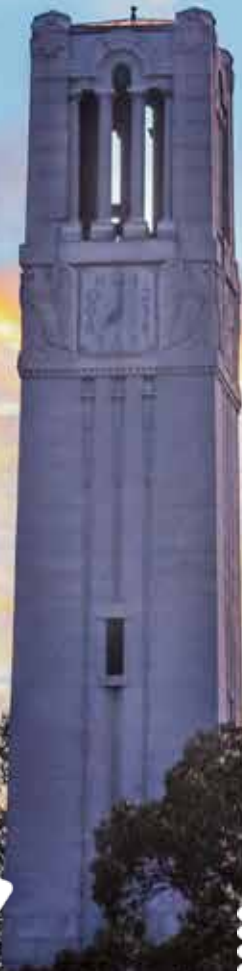


NC STATE

GRADUATE PROGRAMS

Electrical and Computer Engineering

ece.ncsu.edu



#8

University in
the U.S. to
study Electrical
Engineering

according to ShanghaiRanking's Global
Ranking 2019



23

National Science
Foundation
CAREER Award
Recipients



Top 10

in Research
Expenditures
among Public
U.S. Universities

according to ASEE 2019



#14

Public
Engineering
Graduate School
in the U.S.

according to U.S. News & World Report
2020

An aerial photograph of Centennial Campus, showing several large, modern academic buildings with white and brick facades. The campus is surrounded by lush green trees and a body of water is visible in the background. A yellow rectangular overlay covers the left side of the image, containing the title and descriptive text.

CENTENNIAL CAMPUS

The Raleigh-Durham area is consistently listed as one of the best places to live in the country. Located just a few miles from the “epicenter of innovation”—**Research Triangle Park**—our students and graduates have abundant opportunities for internships, co-ops, and employment with leading technology companies. When it’s time to relax and take a break, the beaches and mountains of North Carolina are an easy drive from Raleigh.

Long known as a national hub for research, innovation and public-private partnership, **Centennial Campus** is home to the College of Engineering and a number of research centers, institutes, and laboratories. Not to mention 76 industry, government and nonprofit partners.



But it's more than a research park.

Centennial Campus is a bustling—and growing —community. A sprawling landscape with walking trails, a championship golf course, restaurants, condos and a hotel. A mini-city nestled around Lake Raleigh. And, just as important, a destination for fun.

You can catch a movie on the vast Oval Lawn, chow down at a food truck rodeo, enjoy a live concert on the shore, and kayak by moonlight on the lake (not all at once, of course).

The state-of-the-art campus is a collision of learning, research, and innovation—leading to game-changing advancements and technologies that shape the world.

An entrepreneurial campus



135+

Startups Launched



1,010+

U.S. Patents issued



595+

Products to Market

Visit ECE

Don't just look at the pictures, please come visit our ECE facilities on Centennial Campus and see all that we have to offer.

 ece.ncsu.edu/visit

JUMPSTART YOUR FUTURE

Master's or Ph.D?

The **Master's Degrees** offered in the electrical and computer engineering department can enhance and strengthen a career in industry. The degree is designed for the recent graduate or professional who wishes to expand their engineering knowledge, with or without a thesis, depending on the degree. The degrees emphasize practical aspects of engineering, along with management and communication coursework, allowing graduates to rapidly advance in their career.

The degrees are a bridge to industry, designed to provide advanced learning and specialized training in the applied aspects of ECE technology.

The **Ph.D. program** in electrical or computer engineering provides students with the opportunity to work with leading, world-renowned faculty members in cutting edge research areas, supported by nationally recognized research centers and facilities. A Doctoral Degree is ideal for students with strong academic records with motivation to become a leading researcher in academia, government, or corporate environments.

Purposeful Academics

Programs at NC State provide a variety of excellent education and research opportunities for outstanding students from around the world. With constant feedback from employers and alumni, our courses are carefully designed—including complex projects, demonstrable knowledge and real-world skills. Employers know our graduates are ready to be productive from their first day at work.

Financial Support

We're committed to our students, making every effort to ensure that your time on our vibrant campus prepares you for your future.

We work with our Master's and Ph.D. students to provide financial support from fellowships, scholarships, and financial aid as you progress with your degree.

CAREER READY

Hundreds of companies and organizations actively recruit NC State graduates, including many of the top Fortune 500 companies. The university hosts the largest engineering career fair in the Southeast with employers from across the country recruiting our students—most have a job offer before graduating. We also go beyond academics with ECE-

specific career services and professional development to help you get recruited.

Your success is at the forefront, with a variety of programs in-place to help you succeed as a researcher. These include panels and workshops covering research skills, Ph.D. careers in academia or industry, technical communication, and job hunting.

Around 20 percent of ECE graduates end up in Silicon Valley—NC State is one of the leading providers of talent with its top companies.

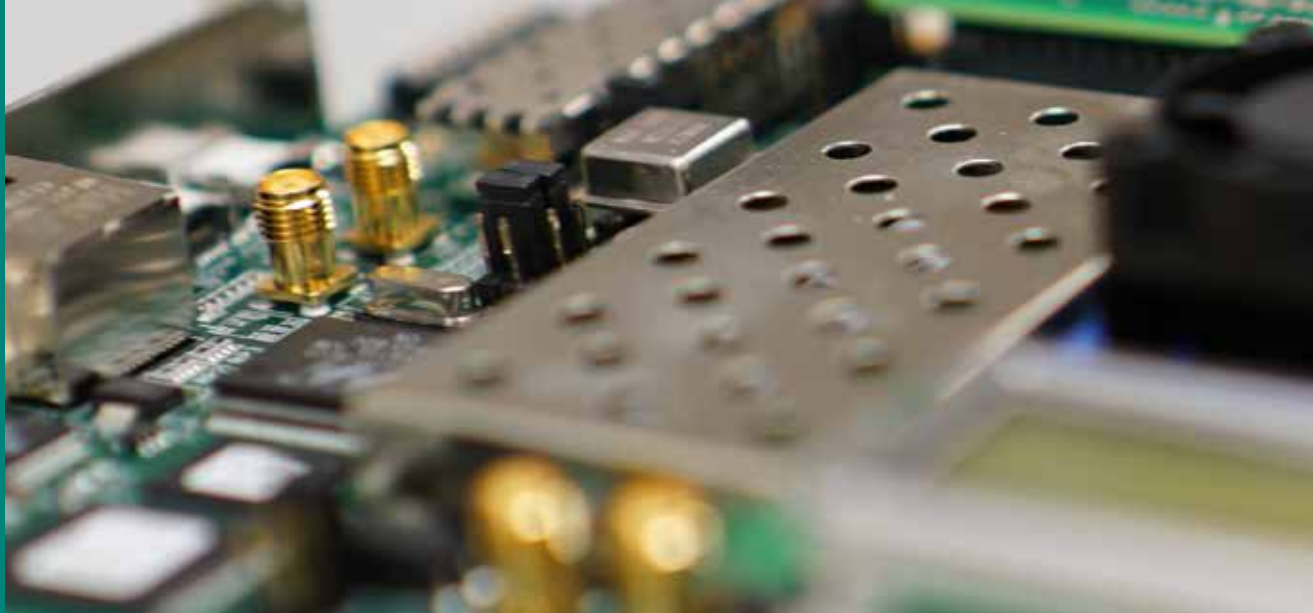


TECHNICAL OPPORTUNITY

We have over 110 distinct graduate courses that cover a wide range of technical areas:

- ⚙ Analog, RF and mm-wave Circuit Design
- ⚙ Antennae, Electromagnetics, Microwaves
- ⚙ Autonomous Systems
- ⚙ Bioelectronics Engineering
- ⚙ Computer Architecture and Design
- ⚙ Computer Networks and Internet of Things
- ⚙ Control, Robotics, and Mechatronics
- ⚙ Digital Circuit Design
- ⚙ Digital Communications
- ⚙ Digital Signal Processing
- ⚙ Digital System Design and Embedded Systems
- ⚙ Electronic Packaging, Power, and Signal Integrity
- ⚙ Integrated Circuit (ASIC) Design and Certification
- ⚙ Machine Learning, Image Recognition and Processing
- ⚙ Nano Systems
- ⚙ Photonics and Optics
- ⚙ Power Electronics
- ⚙ Power Systems
- ⚙ Power Semiconductors
- ⚙ Semiconductor Technologies and Fabrication
- ⚙ Software Development

DEGREE PROGRAMS



Electrical Engineering

With thesis and non-thesis variants of the Master's degree and a robust Ph.D. program, our students are a critical part of a nationally recognized research program in power electronics, power systems, nanoelectronics, photonics, communications, controls and robotics, signal processing, and machine learning.

Students develop the analytical, technical and engineering design skills necessary to innovate and create electronic components, sensors and systems which are the foundation for mobile and deep space communications, optical networks, robotics, biomedical devices, renewable energy sources, power generation and distribution, vehicle electronics, imaging systems, and all consumer electronics.

Computer Engineering

Our Computer Engineering Master's (thesis and non-thesis) and Ph.D. programs prepare students to succeed in a world where computers are now embedded in nearly everything ranging from smartphones and household appliances to autonomous vehicle systems and medical diagnostic systems. They now involve not only computation, but multi-modal sensing, signal processing, machine learning, communications and cyber-physical systems. Functions that were previously considered to be strictly software or strictly hardware can no longer be distinguished in that way.

Providing hands-on experience through projects within their coursework, and through collaborations with leading researchers, we provide an in-depth understanding of the concepts of digital and mixed-signal integrated circuit design; of computer architecture, networks, and system software; and of cutting-edge machine learning techniques.

There are **online** non-thesis Master's degree program options for all four degrees, designed for individuals who cannot attend on campus classes because of employment or geographical constraints, available to U.S. residents and to U.S. military personnel overseas.



4-YEAR FUNDING GUARANTEE

Central to the mission of NC State ECE is the preparation of graduates to meet the country's need for advanced technical knowledge, equipped with the skills and ingenuity to advance society. Our Ph.D. students are vital to this mission, and we are proud to guarantee a funded academic appointment for all Ph.D. students for their first four years.

! For more information: ece.ncsu.edu/funding

Electric Power Systems Engineering

This non-thesis master's degree program provides graduate students a thorough understanding of the tools, methods, and practice of electric power engineering. The program provides an education that is directly applicable to a career in industry—and shaped with constant input from industry partners. It is suitable for a new or recent graduate, as well as experienced professionals who want to receive the necessary retraining to change careers.

The program includes professional skills training through two integrated courses that introduce project management, communication skills, and the business aspects of electric power utilities; solid hands-on experience with a capstone project; and industry experience and exposure by involving experts from industry in teaching.

Partnering with the NSF FREEDM Systems Center on campus, the degree program provides a curriculum that enables graduates to develop devices, simulations, and algorithms to study and control the power distribution system, with the goal of preventing blackouts, integrating renewable energy, and making this critical infrastructure more reliable and more secure around the world.

Computer Networking

The Computer Networking Master's program (thesis and non-thesis) is a joint effort between Computer Science and Electrical and Computer Engineering, in collaboration with the College of Management, and is intended for students who wish to pursue careers in operations, services, development, and research in the networking and IT industries.

With input from the diverse computing industry in the Triangle Area, this exciting program provides a wide variety of technical courses in computer networking, supplemented with management courses, for a truly unique educational opportunity. We offer an optional Professional Science Master's concentration to encourage students to develop workplace skills highly valued by employers while pursuing their degree.

Master's graduates in computer networking are in increasing demand throughout industry as world markets increase their reliance on deploying and securing networking infrastructure.

CERTIFICATE PROGRAMS

WHY GET A CERTIFICATE?

Engineering is an ever-changing field. That is why lifelong learning is such a fundamental priority for engineers, and earning a professional certificate is the best way to stay ahead of the curve.

Certificate programs provide a cost and time-effective opportunity to increase your topic-specific expertise in your field or in lieu of committing to a full Master's Degree.

Electrical Engineering

This certificate program is primarily intended for individuals who wish to increase their knowledge and skills in Electrical Engineering either for future career opportunities or in preparation for graduate studies. This certificate provides the opportunity for students to take Master's degree courses without the commitment of undertaking a full Master's degree.

Many of the courses are available for completion remotely with Engineering Online.

The certificate is also available to on-campus graduate students in the sciences and engineering who want to expand their knowledge of the field.

The certificate requires 12 credit hours from most electrical engineering graduate 500 or 700-level courses, including:

- ⚙️ Principles of Microwave Circuits
- ⚙️ Quantum Engineering
- ⚙️ Physical Electronics 🌐
- ⚙️ Advanced Feedback Control
- ⚙️ Computer Vision
- ⚙️ Advanced Mechatronics
- ⚙️ Pattern Recognition 🌐
- ⚙️ Power System Operation and Control
- ⚙️ Neural Networks 🌐
- ⚙️ Optical Properties of Semiconductors 🌐
- ⚙️ Computer-Aided Circuit Analysis



Computer Engineering

In the certificate program in computer engineering, students gain foundational knowledge in connected systems, networking applications, and computer architecture. Hone your skills in the analysis, design, and operation of computing devices and software, offered over twelve credit hours.

Students will work with a variety of hardware and software tools and analyze research to understand state of the art approaches to computer system design and future challenges the industry will face.

With over half of the courses are available for completion remotely with Engineering Online, you can make the certificate program fit your schedule.

There is no prescribed list of courses for the certificate; students may take a combination of courses tailored to their interests and needs, subject to course prerequisites.

The certificate entails 12 credit hours on topics including:

- ⚙️ VLSI Design Systems 🌐
- ⚙️ Cloud Computing Technology
- ⚙️ Internet Protocols 🌐
- ⚙️ Memory Systems
- ⚙️ Object-Oriented Design and Development 🌐
- ⚙️ Advanced Network Security
- ⚙️ Telecommunications Network Design
- ⚙️ Computer Networks 🌐
- ⚙️ Computer Performance Modeling
- ⚙️ Embedded System Architectures 🌐
- ⚙️ Switched Network Management
- ⚙️ Compiler Optimization and Scheduling
- ⚙️ ASIC and FPGA Design with Verilog 🌐
- ⚙️ Architecture Of Parallel Computers 🌐
- ⚙️ Advanced Topics in Internet Protocols 🌐

CERTIFICATE PROGRAMS

HERE OR THERE

With NC State's **Engineering Online**, we have a long record of success in engineering distance education — more than 40 years long.

We are fully accredited by the Commission on Colleges of the Southern Association of Colleges and Schools, and we are authorized in every U.S. state for delivery of online degree programs.

Courses labeled 🌐 will be offered on Engineering Online in addition to on-campus.



ASIC Design & Verification

Advanced silicon chips, including Application Specific Integrated Circuits (ASIC) power the remarkable systems we rely on every day. They serve as the foundation for everything from smartphones to wearables and from smart medical devices to autonomous cars.

NC State is a leader in ASIC education. Our faculty provide hands on instruction in the cutting edge skills demanded by industry. Our researchers pioneer the processes required to advance this technology.

Engineers trained in state-of-the-art technologies and processes to effectively design—or verify a design—of intricate purpose-built silicon is vital across the industry.

A graduate certificate in ASIC Design and Verification will prepare you to meet the requirements of a growing industry in search of talent equipped to meet the needs of tomorrow.

The ASIC Design and Verification graduate certificate requires a total of 12 credit hours.

- ⚙️ ASIC and FPGA Design with Verilog 🌐
- ⚙️ ASIC Verification 🌐
- ⚙️ ASIC Verification with Universal Verification Methodology 🌐
- ⚙️ VLSI Design 🌐, or
- ⚙️ Electronic System Level and Physical Design 🌐



Nano-Systems Engineering

The NSF Nanosystems Engineering Research Center (NERC) for Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST) offers a Graduate Certificate program in Nano-Systems Engineering.

This multidisciplinary certificate is for students who want to develop additional expertise in the field of nano-science and technology. The graduate certificate consists of a sequence of courses that will equip students with the technical skills essential for graduate research in the field. In addition, the certificate teaches entrepreneurship and other relevant skills that will help students to be competitive in the modern engineering environment.

The scope of the program is broad enough to include applications of nano-technology in a variety of fields including digital logic, energy harvesting, biomedical applications and others. As such, the certificate includes technical electives from many departments to provide breadth in different topics.

This 12 credit-hour certificate provides diverse multi-disciplinary courses from across the university, starting with:

- ⚙ Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems;
- ⚙ Technology Evaluation and Commercialization Concepts; or
- ⚙ Product Innovation

It continues with choosing 3 electives from 23 options, including:

- ⚙ Nanobiotechnology
- ⚙ Materials Science in Processing of Semiconductor Devices
- ⚙ Organic Electronics and LCDs
- ⚙ Self-Powered Nano Systems
- ⚙ Nano-scale Films and Surfaces
- ⚙ Polymeric Biomaterials Engineering

CERTIFICATE PROGRAMS



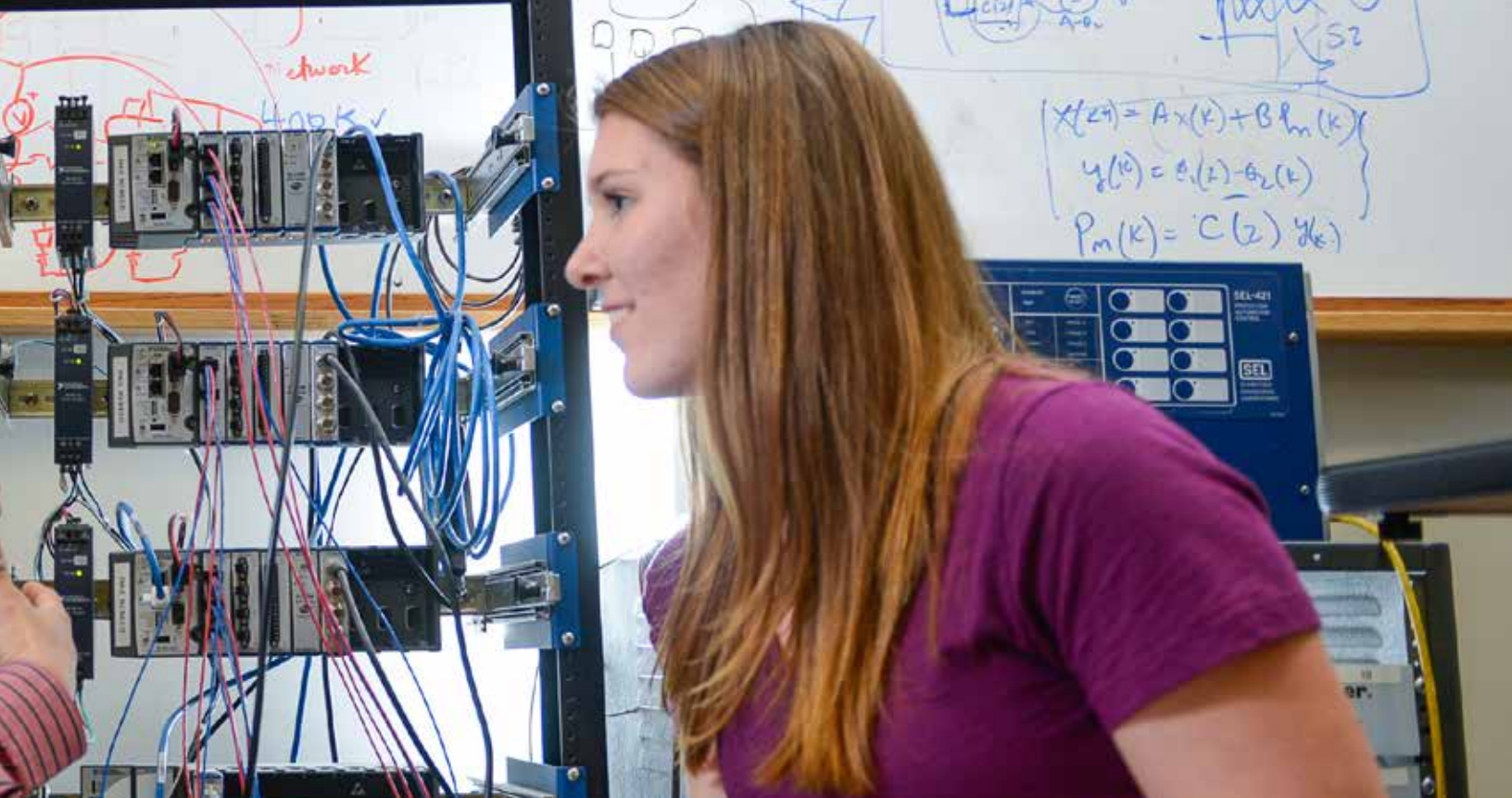
Renewable Electric Energy Systems

Working in conjunction with the Future Renewable Electric Energy Delivery and Management (FREEDM) Systems Center, the Graduate Certificate in REES helps students to develop expertise in renewable electric energy systems and advanced power grid technology.

For those wishing to pursue an advanced degree, the REES certificate program can also provide a strong foundation for a master's degree which addresses broader aspects of renewable energy such as systems theory, semiconductor power devices, distributed grid intelligence, secured communications, power electronics for high frequency and high voltage power conversion, and distributed energy storage devices.

The certificate entails 12 credit hours on topics including:

- ⚙ Power Electronics
- ⚙ Advanced Power Plants
- ⚙ Power System Protection
- ⚙ Solar Thermal
- ⚙ Power System Stability
- ⚙ Electric Vehicle Systems
- ⚙ Electromechanical Systems Design



5G Technologies

5G is the wireless data communications system that will replace the 4G LTE systems currently in use around the world. However, 5G is not an update on 4G. It is a radically new system, using many different architectures, algorithms, circuits, chips and antennas than the previous system. 5G will enable faster streaming to mobile devices with theoretical speeds of up to 10 Gb/s as well as enabling the next generation of the Internet of Things.

As industry is working at a breakneck pace to build out these systems, there is a high demand for engineers who are fluent in the technological challenges and opportunities of this generational leap to 5G.

With a certificate in 5G Technologies, you will be well-equipped to work at the forefront of pivotal technology powered by advanced and advancing communications technologies.

The graduate certificate requires a total of 12 credit hours starting with **LTE and 5G Communications**. Students then choose three 5G-related courses, taking at least two courses from a single track.

Circuits

- ⚙️ Analog Electronics 🌐
- ⚙️ Integrated Circuit Design for Wireless Communications 🌐
- ⚙️ Design of Millimeter-Wave Circuits and Systems 🌐

Microwave Systems and Applied EM

- ⚙️ Radio System Design
- ⚙️ RF Design for Wireless 🌐
- ⚙️ Antennas and Arrays 🌐

Communications

- ⚙️ Introduction to Wireless Networking
- ⚙️ Signal Processing for Communications and Networking
- ⚙️ Computer Networking 🌐



RESOURCED **RESEARCH**

NC State has a rich inventory of research equipment and expertise across the campus' numerous interdisciplinary labs, with over **150 active research grants** in the department alone.

As the only engineering department in the nation to be home to two concurrent **NSF Engineering Research Centers**, one of three **NSF Platforms for Advanced Wireless Research Initiatives**, the home of the **Department of Energy's PowerAmerica institute**, leaders of the only North America **IBM Q Hub**, and home to a world-class **Nanofabrication Facility**, we are ranked among the top academic units engaged in scientific research in the United States.

📍 For more information: ece.ncsu.edu/research



The Center for **Advanced Self-Powered Systems of Integrated Sensors and Technologies** is transforming U.S. and global health informatics, electronics, and biomedical engineering industries and empowering personal environmental health monitoring and emergency response. ASSIST develops and employs nano-enabled energy harvesting, energy storage, nanodevices and sensors to create innovative battery-free, body-powered, and wearable health monitoring systems.



The **Future Renewable Electric Energy Delivery and Management Systems Engineering Research Center** is focused on developing the engineering, science and technology needed to create the 21st century renewable energy power grid and houses several power labs, low and high bay workspaces, and a 40 kilowatt solar array.



PowerAmerica brings together the brightest minds in the wide bandgap (WBG) semiconductor world. Semiconductor manufacturers and the companies that use power semiconductors in their products are working together to accelerate the adoption of next generation silicon carbide (SiC) and gallium nitride (GaN) power electronics.



AERPAW is an NSF Initiative to develop an advanced wireless research platform. The center studies how to use 5G wireless connections to improve the capabilities of drones. The goal is to make sure that the U.S. maintains leadership in the technology, which is seen as a game changer for wireless infrastructure.



The **IBM Q Hub at NC State** is a center of quantum computing education, research, development and implementation. We work directly with IBM to advance quantum computing as well as interdisciplinary applied research, student development and quantum computing curricula at NC State. NC State and members have access to a 53 qubit IBM Q system.



The **Nanofabrication Facility** occupies a 7400 sq. ft. cleanroom. The facility has a full range of micro and nanofabrication capabilities including: photolithography, reactive ion etching (RIE), deep RIE, low pressure chemical vapor deposition (LPCVD), plasma enhanced CVD, rapid thermal anneal, thermal oxidation, solid source diffusion, thermal and e-beam evaporation, sputtering, chemical mechanical polishing, various wet etching and cleaning processes, along with various characterization tools.



"Opportunities to take coursework in other departments—engineering, math, business school etc.—makes students ready to work in cross-domain teams in the real world. There is no better time in your career to learn cross-domain problem solving skills than in graduate school."

Sonali Luniya, Ph.D., 2006
Co-Founder and VP Customer Experience
Patagonia Health



"NC State ECE has the best curriculum along with top-notch course-projects which make a student totally ready to tackle complex real problems after moving to industry."

Anindya Dutta, M.S. 2014
Design Engineer, Intel

\$135,000

Average current salary for NC State ECE Graduates
with a Master's Degree from the past 15 years
according to February 2018 survey of alumni

\$183,000

Average current salary for NC State ECE Graduates
with a Ph.D. from the past 15 years
according to February 2018 survey of alumni