

Computer Engineering (BS)

At its core, computer engineering (<https://ece.ncsu.edu/ugrad/cpe/>) is at the forefront of technological innovation, blending the realms of electrical engineering and computer science to sculpt the future of computing. It's the art and science of crafting the digital architecture that underpins tomorrow's world, where the boundaries between hardware and software blur into seamless integration.

In this ever-evolving landscape, computer engineers are the architects of progress, shaping the next generation of intelligent systems, from advanced robotics to quantum computing. They're the trailblazers who harness the power of emerging technologies like artificial intelligence, augmented reality, and the Internet of Things to engineer solutions that redefine what's possible.

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 computer engineering curriculum take courses in discrete mathematics, data structures, embedded systems, and complex digital systems, along with four specialization electives in areas of their choice and one technical elective. A variety of elective courses are also 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
CSC 226	Discrete Mathematics ²	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		16

Third Year

Fall Semester

ECE 301	Linear Systems	3
ECE 302	Microelectronics	4
ECE 306	Introduction to Embedded Systems	3
ST 371	Introduction to Probability and Distribution Theory	3
Hours		13

Spring Semester

ECE 309	Data Structures and Object-Oriented Programming for Electrical and Computer Engineers	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 310	Design of Complex Digital Systems	3
CPE Elective (p. 2)		3
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	
CPE Elective (p. 2)		3
ECE Elective (p. 2)		3
Hours		9
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 Elective (p. 3)		3
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
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 Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)	3
	GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)	3
	GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)	
	World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)	
Total Hours		17

CPE Electives

Code	Title	Hours
Comp Arch Sys		
ECE 406/506	Architecture Of Parallel Computers	3

ECE 463/563	Microprocessor Architecture	3
ECE 464/564	ASIC and FPGA Design with Verilog	3
ECE 546	VLSI Systems Design	3
Embed Sys		
ECE 460/560		3
ECE 461/561	Embedded System Analysis and Optimization	3
Networking Sys		
ECE 407	Introduction to Computer Networking	3
ECE 470	Internetworking	3
ECE 547	Cloud Computing Technology	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
Software Sys		
ECE 465/565	Operating Systems Design	3
ECE 466/566	Compiler Optimization and Scheduling	3
ECE 517	Object-Oriented Design and Development	3

ECE Elective

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 Electives

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 ²	1
ENG 101	Academic Writing and Research 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 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory ¹	4

Hours 15

Spring Semester

COM 110	Public Speaking	3
CSC 226	Discrete Mathematics ²	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		16

Third Year**Fall Semester**

ECE 301	Linear Systems	3
ECE 302	Microelectronics	4
ECE 306	Introduction to Embedded Systems	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
ST 371	Introduction to Probability and Distribution Theory	3
Hours		16

Spring Semester

ECE 309	Data Structures and Object-Oriented Programming for Electrical and Computer Engineers	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 310	Design of Complex Digital Systems	3
Open/Technical Elective (p. 3)		3
ENG 331	Communication for Engineering and Technology	3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Hours		14

Fourth Year**Fall Semester**

ECE 484	Electrical and Computer Engineering Senior Design I	3
CPE Elective (p. 2)		3
CPE 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

Spring Semester

ECE 485	Electrical and Computer Engineering Senior Design II	3
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 A grade of C or higher is required.

² A grade of C- or higher is required.

A computer engineering degree unlocks a vast array of exciting career opportunities at the forefront of technology. Graduates can delve into roles such as hardware engineers—designing and optimizing the next generation of computing devices—or software engineers who crafting innovative applications and systems that drive technological progress. You have career opportunities in fields like cybersecurity or you can delve into artificial intelligence and machine learning, developing algorithms that power intelligent systems.

Additionally, opportunities abound in areas such as embedded systems, where engineers create the brains behind smart devices, and in networking, where they build the backbone of our connected world. Moreover, with the rapid expansion of fields like the Internet of Things, augmented reality, and quantum computing, the possibilities for computer engineering professionals are continually expanding, offering avenues for creative problem-solving and impactful innovation across industries.

Whether in established tech giants like Apple, Samsung, or Analog Devices, cutting-edge startups, research institutions, or entrepreneurial ventures, computer engineering graduates are poised to shape the future of technology and drive meaningful change in society.

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

Career Titles

- Architectural Drafters
- Automotive Engineering Technicians
- Computer and Information Scientists
- Computer and Information Systems Managers
- Computer Hardware Engineers
- Computer Network Architects
- Computer Programmer
- Computer Systems Analyst
- Computer Systems Engineer
- Database Administrator
- Database Architects
- Electrical and Electronic Engineering Technologists and Technicians
- Engineering Professor
- Information Security Analysts
- Sales Representative (Computers)
- Software Developers - Applications
- Telecommunications Engineering Specialists

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 Electronics Engineers (<http://www.ieee.org/>)

National Association of Professional Engineers (<https://www.nspe.org/>)