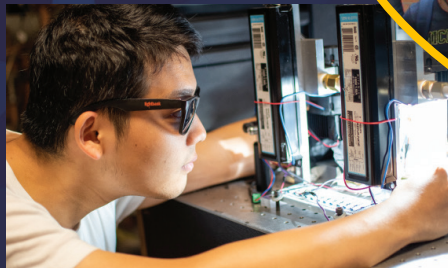


STRATEGIC PLAN 2021

People Powering Innovation



Planning for the Future

Electrical and Computer Engineering (ECE) is the technological foundation of modern society. It is the unseen force behind today's intelligent systems, and with its impact on clean energy, precision health, cybersecurity, autonomy, communications, the quantum revolution and more, ECE holds the key to solving many of society's most pressing problems.

Michigan ECE is proud to be part of a worldwide community of passionate researchers and educators that are continuing to push the boundaries of what is possible. We have brilliant, motivated students, world-class faculty with wide-ranging expertise, and highly committed staff. Our 19K+ game-changing alumni established the Information age (Claude Shannon) and forever changed our access to information (Google co-founder Larry Page). Others are running some of the world's biggest companies (Steve Mollenkopf, former CEO, Qualcomm, and Rick Wallace, CEO, KLA), starting new companies, developing transformative technology, and teaching at the best schools all over the world.

Throughout its history, Michigan ECE has maintained close ties with industry. We are leaders in the generation of intellectual property leading to technology transition impacting our economy, health care, security, and environment.

To focus our efforts in the coming years for maximum continued impact, Michigan ECE has undergone a thorough strategic planning process.

We have identified three major areas of primary importance to the future of Michigan ECE:

- Research excellence and impact for a better society
- Education and enrichment for future leaders
- People-first culture for innovation, excellence, community

This document provides a general overview of recent achievements in each of these areas, as well as specific priorities for the future. Task forces composed of faculty, staff, and students will be working over the next several years to develop and implement specific initiatives to accelerate progress in each area.

We are all working together to continue improving Michigan ECE. The directions outlined in this 2021 strategic plan are aligned with our vision and mission, and provide a path to a brighter future for our entire society.

Mingyan Liu

Peter and Evelyn Fuss Chair of
Electrical and Computer Engineering



Vision

To exemplify the highest levels of creative innovation in education and research, working collaboratively to protect and enhance the public good.

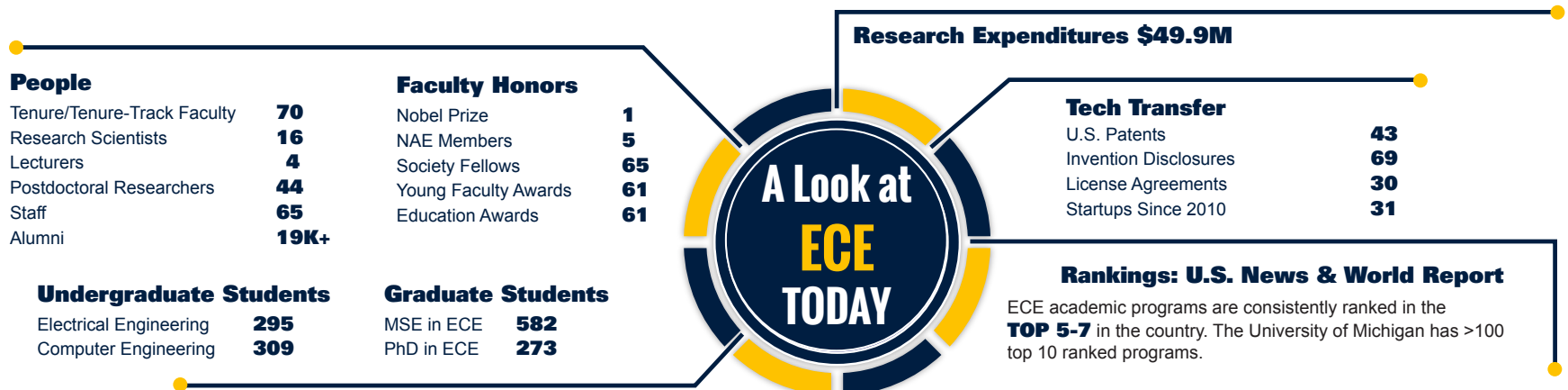
Mission

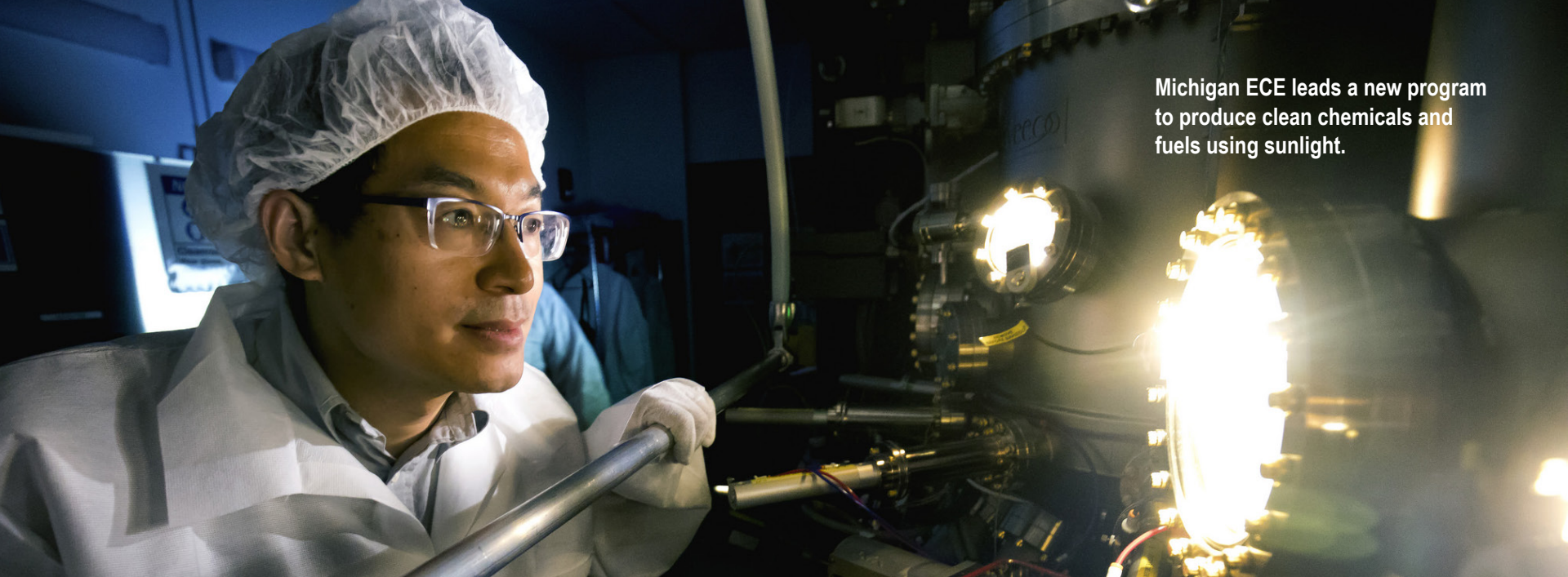
The mission of Electrical and Computer Engineering (ECE) at Michigan is to pursue the discovery, communication, education, and application of fundamental and applied principles of electrical and computer engineering, and to integrate these principles with other engineering, scientific, and medical domains to provide the greatest possible benefit to society.

Values

In pursuing its vision and mission, ECE at Michigan will:

- Pursue innovation in education and research to meet the changing needs of our students and society
- Emphasize creativity in education, research, and problem solving
- Promote and foster equity, diversity, and inclusion for all people in our teaching, research, and service to the community
- Strive for excellence in all that we do, practice the highest standards of professional ethics in advancing knowledge and technology, and do so with an awareness of environmental and social impact
- Bring a spirit of collaboration and partnership to every level of interaction
- Serve the university, the state, the nation, and the world by sharing our unique talents
- Prioritize professional growth of faculty, students, and staff to inspire lifelong learning





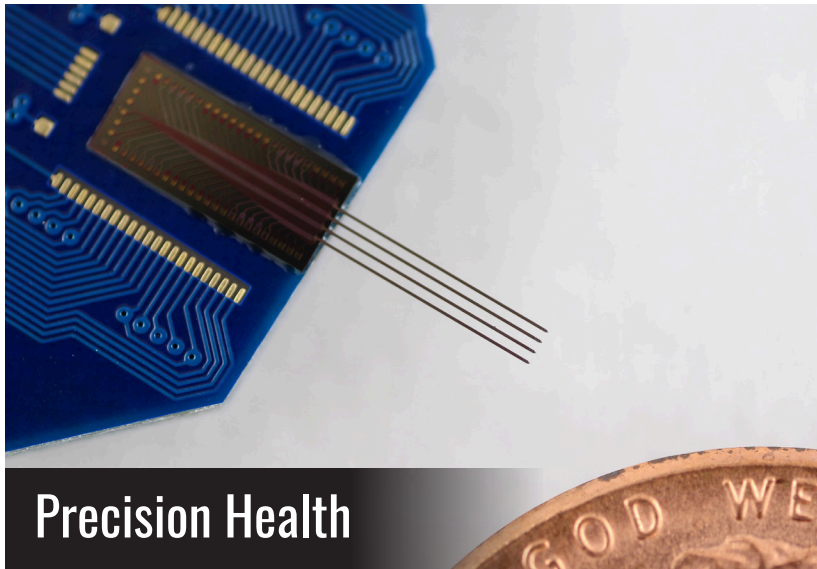
Michigan ECE leads a new program to produce clean chemicals and fuels using sunlight.

RESEARCH EXCELLENCE AND IMPACT FOR A BETTER SOCIETY

Electrical and computer engineering drives the technology of today and tomorrow. ECE is critical to future developments in areas such as precision health, autonomous systems, sensing systems, Internet of Everything, 5G and beyond, quantum computing, sustainable energy, post CMOS computing, and data science. Michigan ECE is looking to maximize our impact in these areas, as well as emerging areas in the future.

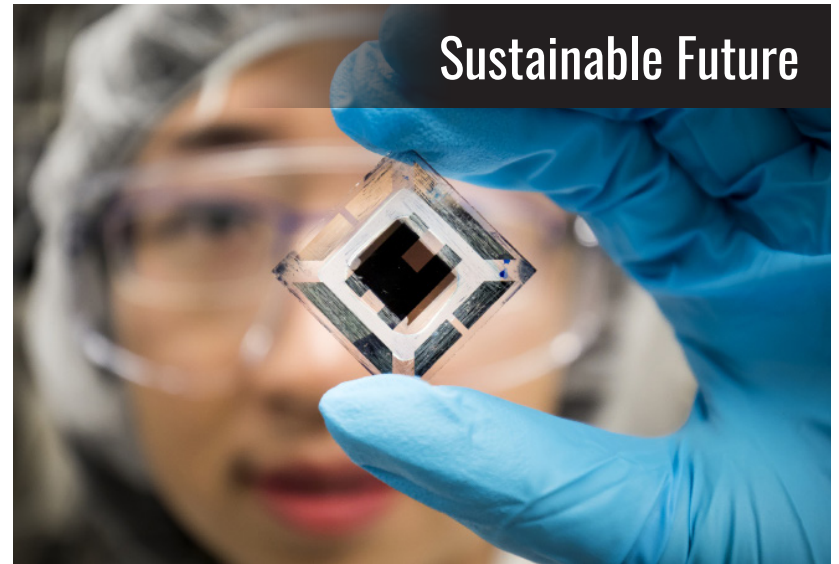
We have an excellent track record for impact. Our technology is evident in the marketplace, and Michigan ECE is one of the top producers of intellectual property within the University. We plan to expand our already strong relationships between faculty and industry to create tighter connections between research, academics, and societal impact.

Collaborative teamwork between groups with complementary expertise is critical to solving the grand challenges facing humankind. It's how the major breakthroughs by Michigan researchers have occurred. Continuing this legacy is important to achieving lasting and positive impact on our communities.



Precision Health

Neural probes equipped with LEDs tiny enough to target a single neuron are making it possible to demystify the brain.



Sustainable Future

This organic photovoltaic cell reached record-high efficiencies, paving the way for commercialization. These flexible and transparent solar cells can be built into windows of the future.



People First

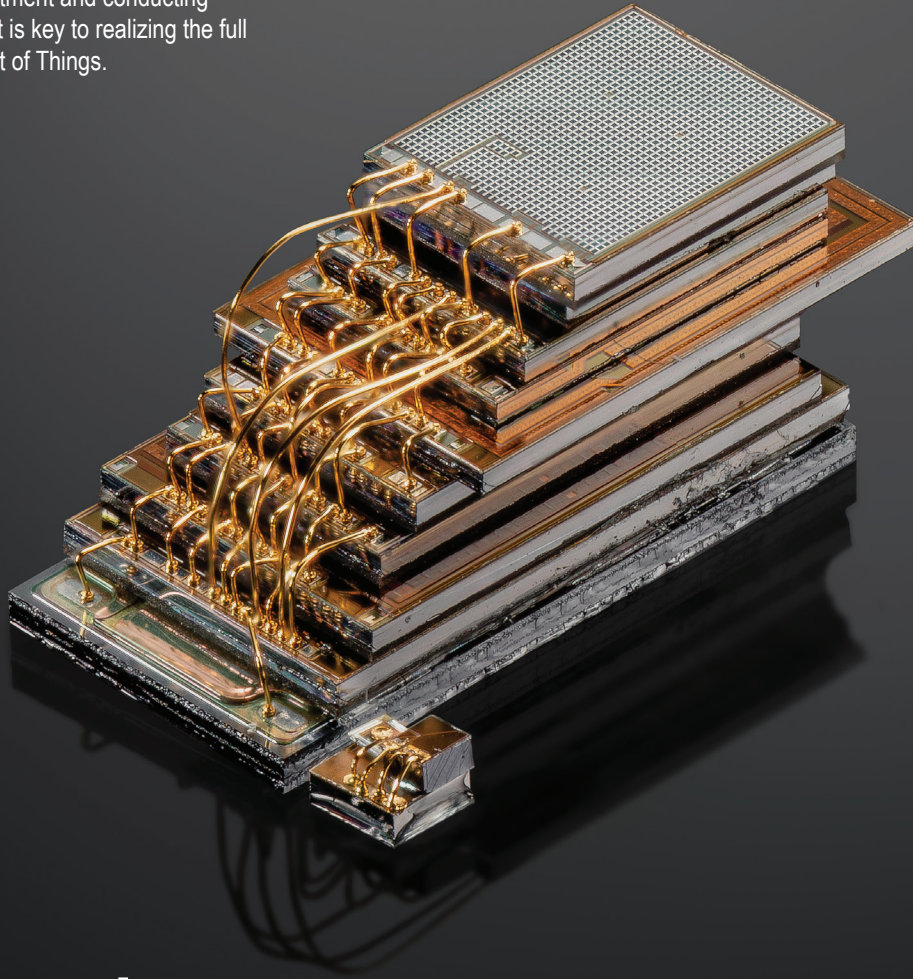
ECE researchers developed an augmented reality system to facilitate a life-sized version of air hockey where people of all abilities can play together.



Safe Autonomy

Mcity is the 32-acre playground for testing autonomous systems, one area of focus at Michigan ECE.

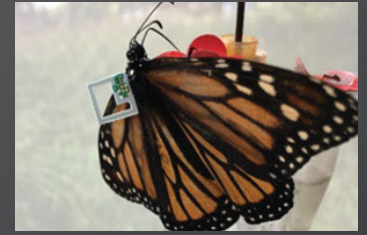
The Michigan Micro Mote (the world's smallest computer) is a technological marvel on its own, but it was created to solve problems, like monitoring cancer treatment and conducting small animal studies. It is key to realizing the full potential of the Internet of Things.



ECE is at the center of computing

From building the world's smallest computer, to designing next-generation quantum computers, and facilitating data processing on chip, at the edge, and in the cloud - Michigan ECE stands at the center of the computing revolution, and places this as a priority for the future.

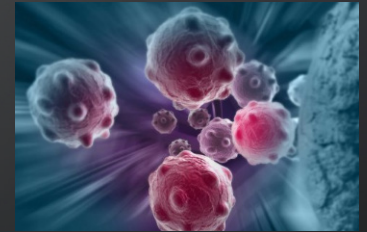
Computing is at the center of ECE



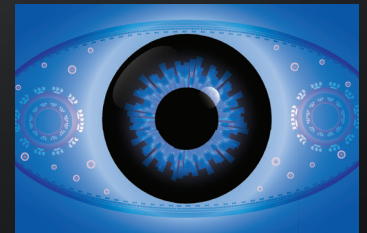
Butterfly migrations and survival



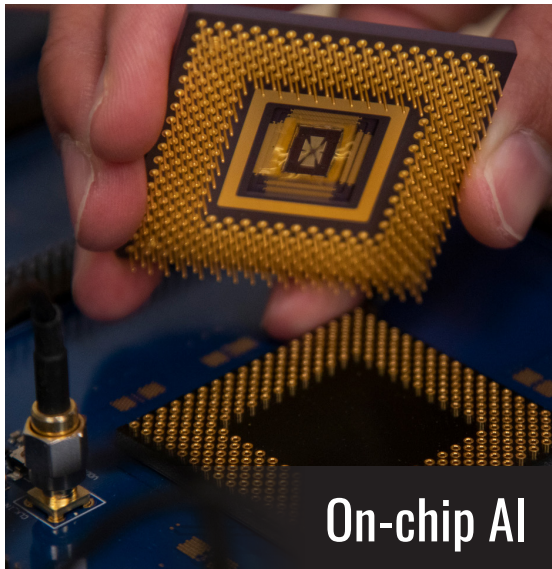
Island and forest ecosystems



Monitoring cancer treatment



Detecting glaucoma



This memristor array chip runs three types of machine learning algorithms, which could lead to AI processing directly on smartphones or sensors.



Active 5G research includes bringing 5G to rural communities, designing advanced chips for Beyond 5G, improving secure and reliable computing, and more.

ACCOMPLISHMENTS + INITIATIVES

- Contributions to twelve recent Multidisciplinary University Research Initiatives (MURIs) and Engineering Research Centers reflect our commitment to collaborative, interdisciplinary teamwork
- Inventors of the Michigan Micro Mote (the world's smallest sensing computer)
- World-class research in the Center for Wireless Integrated MicroSensing & Systems (WIMS²), revolutionizing research in neural probes, environmental monitoring, and smart stents
- Nobel Prize winning research at the Gérard Mourou Center for Ultrafast Optical Science, leading to bladeless Lasik surgery, record-breaking high-intensity lasers, and a new 3 PW laser ZEUS, to be the highest power laser in the U.S. and operated as an NSF user facility
- Wide-ranging and fundamental research in health, including cancer treatment, genomic sequencing, and medical imaging
- Groundbreaking research in sustainable energy sources through photovoltaics and artificial photosynthesis
- Best-in-class low-power lighting and displays
- Groundbreaking research in quantum devices and computing
- World-class research in wide bandgap semiconductor electronics, optoelectronics, and nanotechnology
- Innovative research in communications and networks: 5G, 6G+, edge computing, IoT
- World-class contributions to radar remote sensing of environment
- Forward-looking research in smart energy distribution
- Record-breaking and fundamental research in robotics, autonomous systems, and cyber-physical systems
- Leadership in ECE education research
- World-class facilities and research labs, including the Lurie Nanofabrication Facility

STRATEGIC PLAN PRIORITIES

- Continue to excel in areas of research with positive societal impact
- Focus new faculty hiring in computing
- Expand relationships with industry
- Support and encourage interdisciplinary and multidisciplinary research
- Plan a new research building dedicated to ECE physical layer work to centralize work in nanotechnology, optics, electromagnetics, and more



These ECE students are participating in the student group GRID Alternatives Students for Sustainable Energy, which sends students to underprivileged communities around the world to install solar panels to provide clean, affordable energy to homes and communities.

EDUCATION AND ENRICHMENT FOR FUTURE LEADERS

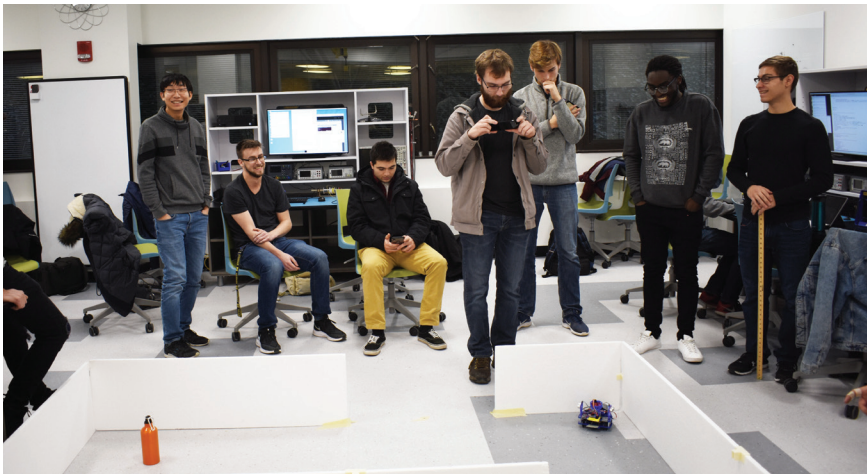
Today's students are more dedicated than ever to work on problems with positive societal impact, and they want hands-on experiences both in and out of the classroom. ECE offers a rich combination of learning experiences that begin in the classroom and extend far beyond, producing students who are global citizens and leaders.

ECE students contribute their unique training and skills to a wide variety of interdisciplinary student teams. They work with others in multidisciplinary design projects, often sponsored by industry. They work with faculty on research projects, and acquire the knowledge to help bring world-changing technology to society. ECE is also developing online learning programs suitable for pre-college to seasoned professionals to democratize education on a global scale.

A key initiative for the future is expanding the focus on computational skills throughout our educational programs.



ECE students get exposure to different companies and learn about the day-to-day life of an electrical and computer engineer through the ECE Expeditions program.



Electrical Engineering System Design I is the first of two new required undergraduate courses in electrical engineering focusing on engineering design, using an autonomous platform with a societally-relevant challenge.

ACCOMPLISHMENTS + INITIATIVES

- New Master's of Engineering degree for industry-focused students
- New continuing online learning program, called Continuum
- Newly updated undergraduate curriculum focusing on engineering design and social impact
- Successful implementation of a free textbook initiative for undergraduate students
- New opportunities for multidisciplinary design projects
- Initiated the ECE summer camp, Electrify, for pre-College students
- Focused efforts on entrepreneurial thinking and opportunities
- New programs to support student professional development
- New courses in computational data science, machine learning, artificial intelligence, quantum computing, software defined radio, big data, cybersecurity, and energy
- New Exploring ECE Graduate School Workshop to encourage undergraduate students to consider graduate school
- New focus on identifying teaching practices to support a more diverse student body
- Expanded relationships with Historically Black Colleges and Universities

STRATEGIC PLAN PRIORITIES

- Increase computational tools and thinking throughout the curriculum, both within existing courses and in new courses
- Expand opportunities for student research and student internships
- Support and incentivize at-home learning and non-classroom education
- Develop graduate course in professional ethics
- Enhance what we do to train students to communicate and lead teams
- Increase student fellowships



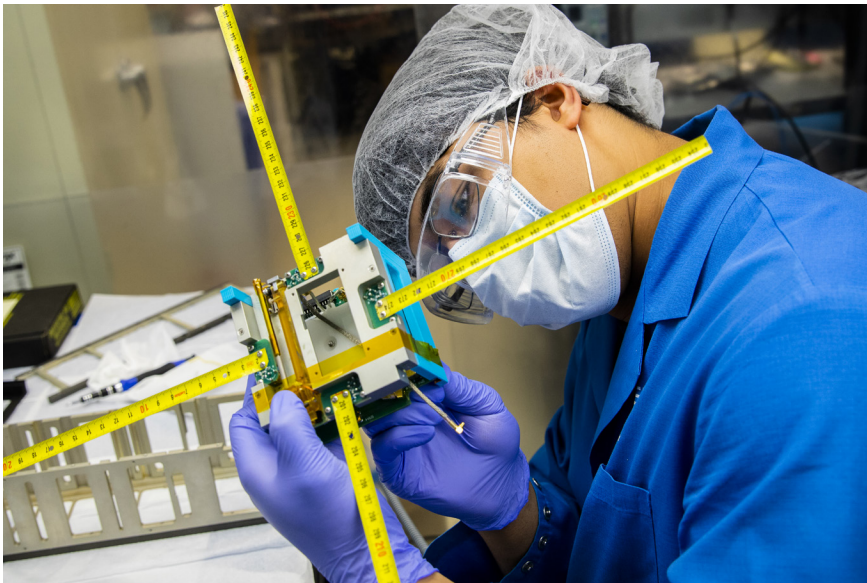
PEOPLE-FIRST CULTURE FOR INNOVATION, EXCELLENCE, COMMUNITY

People power innovation, and ECE is laser-focused on providing an environment that empowers all its people to be their best and most creative selves. This can only be achieved in a diverse and inclusive environment.

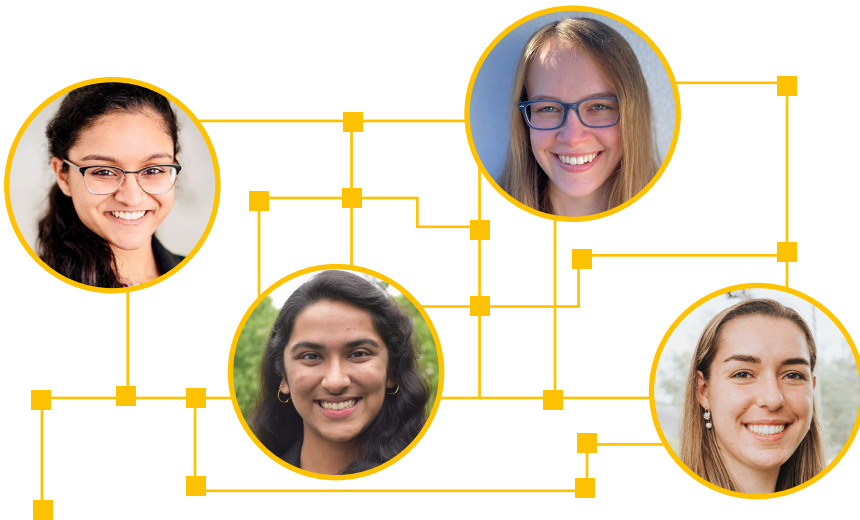
Michigan ECE has implemented a wide variety of programs and initiatives focused on improving connections between and among faculty, students, staff, and alumni.

While continuing those efforts, our faculty will be working together to make changes that allow them greater freedom to pursue individual passions in a transparent and supportive environment.

For all our people, we encourage a culture of entrepreneurship and innovation, where failure is expected and success celebrated.



More than 250 students had a hand in launching a cubesat into space in 2021, testing the feasibility of a new propulsion method that could enable very small satellites to move around space without carrying fuel.



WECE

Women in ECE (WECE) is a new student-run, diversity-focused organization dedicated to the personal and professional growth of those committed to innovation and excellence in ECE fields.

ACCOMPLISHMENTS + INITIATIVES

- Special programs promoting entrepreneurship and innovation
- Improved mentoring of new and young faculty members
- Enhanced onboarding programs for new graduate students
- New faculty and staff training in issues of diversity, equity, and inclusion
- Student-focused events celebrating individual cultures (including Diwali, Lunar New Year, Nowruz, Iftar, LGBTQ+ Spirit Day, and International Women's Day)
- Work-life balance improvements for faculty and staff
- ECE Expeditions: connecting students with ECE companies
- Recognition of alumni, staff, and students through newly-created awards and honors
- New committees to support diversity, positive community, and non-curricular student education
- New staff hires to support alumni engagement and student recruiting

STRATEGIC PLAN PRIORITIES

- Enhance freedom for faculty to explore new areas and focus on individual priorities
- Continue efforts to improve diversity, equity and inclusion for faculty, students and staff
- Empower ECE people (faculty, students, staff) to explore their passions and be their best both individually and through collaborative partnerships
- Attract and retain the best students from diverse backgrounds to Michigan ECE by providing a welcoming and supportive environment where students of all backgrounds can thrive



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