

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 Project I	
MAE 482	Engineering Entrepreneurship and New Product Development I	

ECE Electives (p. 2)		6
Choose any two from the list of ECE and EE electives below (p. 2)		
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 Project II	
MAE 483	Engineering Entrepreneurship and New Product Development II	

Open/Technical Electives (p. 4)		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
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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/)		3	
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GEP U.S. Diversity (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-us-diversity/) (verify requirement)			
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GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)			
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Foreign Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/foreign-language-proficiency/) (verify requirement)			
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Total Hours		17	
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ECE and EE Electives

Code	Title	Hours	Counts towards
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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 468	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems
ECE 556	Mechatronics	ECE 489	Solid State Solar and Thermal Energy Harvesting
Circ, E&M Sys		ECE 518	Wearable Biosensors and Microsystems
ECE 403	Electronics Engineering	ECE 523	Photonics and Optical Communications
ECE 422	Transmission Lines and Antennas for Wireless	ECE 530	Physical Electronics
ECE 424	Radio System Design	ECE 531	Principles Of Transistor Devices
ECE 426	Analog Electronics Laboratory	ECE 557	Principles Of MOS Transistors
ECE 511	Analog Electronics	ECE 568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems
ECE 524	Radio System Design	MSE 489/589/ ECE 589	Solid State Solar and Thermal Energy Harvesting
ECE 532	Principles Of Microwave Circuits	PY 489/589	Solid State Solar and Thermal Energy Harvesting
ECE 540	Electromagnetic Fields	Power Sys	
ECE 544	Design Of Electronic Packaging and Interconnects	ECE 434	Fundamentals of Power Electronics
ECE 546	VLSI Systems Design	ECE 451	Power System Analysis
ECE 549	RF Design for Wireless	ECE 452	Renewable Electric Energy Systems
Nano Sys		ECE 453	Electric Motor Drives
BME 418/518	Wearable Biosensors and Microsystems	ECE 533	Power Electronics Design & Packaging
CHE 468/568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems	ECE 534	Power Electronics
ECE 404	Introduction to Solid-State Devices		
ECE 418	Wearable Biosensors and Microsystems		
ECE 423	Introduction to Photonics and Optical Communications		
ECE 442	Introduction to Integrated Circuit Technology and Fabrication		

ECE 535	Design of Electromechanical Systems
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 Design
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

Open/Tech Electives

Code	Title	Hours	Counts towards
Open/Tech Elective			
BME 418/518/ ECE 418	Wearable Biosensors and Microsystems		
BME 522	Medical Instrumentation		
CHE 468/568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems		
CSC 517	Object-Oriented Design and Development		
CSC 570	Computer Networks		
CSC 573	Internet Protocols		
CSC 574	Computer and Network Security		
CSC 575	Introduction to Wireless Networking		
CSC 577	Switched Network Management		

E 304	Introduction to Nano Science and Technology	ECE 442	Introduction to Integrated Circuit Technology and Fabrication
ECE 305	Principles of Electromechanical Energy Conversion	ECE 451	Power System Analysis
ECE 306	Introduction to Embedded Systems	ECE 452	Renewable Electric Energy Systems
ECE 308	Elements of Control Systems	ECE 453	Electric Motor Drives
ECE 309	Data Structures and Object-Oriented Programming for Electrical and Computer Engineers	ECE 455	Industrial Robot Systems
ECE 310	Design of Complex Digital Systems	ECE 456	Mechatronics
ECE 402	Communications Engineering	ECE 460	Embedded System Architectures
ECE 403	Electronics Engineering	ECE 461	Embedded System Design
ECE 404	Introduction to Solid-State Devices	ECE 463	Microprocessor Architecture
ECE 407	Introduction to Computer Networking	ECE 464	ASIC and FPGA Design with Verilog
ECE 420	Wireless Communication Systems	ECE 466	Compiler Optimization and Scheduling
ECE 421	Introduction to Signal Processing	ECE 468	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems
ECE 422	Transmission Lines and Antennas for Wireless	ECE 470	Internetworking
ECE 423	Introduction to Photonics and Optical Communications	ECE 489	Solid State Solar and Thermal Energy Harvesting
ECE 424	Radio System Design	ECE 492	Special Topics in Electrical and Computer Engineering
ECE 426	Analog Electronics Laboratory	ECE 511	Analog Electronics
ECE 434	Fundamentals of Power Electronics	ECE 513	Digital Signal Processing
ECE 436	Digital Control Systems	ECE 514	Random Processes
		ECE 515	Digital Communications
		ECE 516	System Control Engineering
		ECE 517	Object-Oriented Design and Development

ECE 518	Wearable Biosensors and Microsystems	ECE 560	Embedded System Architectures
ECE 522	Medical Instrumentation	ECE 561	Embedded System Design
ECE 523	Photonics and Optical Communications	ECE 563	Microprocessor Architecture
ECE 524	Radio System Design	ECE 564	ASIC and FPGA Design with Verilog
ECE 530	Physical Electronics	ECE 566	Compiler Optimization and Scheduling
ECE 531	Principles Of Transistor Devices	ECE 568	Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems
ECE 532	Principles Of Microwave Circuits	ECE 570	Computer Networks
ECE 533	Power Electronics Design & Packaging	ECE 573	Internet Protocols
ECE 534	Power Electronics	ECE 574	Computer and Network Security
ECE 535	Design of Electromechanical Systems	ECE 575	Introduction to Wireless Networking
ECE 540	Electromagnetic Fields	ECE 577	Switched Network Management
ECE 542	Neural Networks	ECE 581	Electric Power System Protection
ECE 544	Design Of Electronic Packaging and Interconnects	ECE 582	Wireless Communication Systems
ECE 546	VLSI Systems Design	ECE 584	Electric Power Engineering Practicum II
ECE 549	RF Design for Wireless	ECE 585	The Business of the Electric Utility Industry
ECE 550	Power System Operation and Control	ECE 586	Communication and SCADA Systems for Smart Grid
ECE 551	Smart Electric Power Distribution Systems	ECE 589	Solid State Solar and Thermal Energy Harvesting
ECE 552	Renewable Electric Energy Systems	ISE 311	Engineering Economic Analysis
ECE 553	Semiconductor Power Devices	MAE 201	Engineering Thermodynamics I
ECE 555	Autonomous Robot Systems		
ECE 556	Mechatronics		
ECE 557	Principles Of MOS Transistors		
ECE 558	Digital Imaging Systems		

MAE 208	Engineering Dynamics
MAE 302	Engineering Thermodynamics II
MAE 535	Design of Electromechanical Systems
MSE 489	Solid State Solar and Thermal Energy Harvesting
MSE 589	Solid State Solar and Thermal Energy Harvesting
PY 489	Solid State Solar and Thermal Energy Harvesting
PY 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 ^{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		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
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. 2)		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. 2)		3
Open/Technical Elective (p. 4)		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 Project I	3
ECE Elective (p. 2)		3
ECE Elective (p. 2)		3
Open/Technical Elective (p. 4)		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	3
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ECE Elective (p. 2)	3
ECE Elective (p. 2)	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).