by internationally renowned researchers in the field of communications, signal processing, control systems and machine learning.

- **Research Showcase** in March, featuring cutting-edge research presentations by our graduate students. Visitors have a chance to review posters, speak with students and their advisers and learn more about the exciting projects underway across the various labs in the department. The Research Showcase is also a perfect opportunity for visiting prospective students to learn more about the Department's research as it coincides with our admitted graduate student visit days.

- **ENGINE Showcase** in June, featuring poster presentations of industry sponsored capstone projects, with students presenting and discussing their projects and posters with many industry partners, faculty, and members of the general public in attendance.

Numerous other talks by visitors, industry visits and information sessions, and technical workshops are conducted every quarter as well and announced to students.

We also have faculty in service roles who partner with staff and students. Our undergraduate (faculty) Program Coordinator (UPC) works with our lead undergraduate adviser to provide support in student challenges and issues, petitions to degree requirements, and other undergraduate related issues. The UPC is part of the weekly meeting with all the undergraduate advisers, meets with students who are struggling and may be on their way to dismissal to see how to turn things around, and discusses ways to support students who are pursuing interests outside the regular process or curriculum.

On the graduate side, we have two faculty program coordinators (GPC) for the MS and Ph.D. programs. Among their responsibilities are MS and Ph.D. admissions, coordinating assignment of faculty advisers to MS students, and meeting with our lead graduate adviser to go over Ph.D. student progress reports and address challenges and concerns from the student or faculty member.

The Department's Associate Chair for Education oversees all the activities of the Department related to the undergraduate, graduate and professional master's degrees. In particular, the Associate Chair is responsible for ensuring that the curriculum remains up to date, that the students develop entrepreneurial skills, and that they receive adequate advising.

We also have a faculty member who works with the IEEE-HKN student chapter to help them with their goals of bringing more industry partner workshops and collaboration opportunities to our students.

Describe how the unit works with undergraduate and graduate students to ensure steady academic progress and overall success in the program.

The undergraduate programs have a satisfactory progress policy. This is a structured way for students and advisers to be aware of challenges that arise early enough so intervention measures can be taken to help the student stay on track.

The basic standards our undergraduate students must adhere to are:

1. Satisfactorily complete 12 or more credits applicable to their degree each quarter, excluding summer. If a student is required to complete English as a Second Language courses, they must do so each quarter until completed.
2. Students may submit a petition to an ECE Adviser if there are exceptional circumstances that require them to go part time.
3. Students must complete prerequisites in the appropriate sequence or obtain permission from the instructor.
4. For the EE degree, students must complete the core classes within their first year of admittance to the program
5. For the EE degree, students must complete all EE courses with a 2.0 and for non EE courses they must complete with a 0.7.

6. For the ECE degree students must complete the core with a 2.0
7. Students must maintain an overall cumulative GPA and quarterly GPA of a 2.0
8. Students must file a graduation plan with the ECE Advising office
9. Students must receive approval from the department if they wish to withdraw from UW in order to avoid being dropped from the program

The Graduate Programs follow the Graduate School Satisfactory Requirements which are:

1. The student must earn a 2.7 in each class
2. The cumulative GPA must be a 3.0
3. In addition, ECE Ph.D. students must adhere to the ECE Satisfactory Progress Policies below:
4. Students should identify their research adviser before the end of their first year
5. Students should pass their qualifying exam by the end of their second year
6. Students should pass their general exam by the end of their third to fourth year
7. Students supervisory committee should be appointed at least 3 months before the general exam
8. Students reading committee should be appointed at least 3 months before the final exam
9. Students must have satisfactory work performance in their Academic Student Employee appointment
10. Students must meet all standards of the University of washington Student Conduct Code
11. Students must demonstrate English language proficiency according to the Graduate School Policy 5.2: Conditions of Appointment for TA's no later than the end of their first year

A report is run for each program to identify students who do not meet satisfactory progress requirements.

Undergraduate students receive a first quarter probation letter the first quarter they do not make satisfactory progress and are required to meet with an adviser. The second quarter they do not meet progress, students receive a second quarter probation letter and are required to meet with an adviser for more targeted support. If there are two consecutive quarters a student does not meet progress, they are up for dismissal from the department. Before the dismissal is finalized, advising, the student and the UPC meet to determine if dismissal is the best course of action.

As outlined above, the Department also conducts an annual graduate student review, requesting students to report on a summary of their research and degree progress over the past year, accomplishments, awards, publications, and goals for the next year. Students also have the opportunity to submit confidential comments to their graduate adviser and the Graduate Program Coordinator - these will not be shared with the student's faculty adviser(s). Once these are received, they are reviewed for completeness and then passed to the student's faculty adviser(s), who adds their own assessment to the review. Finally both the student and adviser will come to an understanding of past student performance, and future plans.

Master's students identified as not meeting progress are first reached out to by an adviser to check and see what support is needed. If a pattern emerges of not meeting progress, then a warning letter is sent. A student who does not make progress the following quarter after a warning letter is sent may receive a probation letter and must meet with their adviser.

For Ph.D. students, a consultation with their faculty adviser is done when they do not meet satisfactory progress. A warning letter is issued if determined necessary from the consultation. If a student does not make progress in a timely manner, a probation letter is given to the student and the faculty adviser is notified. A more targeted conversation on goals, objectives and resources is then conducted.

Describe how the unit works with undergraduate and graduate students to prepare them for the next phases of their academic or professional lives.

The Department has an IEEE-HKN student chapter whose goal is to bring industry and students together throughout the year. IEEE-HKN sponsors workshops, information sessions and holds an event in which industry, faculty, staff and students can engage in an informal setting.

Advisers work closely with the **Career Center@Engineering** office, ensuring students are aware of all their career fairs, resources and workshops. ECE Advising is looking into BSECE targeted resumes and interview workshops for ECE students in this upcoming year.

The Department has an **industry mentorship program** that matches students with mentors based on their academic

and professional interests. Mentorship groups of up to three students meet monthly (virtually or in person) with their mentor from January – May. Each group has flexibility to determine their goals and topics of discussion such as professional preparation, career exploration, and networking.

The Department also organizes an annual **career fair** that connects employers with our exceptional pool of undergraduate and graduate students. The fair provides an invaluable opportunity for employers to network with and recruit our talented students for full-time, part-time, and internship opportunities.

The Department has a large industry sponsored capstone program (**ENGINE**) in which industry partners work with a team of students and a faculty mentor on a 2-quarter real-world system design/build/test project using industry standard tools and best practices. The mentorship students receive from these industry partners significantly accelerates their placement in technical leadership roles in industry and yields job offers after graduation.

Consider including artifacts supporting this section in the appendix (e.g., a link to students' video presentations, select photos of poster presentations, a description of projects featured in the Undergraduate Research Symposium, etc.). This is encouraged but not required.

Examples of graduate research projects and presentations (posters and photos) can be found on our **Research Showcase** page.

Examples of industry sponsored student projects (posters and videos) can be found on our **ENGINE Showcase** page.

An overview of student work and faculty teaching in our new Certificate in Applied Cybersecurity Engineering can be viewed in the video **here.**

Details of this year's WAFER program can be found **here.**