

Electrical Engineering (BS)

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	
E 102	Engineering in the 21st Century	2
Hours		16

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
Select two of the following ECE Foundation Electives:		6
E 304	Introduction to Nano Science and Technology	
ECE 305	Principles of Electromechanical Energy Conversion	
ECE 306 or ECE 310	Introduction to Embedded Systems or Design of Complex Digital Systems	
ECE 308	Elements of Control Systems	
Hours		16

Spring Semester

ECE 303	Electromagnetic Fields	3
Select one of the following:		1
ECE 380	Engineering Profession for Electrical Engineers	
ECE 381	Engineering Profession for Computer Engineers	
ECE 383	Introduction to Entrepreneurship and New Product Development	
EE Electives (p. 2)		6

Choose 2 from the same group of "Comm, Sig, Proc Sys" or "Control Sys" or "Circ, E&M Sys" or "Nano Sys" or "Power Sys" from the ECE and EE Electives List below

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 I	

ECE Electives (p. 4) 6

Choose any two from the list of ECE and EE electives below (p. 4)		
Hours		9

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 II	

Open/Technical Electives (p. 6) 6

Hours		9
Total Hours		105

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 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/)	3	
	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 17

EE Electives

Code	Title	Hours	Counts towards
ECE and EE Electives			
Comm, Sig, Proc Sys			
ECE 402	Communications Engineering		
ECE 420	Wireless Communication Systems		
ECE 421	Introduction to Signal Processing		
ECE 513	Digital Signal Processing		
ECE 514	Random Processes		
ECE 515	Digital Communications		
ECE 542	Neural Networks		
ECE 558	Digital Imaging Systems		
ECE 582	Wireless Communication Systems		
Control Sys			
BME 522	Medical Instrumentation		
ECE 436	Digital Control Systems		
ECE 455	Industrial Robot Systems		
ECE 456	Mechatronics		
ECE 516	System Control Engineering		
ECE 522	Medical Instrumentation		
ECE 555	Autonomous Robot Systems		
ECE 556	Mechatronics		
Circ, E&M Sys			
ECE 403	Electronics Engineering		
ECE 422	Transmission Lines and Antennas for Wireless		

ECE 424	Radio System Design	ECE 518	Wearable Biosensors and Microsystems
ECE 426	Analog Electronics Laboratory	ECE 523	Photonics and Optical Communications
ECE 511	Analog Electronics	ECE 530	Physical Electronics
ECE 524	Radio System Design	ECE 531	Principles Of Transistor Devices
ECE 532	Principles Of Microwave Circuits	ECE 557	Principles Of MOS Transistors
ECE 540	Electromagnetic Fields	ECE 568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems
ECE 544	Design Of Electronic Packaging and Interconnects	MSE 489/589/ ECE 589	Solid State Solar and Thermal Energy Harvesting
ECE 546	VLSI Systems Design	PY 489/589	Solid State Solar and Thermal Energy Harvesting
ECE 549	RF Design for Wireless		
Nano Sys		Power Sys	
BME 418/518	Wearable Biosensors and Microsystems	ECE 434	Fundamentals of Power Electronics
CHE 468/568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems	ECE 451	Power System Analysis
ECE 404	Introduction to Solid-State Devices	ECE 452	Renewable Electric Energy Systems
ECE 418	Wearable Biosensors and Microsystems	ECE 453	Electric Motor Drives
ECE 423	Introduction to Photonics and Optical Communications	ECE 533	Power Electronics Design & Packaging
ECE 442	Introduction to Integrated Circuit Technology and Fabrication	ECE 534	Power Electronics
ECE 468	Conventional and Emerging Nanomanufacturin Techniques and Their Applications in Nanosystems	ECE 535	Design of Electromechanical Systems
ECE 489	Solid State Solar and Thermal Energy Harvesting	ECE 550	Power System Operation and Control
		ECE 551	Smart Electric Power Distribution Systems
		ECE 552	Renewable Electric Energy Systems

ECE 553	Semiconductor Power Devices
ECE 581	Electric Power System Protection
ECE 583	Electric Power Engineering Practicum I
ECE 585	The Business of the Electric Utility Industry
ECE 586	Communication and SCADA Systems for Smart Grid
MAE 535	Design of Electromechanical Systems
Comp Arch Sys	
CSC 406/506/ ECE 406	Architecture Of Parallel Computers
ECE 463	Microprocessor Architecture
ECE 464	ASIC and FPGA Design with Verilog
ECE 506	Architecture Of Parallel Computers
ECE 546	VLSI Systems Design
ECE 563	Microprocessor Architecture
ECE 564	ASIC and FPGA Design with Verilog
Embed Sys	
ECE 460/560	Embedded System Architectures
ECE 461/561	Embedded System Analysis and Optimization
Networking Sys	
CSC/ECE 570	Computer Networks
CSC/ECE 573	Internet Protocols
CSC/ECE 574	Computer and Network Security
CSC/ECE 575	Introduction to Wireless Networking
CSC/ECE 577	Switched Network Management

ECE 407	Introduction to Computer Networking
ECE 470	Internetworking
Software Sys	
CSC/ECE 517	Object-Oriented Design and Development
ECE 466/566	Compiler Optimization and Scheduling
Special Topics	
ECE 492	Special Topics in Electrical and Computer Engineering

ECE Electives

ECE Elective

Code	Title	Hours	Counts towards
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 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 522	Medical Instrumentation	3
ECE 436	Digital Control Systems	3	ECE 523	Photonics and Optical Communications	3
ECE 442	Introduction to Integrated Circuit Technology and Fabrication	3	ECE 530	Physical Electronics	3
ECE 451	Power System Analysis	3	ECE 531	Principles Of Transistor Devices	3
ECE 452/552	Renewable Electric Energy Systems	3	ECE 532	Principles Of Microwave Circuits	3
ECE 453	Electric Motor Drives	3	ECE 533	Power Electronics Design & Packaging	3
ECE 455	Industrial Robot Systems	3	ECE 534	Power Electronics	3
ECE 456/556	Mechatronics	3	ECE 535	Design of Electromechanical Systems	3
ECE 460/560	Embedded System Architectures	3	ECE 540	Electromagnetic Fields	3
ECE 461/561	Embedded System Analysis and Optimization	3	ECE 542	Neural Networks	3
ECE 463/563	Microprocessor Architecture	3	ECE 544	Design Of Electronic Packaging and Interconnects	3
ECE 464/564	ASIC and FPGA Design with Verilog	3	ECE 546	VLSI Systems Design	3
ECE 466	Compiler Optimization and Scheduling	3	ECE 549	RF Design for Wireless	3
ECE 470	Internetworking	3	ECE 550	Power System Operation and Control	3
ECE 489/589	Solid State Solar and Thermal Energy Harvesting	3	ECE 551	Smart Electric Power Distribution Systems	3
ECE 492	Special Topics in Electrical and Computer Engineering	1-4	ECE 553	Semiconductor Power Devices	3
ECE 505	Neural Interface Engineering	3	ECE 555	Autonomous Robot Systems	3
ECE 511	Analog Electronics	3	ECE 557	Principles Of MOS Transistors	3
ECE 513	Digital Signal Processing	3	ECE 558	Digital Imaging Systems	3
ECE 514	Random Processes	3	ECE 568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems	3
ECE 515	Digital Communications	3	ECE 570	Computer Networks	3
ECE 516	System Control Engineering	3	ECE 573	Internet Protocols	3
ECE 517	Object-Oriented Design and Development	3			

ECE 574	Computer and Network Security	3
ECE 575	Introduction to Wireless Networking	3
ECE 577	Switched Network Management	3
ECE 581	Electric Power System Protection	3
ECE 582	Wireless Communication Systems	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
ECE 592	Special Topics In Electrical Engineering	1-6

Open/Tech Electives

Open Electives

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

ECE Elective

Code	Title	Hours	Counts towards
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 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	Embedded System Architectures	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 466	Compiler Optimization and Scheduling	3
ECE 470	Internetworking	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	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	Physical Electronics	3
ECE 531	Principles Of Transistor Devices	3
ECE 532	Principles Of Microwave Circuits	3
ECE 533	Power Electronics Design & Packaging	3
ECE 534	Power Electronics	3
ECE 535	Design of Electromechanical Systems	3
ECE 540	Electromagnetic Fields	3
ECE 542	Neural Networks	3
ECE 544	Design Of Electronic Packaging and Interconnects	3
ECE 546	VLSI Systems Design	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 555	Autonomous Robot Systems	3

ECE 557	Principles Of MOS Transistors	3
ECE 558	Digital Imaging Systems	3
ECE 568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems	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 577	Switched Network Management	3
ECE 581	Electric Power System Protection	3
ECE 582	Wireless Communication Systems	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
ECE 592	Special Topics In Electrical Engineering	1-6

Code	Title	Hours	Counts towards
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
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	Engineering Thermodynamics I	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 ^{1,2}	1
E 115	Introduction to Computing Environments ^{1,2}	1
ENG 101	Academic Writing and Research ^{1,2}	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
E 102	Engineering in the 21st Century	2

GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
---	--	---

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	Physics for Engineers and Scientists II	3
PY 209	Physics for Engineers and Scientists II Laboratory	1

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

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
ECE Foundation Elective (p. 1)		3
ST 371	Introduction to Probability and Distribution Theory	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
Select one of the following:		1

ECE 380	Engineering Profession for Electrical Engineers
---------	---

ECE 381	Engineering Profession for Computer Engineers
---------	---

ECE 383	Introduction to Entrepreneurship and New Product Development
---------	--

ECE Foundation Elective (p. 1)		3
--------------------------------	--	---

Open/Technical Elective (p. 6)		3
--------------------------------	--	---

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
---------	---	---

ECE Elective (p. 4)		3
EE Elective (p. 2)		3
Open/Technical Elective (p. 6)		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	3
EE Elective (p. 2)		3
ECE Elective (p. 4)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	15
	Total Hours	122

¹ Courses required for Change of Degree Audit (CODA). CH 101, 102; MA 141, 241; PY 205, 206 must be completed with C or higher.

² A grade of C- or higher is required. E 115 requires satisfactory completion (S).