Electrical Engineering (BS): Renewable Electric Energy Systems Concentration

The undergraduate concentration in Renewable Electric Energy Systems (https://ece.ncsu.edu/ugrad/ee/rees/) (REES) is within the Bachelor of Science in Electrical Engineering degree program. With a keen eye on the future, students in the REES concentration prepare to tackle the urgent demand for innovative technologies to harness abundant yet dispersed renewable energy sources like solar and wind. This cutting-edge program is all about engineering smart electric power systems that seamlessly integrate these diverse energy generators.

Students in the REES concentration aren't just learning theory—they're diving deep into renewable energy, power systems, power electronics, and the design of electromechanical systems, preparing to lead the charge in powering a greener, more sustainable future.

Core Courses

The electrical and computer engineering curricula share core courses comprising a substantial portion of the first three years of study. Many of the core courses are offered three times a year in fall, spring, and summer. A strong emphasis is placed on fundamental concepts in core courses so that graduates are prepared for rapid technological changes common in the electrical and computer engineering professions. A comprehensive foundation in mathematics and the physical sciences in the freshman year is followed in subsequent years by additional core courses in mathematics, physics, electric circuit theory, digital logic, computer systems, electronics, electromagnetics, and linear systems. Laboratory work is designed to demonstrate fundamental principles and to provide experience in designing and testing electronic hardware and computer software. Both curricula have a required two semester senior design project which gives students comprehensive experience in designing, building, and testing physical systems.

Curricula

In addition to the core courses described above, students in the electrical engineering curriculum take two foundational electives and four specialization electives in areas of their choice within the discipline and two technical electives that can be in either electrical engineering or selected engineering courses offered by other departments. The concentration enriches the electrical engineering curriculum with coursework in electromechanical energy conversion, renewable electric power systems, power electronics, and power transmission and distribution systems. Additionally, a variety of elective courses are offered in communications, computational intelligence, controls, digital signal processing, digital systems, nanotechnology, mechatronics, microelectronics, networking, robotics, and VLSI design. There are typically a dozen or more of these courses offered each fall and spring semester and two or three available each summer.

Plan Requirements

First Year		
Fall Semester		**Hours**
CH 101	Chemistry - A Molecular Science [1]	3
CH 102	General Chemistry Laboratory [1]	1
E 101	Introduction to Engineering & Problem Solving [2]	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research [2]	4
MA 141	Calculus I [1]	4
	Hours	**14**
Spring Semester		
ECE 109	Introduction to Computer Systems [2]	3
MA 241	Calculus II [1]	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory [1]	4
Select one of the following Economics courses:		3
ARE 201	Introduction to Agricultural & Resource Economics	
ARE 201A	Introduction to Agricultural & Resource Economics	
EC 201	Principles of Microeconomics	
EC 205	Fundamentals of Economics	
	Hours	**14**
Second Year		
Fall Semester		
ECE 200	Introduction to Signals, Circuits and Systems [2]	4
ECE 209	Computer Systems Programming [2]	3
MA 242	Calculus III	4
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
	Hours	**15**
Spring Semester		
COM 110	Public Speaking	3
ECE 211	Electric Circuits [2]	4
ECE 212	Fundamentals of Logic Design [2]	3
ECE 220	Analytical Foundations of Electrical and Computer Engineering [2]	3
	Hours	**13**
Third Year		
Fall Semester		
ECE 301	Linear Systems	3
ECE 302	Microelectronics	4
ST 371	Introduction to Probability and Distribution Theory	3
	Hours	**10**
Spring Semester		
ECE 303	Electromagnetic Fields	3
ECE 380	Engineering Profession for Electrical Engineers	1

ECE 305	Principles of Electromechanical Energy Conversion	3
Select one of the following ECE 3** Foundation courses:		3
E 304	Introduction to Nano Science and Technology	
ECE 306	Introduction to Embedded Systems	
ECE 308	Elements of Control Systems	
ECE 310	Design of Complex Digital Systems	
ENG 331	Communication for Engineering and Technology	3
	Hours	**13**

Fourth Year

Fall Semester

Select one of the following Senior Design Project I courses:		3
ECE 482	Engineering Entrepreneurship Senior Design I	
ECE 484	Electrical and Computer Engineering Senior Design I	
ECE 452	Renewable Electric Energy Systems	3
REES Electives (p. 2)		6
	Hours	**12**

Spring Semester

Select one of the following Senior Design Project II courses:		3
ECE 483	Engineering Entrepreneurship Senior Design II	
ECE 485	Electrical and Computer Engineering Senior Design II	
ECE Elective (p. 2)		3
Open/Technical Electives (p. 3)		6
	Hours	**12**
	Total Hours	**103**

[1] A grade of C or higher is required.
[2] A grade of C- or higher is required.

Code	Title	Hours
GEP Courses		
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		6
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		2
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		5
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
Foreign Language Proficiency (verify requirement)		
Total Hours		**19**

REES Electives

Code	Title	Hours
ECE 434	Fundamentals of Power Electronics	3
ECE 451	Power System Analysis	3
ECE 453	Electric Motor Drives	3
ECE 533	Power Electronics Design & Packaging	3
ECE 534	Power Electronics	3
ECE 535	Design of Electromechanical Systems	3
ECE 550	Power System Operation and Control	3
ECE 551	Smart Electric Power Distribution Systems	3
ECE 553	Semiconductor Power Devices	3
ECE 581	Electric Power System Protection	3
ECE 583	Electric Power Engineering Practicum I	3
ECE 585	The Business of the Electric Utility Industry	3
ECE 586	Communication and SCADA Systems for Smart Grid	3
MAE 535	Design of Electromechanical Systems	3

ECE Electives

ECE Elective

Code	Title	Hours
ECE 402	Communications Engineering	3
ECE 403	Electronics Engineering	3
ECE 404	Introduction to Solid-State Devices	3
ECE 406/506	Architecture Of Parallel Computers	3
ECE 407	Introduction to Computer Networking	3
ECE 410/510	Introduction to Signal Processing	3
ECE 411	Introduction to Machine Learning	3
ECE 418/518	Wearable Biosensors and Microsystems	3
ECE 420	Wireless Communication Systems	3
ECE 421	Introduction to Signal Processing	3
ECE 422	Transmission Lines and Antennas for Wireless	3
ECE 423	Introduction to Photonics and Optical Communications	3
ECE 424/524	Radio System Design	3
ECE 426	Analog Electronics Laboratory	3
ECE 434	Fundamentals of Power Electronics	3
ECE 436	Digital Control Systems	3
ECE 442	Introduction to Integrated Circuit Technology and Fabrication	3
ECE 451	Power System Analysis	3
ECE 452/552	Renewable Electric Energy Systems	3
ECE 453	Electric Motor Drives	3
ECE 455	Industrial Robot Systems	3
ECE 456/556	Mechatronics	3
ECE 460/560		3
ECE 461/561	Embedded System Analysis and Optimization	3
ECE 463/563	Microprocessor Architecture	3
ECE 464/564	ASIC and FPGA Design with Verilog	3
ECE 465/565	Operating Systems Design	3
ECE 466/566	Compiler Optimization and Scheduling	3

ECE 468/568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems	3
ECE 470	Internetworking	3
ECE 488/588	Systems Biology Modeling of Plant Regulation	3
ECE 489/589	Solid State Solar and Thermal Energy Harvesting	3
ECE 492	Special Topics in Electrical and Computer Engineering	1-4
ECE 505	Neural Interface Engineering	3
ECE 511	Analog Electronics	3
ECE 513	Advanced Digital Signal Processing	3
ECE 514	Random Processes	3
ECE 515	Digital Communications	3
ECE 516	System Control Engineering	3
ECE 517	Object-Oriented Design and Development	3
ECE 522	Medical Instrumentation	3
ECE 523	Photonics and Optical Communications	3
ECE 530	Physics of Semiconductors	3
ECE 531		3
ECE 532		3
ECE 533	Power Electronics Design & Packaging	3
ECE 534	Power Electronics	3
ECE 535	Design of Electromechanical Systems	3
ECE 536	Digital Control System Projects	3
ECE 538	Integrated Circuits Technology and Fabrication	3
ECE 540	Electromagnetic Fields	3
ECE 541	Antennas and Arrays	3
ECE 542	Neural Networks and Deep Learning	3
ECE 544	Design Of Electronic Packaging and Interconnects	3
ECE 546	VLSI Systems Design	3
ECE 547	Cloud Computing Technology	3
ECE 549	RF Design for Wireless	3
ECE 550	Power System Operation and Control	3
ECE 551	Smart Electric Power Distribution Systems	3
ECE 553	Semiconductor Power Devices	3
ECE 554	Electric Motor Drives	3
ECE 555	Autonomous Robot Systems	3
ECE 557	Principles Of MOS Transistors	3
ECE 558	Digital Imaging Systems	3
ECE 570	Computer Networks	3
ECE 573	Internet Protocols	3
ECE 574	Computer and Network Security	3
ECE 575	Introduction to Wireless Networking	3
ECE 576	Networking Services: QoS, Signaling, Processes	3
ECE 577	Switched Network Management	3
ECE 578	LTE and 5G Communications	3
ECE 579	Introduction to Computer Performance Modeling	3
ECE 581	Electric Power System Protection	3
ECE 582		3
ECE 583	Electric Power Engineering Practicum I	3
ECE 584	Electric Power Engineering Practicum II	3
ECE 585	The Business of the Electric Utility Industry	3
ECE 586	Communication and SCADA Systems for Smart Grid	3
ECE 587	Power System Transients Analysis	3
ECE 591	Special Topics In Electrical Engineering	1-6
ECE 592	Special Topics In Electrical Engineering	1-6

Open/Technical Elective

Open Electives

Choose from the ECE Elective List or the other Open Electives listed below

ECE Elective

Code	Title	Hours
ECE 402	Communications Engineering	3
ECE 403	Electronics Engineering	3
ECE 404	Introduction to Solid-State Devices	3
ECE 406/506	Architecture Of Parallel Computers	3
ECE 407	Introduction to Computer Networking	3
ECE 410/510	Introduction to Signal Processing	3
ECE 411	Introduction to Machine Learning	3
ECE 418/518	Wearable Biosensors and Microsystems	3
ECE 420	Wireless Communication Systems	3
ECE 421	Introduction to Signal Processing	3
ECE 422	Transmission Lines and Antennas for Wireless	3
ECE 423	Introduction to Photonics and Optical Communications	3
ECE 424/524	Radio System Design	3
ECE 426	Analog Electronics Laboratory	3
ECE 434	Fundamentals of Power Electronics	3
ECE 436	Digital Control Systems	3
ECE 442	Introduction to Integrated Circuit Technology and Fabrication	3
ECE 451	Power System Analysis	3
ECE 452/552	Renewable Electric Energy Systems	3
ECE 453	Electric Motor Drives	3
ECE 455	Industrial Robot Systems	3
ECE 456/556	Mechatronics	3
ECE 460/560		3
ECE 461/561	Embedded System Analysis and Optimization	3
ECE 463/563	Microprocessor Architecture	3
ECE 464/564	ASIC and FPGA Design with Verilog	3
ECE 465/565	Operating Systems Design	3
ECE 466/566	Compiler Optimization and Scheduling	3
ECE 468/568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems	3
ECE 470	Internetworking	3
ECE 488/588	Systems Biology Modeling of Plant Regulation	3
ECE 489/589	Solid State Solar and Thermal Energy Harvesting	3
ECE 492	Special Topics in Electrical and Computer Engineering	1-4
ECE 505	Neural Interface Engineering	3
ECE 511	Analog Electronics	3

ECE 513	Advanced Digital Signal Processing	3
ECE 514	Random Processes	3
ECE 515	Digital Communications	3
ECE 516	System Control Engineering	3
ECE 517	Object-Oriented Design and Development	3
ECE 522	Medical Instrumentation	3
ECE 523	Photonics and Optical Communications	3
ECE 530	Physics of Semiconductors	3
ECE 531		3
ECE 532		3
ECE 533	Power Electronics Design & Packaging	3
ECE 534	Power Electronics	3
ECE 535	Design of Electromechanical Systems	3
ECE 536	Digital Control System Projects	3
ECE 538	Integrated Circuits Technology and Fabrication	3
ECE 540	Electromagnetic Fields	3
ECE 541	Antennas and Arrays	3
ECE 542	Neural Networks and Deep Learning	3
ECE 544	Design Of Electronic Packaging and Interconnects	3
ECE 546	VLSI Systems Design	3
ECE 547	Cloud Computing Technology	3
ECE 549	RF Design for Wireless	3
ECE 550	Power System Operation and Control	3
ECE 551	Smart Electric Power Distribution Systems	3
ECE 553	Semiconductor Power Devices	3
ECE 554	Electric Motor Drives	3
ECE 555	Autonomous Robot Systems	3
ECE 557	Principles Of MOS Transistors	3
ECE 558	Digital Imaging Systems	3
ECE 570	Computer Networks	3
ECE 573	Internet Protocols	3
ECE 574	Computer and Network Security	3
ECE 575	Introduction to Wireless Networking	3
ECE 576	Networking Services: QoS, Signaling, Processes	3
ECE 577	Switched Network Management	3
ECE 578	LTE and 5G Communications	3
ECE 579	Introduction to Computer Performance Modeling	3
ECE 581	Electric Power System Protection	3
ECE 582		3
ECE 583	Electric Power Engineering Practicum I	3
ECE 584	Electric Power Engineering Practicum II	3
ECE 585	The Business of the Electric Utility Industry	3
ECE 586	Communication and SCADA Systems for Smart Grid	3
ECE 587	Power System Transients Analysis	3
ECE 591	Special Topics In Electrical Engineering	1-6
ECE 592	Special Topics In Electrical Engineering	1-6

Code	Title	Hours
ECE 303	Electromagnetic Fields	3
E 304	Introduction to Nano Science and Technology	3
ECE 305	Principles of Electromechanical Energy Conversion	3
ECE 306	Introduction to Embedded Systems	3
ECE 308	Elements of Control Systems	3
ECE 309	Data Structures and Object-Oriented Programming for Electrical and Computer Engineers	3
ECE 310	Design of Complex Digital Systems	3
ECE 384	Practical Engineering Prototyping	3
CE 214	Engineering Mechanics-Statics	3
or MAE 206	Engineering Statics	
MSE 200	Mechanical Properties of Structural Materials	3
or MSE 201	Structure and Properties of Engineering Materials	
ISE 311	Engineering Economic Analysis	3
MAE 208	Engineering Dynamics	3
MAE 201	Thermal-Fluid Sciences	3
MAE 302/ BME 525	Engineering Thermodynamics II	3

Semester Sequence

This is a sample.

First Year		
Fall Semester		**Hours**
CH 101	Chemistry - A Molecular Science [1]	3
CH 102	General Chemistry Laboratory [1]	1
E 101	Introduction to Engineering & Problem Solving [2]	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research	4
MA 141	Calculus I [1]	4
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**17**
Spring Semester		
ECE 109	Introduction to Computer Systems [2]	3
MA 241	Calculus II [1]	4
PY 205	Physics for Engineers and Scientists I [1]	3
PY 206	Physics for Engineers and Scientists I Laboratory	1
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
EC 205	Fundamentals of Economics	3
	Hours	**15**
Second Year		
Fall Semester		
ECE 200	Introduction to Signals, Circuits and Systems [2]	4
ECE 209	Computer Systems Programming [2]	3
MA 242	Calculus III	4
PY 208	Physics for Engineers and Scientists II	3
	Hours	**14**
Spring Semester		
COM 110	Public Speaking	3
ECE 211	Electric Circuits [2]	4
ECE 212	Fundamentals of Logic Design [2]	3

ECE 220	Analytical Foundations of Electrical and Computer Engineering [2]	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**16**
Third Year		
Fall Semester		
ECE 301	Linear Systems	3
ECE 302	Microelectronics	4
ST 371	Introduction to Probability and Distribution Theory	3
ECE 305	Principles of Electromechanical Energy Conversion	3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
	Hours	**14**
Spring Semester		
ECE 303	Electromagnetic Fields	3
ECE 380	Engineering Profession for Electrical Engineers [3]	1
REES Elective (p. 2) [4]		3
Select one of the following Foundation Electives:		3
E 304	Introduction to Nano Science and Technology	
ECE 306	Introduction to Embedded Systems	
ECE 308	Elements of Control Systems	
ECE 310	Design of Complex Digital Systems	
ENG 331	Communication for Engineering and Technology	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**16**
Fourth Year		
Fall Semester		
ECE 484	Electrical and Computer Engineering Senior Design I [3]	3
REES Electives (p. 2) [4]		3
ECE 452	Renewable Electric Energy Systems	3
Open/Technical Elective (p. 3)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**15**
Spring Semester		
ECE 485	Electrical and Computer Engineering Senior Design II [4]	3
ECE Elective (p. 2) [5]		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Open/Technical Electives (p. 3)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		2-3
	Hours	**14-15**
	Total Hours	**121-122**

1. A grade of C or higher is required.
2. A grade of C- or higher is required.
3. Students in the entrepreneurs program should take ECE 383/ECE 482/ECE 483, instead of ECE 380/ECE 484/ECE 485.
4. Major GPAs greater than 3.5 are required to take 5xx courses.
5. Students with major GPAs greater than 3.5 can take 5xx courses

A degree in electrical engineering with a concentration in renewable electric energy systems opens up a world of exciting career opportunities at the forefront of the green energy revolution. Graduates can pursue roles designing and implementing sustainable power systems that harness solar, wind, and other renewable resources. They may work at optimizing the integration of renewable energy sources into existing electrical grids to enhance efficiency and reliability. Additionally, opportunities abound in research and development, where engineers innovate new technologies to improve the performance and scalability of renewable energy systems.

Whether in traditional engineering firms, renewable energy startups, government agencies, or multinational corporations, expertise in renewable electric energy systems is in high demand, driving positive change and paving the way towards a cleaner, more sustainable energy future.

You can see some currently hiring positions in ePack (https://my.ece.ncsu.edu/careers/jobs/) for examples of career paths.

Career Titles

- Computer Network Architects
- Control and Valve Installers and Repairers, Except Mechanical Door
- Electrical Drafter
- Electrical Engineer
- Electrical EngineeringTechnician
- Electro-Mechanical Technicians
- Electronic Drafter
- Electronics Engineer
- Electronics Technician
- Engineering Professor
- Instrument Technician
- Mechanical Drafter
- Mechatronics Engineers
- Photonics Engineers
- Radio Frequency Identification Device Specialists
- Sales Engineers
- Solar Energy Systems Engineers

Learn More About Careers

NCcareers.org (https://nccareers.org/)
Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (https://www.bls.gov/ooh/)
Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (https://www.careeronestop.org/)
View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (https://careers.dasa.ncsu.edu/explore-careers/career-assessments/) (NC State student email address required)
This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (https://careers.dasa.ncsu.edu/about/hours-appointments/) to discuss the results.

Focus 2 Apply Assessment (https://www.focus2career.com/Portal/Register.cfm?SID=1929) (Available to prospective students)
A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

Institute of Electrical and Electronic Engineers (http://www.ieee.org/)
National Society of Professional Engineers (https://www.nspe.org/)