

Electrical Engineering (BS), Renewable Electric Energy Systems Concentration

To see more about what you will learn in this program, visit the Learning Outcomes website (<https://apps.oirp.ncsu.edu/pgas/>)!

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. Beyond the core, students in the computer engineering curriculum take courses in discrete mathematics, data structures, embedded systems, and complex digital systems, in addition to four specialization electives in areas of their choice and one technical elective. For both curricula, 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 and New Product Development I	
ECE 484	Electrical and Computer Engineering Senior Design Project I	
MAE 482	Engineering Entrepreneurship and New Product Development 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 and New Product Development II	
ECE 485	Electrical and Computer Engineering Senior Design Project II	
MAE 483	Engineering Entrepreneurship and New Product Development II	
ECE Elective (p. 3)		3
Open/Technical Electives (p. 5)		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	Counts towards
------	-------	-------	----------------

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 Additional Breadth (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/) (Humanities/Social Sciences/Visual and Performing Arts)		3	
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		5	
GEP U.S. Diversity (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-us-diversity/) (verify requirement)			

GEP Global Knowledge (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/>) (verify requirement)

Foreign Language Proficiency (<http://catalog.ncsu.edu/undergraduate/gep-category-requirements/foreign-language-proficiency/>) (verify requirement)

Total Hours	19
--------------------	-----------

REES Electives

Code	Title	Hours	Counts towards
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

Code	Title	Hours	Counts towards
BME 418/518	Wearable Biosensors and Microsystems		
BME 522	Medical Instrumentation		
CHE 468/568/ ECE 468/568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems		
CSC 406/506/ ECE 406/506	Architecture Of Parallel Computers		
CSC 517	Object-Oriented Design and Development		
CSC 547	Cloud Computing Technology		
CSC 570	Computer Networks		
CSC 573	Internet Protocols		
CSC 574	Computer and Network Security		
CSC 575	Introduction to Wireless Networking		
CSC 576	Networking Services: QoS, Signaling, Processes		
CSC 577	Switched Network Management		
CSC 579	Introduction to Computer Performance Modeling		
ECE 308	Elements of Control Systems		
ECE 402	Communications Engineering		
ECE 403	Electronics Engineering		
ECE 404	Introduction to Solid-State Devices		
ECE 407	Introduction to Computer Networking		
ECE 418	Wearable Biosensors and Microsystems		

ECE 420	Wireless Communication Systems		
ECE 421	Introduction to Signal Processing		
ECE 422	Transmission Lines and Antennas for Wireless		
ECE 423	Introduction to Photonics and Optical Communications		
ECE 424	Radio System Design		
ECE 426	Analog Electronics Laboratory		
ECE 434	Fundamentals of Power Electronics		
ECE 436	Digital Control Systems		
ECE 442	Introduction to Integrated Circuit Technology and Fabrication		
ECE 451	Power System Analysis		
ECE 453	Electric Motor Drives		
ECE 455	Industrial Robot Systems		
ECE 456	Mechatronics		
ECE 460	Embedded System Architectures		
ECE 461	Embedded System Design		
ECE 463	Microprocessor Architecture	3	
ECE 464	ASIC and FPGA Design with Verilog	3	
ECE 466	Compiler Optimization and Scheduling	3	
ECE 470	Internetworking	3	
ECE 488	Systems Biology Modeling of Plant Regulation	3	
ECE 492	Special Topics in Electrical and Computer Engineering	1-4	
ECE 495	Individual Study in ECE	1-3	

ECE 498	Special Projects in ECE	1-3	ECE 544	Design Of Electronic Packaging and Interconnects	3
ECE 505	Neural Interface Engineering	3	ECE 546	VLSI Systems Design	3
ECE 506	Architecture Of Parallel Computers	3	ECE 547	Cloud Computing Technology	3
ECE 511	Analog Electronics	3	ECE 549	RF Design for Wireless	3
ECE 513	Digital Signal Processing	3	ECE 550	Power System Operation and Control	3
ECE 514	Random Processes	3	ECE 551	Smart Electric Power Distribution Systems	3
ECE 515	Digital Communications	3	ECE 553	Semiconductor Power Devices	3
ECE 516	System Control Engineering	3	ECE 554	Electric Motor Drives	3
ECE 517	Object-Oriented Design and Development	3	ECE 555	Autonomous Robot Systems	3
ECE 518	Wearable Biosensors and Microsystems	3	ECE 556	Mechatronics	3
ECE 522	Medical Instrumentation	3	ECE 557	Principles Of MOS Transistors	3
ECE 523	Photonics and Optical Communications	3	ECE 558	Digital Imaging Systems	3
ECE 524	Radio System Design	3	ECE 560	Embedded System Architectures	3
ECE 530	Physical Electronics	3	ECE 561	Embedded System Design	3
ECE 531	Principles Of Transistor Devices	3	ECE 563	Microprocessor Architecture	3
ECE 532	Principles Of Microwave Circuits	3	ECE 564	ASIC and FPGA Design with Verilog	3
ECE 533	Power Electronics Design & Packaging	3	ECE 566	Compiler Optimization and Scheduling	3
ECE 534	Power Electronics	3	ECE 570	Computer Networks	3
ECE 535	Design of Electromechanical Systems	3	ECE 573	Internet Protocols	3
ECE 536	Digital Control System Projects	3	ECE 574	Computer and Network Security	3
ECE 538	Integrated Circuits Technology and Fabrication	3	ECE 575	Introduction to Wireless Networking	3
ECE 540	Electromagnetic Fields	3	ECE 576	Networking Services: QoS, Signaling, Processes	3
ECE 542	Neural Networks	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	Wireless Communication Systems	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 588	Systems Biology Modeling of Plant Regulation	3
ECE 589	Solid State Solar and Thermal Energy Harvesting	3
ECE 591	Special Topics In Electrical Engineering	1-6
ECE 592	Special Topics In Electrical Engineering	1-6
MAE 535	Design of Electromechanical Systems	
MSE 489/589	Solid State Solar and Thermal Energy Harvesting	
OR 579	Introduction to Computer Performance Modeling	
PB 488/588	Systems Biology Modeling of Plant Regulation	

PY 489/589	Solid State Solar and Thermal Energy Harvesting	
PY 552	Condensed Matter Physics I	

Open/Technical Elective

Code	Title	Hours	Counts towards
CE 214	Engineering Mechanics-Statics		
or MAE 206	Engineering Statics		
MSE 200	Mechanical Properties of Structural Materials		
or MSE 201	Structure and Properties of Engineering Materials		
BME 418/518	Wearable Biosensors and Microsystems		
BME 425/525	Bioelectricity		
CHE 468/568/ ECE 468/568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems		
CSC 406/506	Architecture Of Parallel Computers		
ECE 306	Introduction to Embedded Systems		
ECE 308	Elements of Control Systems		
ECE 309	Data Structures and Object-Oriented Programming for Electrical and Computer Engineers		
ECE 310	Design of Complex Digital Systems		
ECE 383	Introduction to Entrepreneurship and New Product Development		
ECE 384	Practical Engineering Prototyping	3	
ECE 402	Communications Engineering	3	

ECE 403	Electronics Engineering	3	ECE 464	ASIC and FPGA Design with Verilog	3
ECE 404	Introduction to Solid-State Devices	3	ECE 466	Compiler Optimization and Scheduling	3
ECE 406	Architecture Of Parallel Computers	3	ECE 470	Internetworking	3
ECE 407	Introduction to Computer Networking	3	ECE 488	Systems Biology Modeling of Plant Regulation	3
ECE 418	Wearable Biosensors and Microsystems	3	ECE 489	Solid State Solar and Thermal Energy Harvesting	3
ECE 420	Wireless Communication Systems	3	ECE 492	Special Topics in Electrical and Computer Engineering	1-4
ECE 421	Introduction to Signal Processing	3	ECE 495	Individual Study in ECE	1-3
ECE 422	Transmission Lines and Antennas for Wireless	3	ECE 498	Special Projects in ECE	1-3
ECE 423	Introduction to Photonics and Optical Communications	3	ECE 506	Architecture Of Parallel Computers	3
ECE 424	Radio System Design	3	ECE 518	Wearable Biosensors and Microsystems	3
ECE 426	Analog Electronics Laboratory	3	ECE 524	Radio System Design	3
ECE 434	Fundamentals of Power Electronics	3	ECE 556	Mechatronics	3
ECE 436	Digital Control Systems	3	ECE 560	Embedded System Architectures	3
ECE 442	Introduction to Integrated Circuit Technology and Fabrication	3	ECE 561	Embedded System Design	3
ECE 451	Power System Analysis	3	ECE 563	Microprocessor Architecture	3
ECE 453	Electric Motor Drives	3	ECE 564	ASIC and FPGA Design with Verilog	3
ECE 455	Industrial Robot Systems	3	ECE 566	Compiler Optimization and Scheduling	3
ECE 456	Mechatronics	3	ECE 588	Systems Biology Modeling of Plant Regulation	3
ECE 460	Embedded System Architectures	3	ECE 589	Solid State Solar and Thermal Energy Harvesting	3
ECE 461	Embedded System Design	3	ISE 311	Engineering Economic Analysis	3
ECE 463	Microprocessor Architecture	3	MAE 201	Engineering Thermodynamics I	3

MAE 208	Engineering Dynamics
MAE 302	Engineering Thermodynamics II
MSE 489/589	Solid State Solar and Thermal Energy Harvesting
PB 488/588	Systems Biology Modeling of Plant Regulation
PY 489/589	Solid State Solar and Thermal Energy Harvesting

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		Hours
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		Hours
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 Project I ³	3
REES Electives (p. 2) ⁴		3
ECE 452	Renewable Electric Energy Systems	3
Open/Technical Elective (p. 5)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3

Hours **15**

Spring Semester

ECE 485	Electrical and Computer Engineering Senior Design Project II ⁴	3
ECE Elective (p. 3) ⁵		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Open/Technical Electives (p. 5)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		2-3

Hours **14-15**

Total Hours **121-122**

8 Electrical Engineering (BS), Renewable Electric Energy Systems Concentration

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