

Computer Science (BS): Artificial Intelligence Concentration

The Department of Computer Science in the College of Engineering at NC State University offers a Bachelor of Science in Computer Science degree. The program is accredited by the Computing Accreditation Commission of ABET, <https://www.abet.org>.

Students complete the standard set of engineering first-year courses, which include courses in the humanities, chemistry, mathematics, physics, and computing. Students may apply to join the Department of Computer Science as degree-seeking students via the CODA process (<https://www.engr.ncsu.edu/academics/undergrad/coda/>).

The Computer Science curriculum teaches students the skills needed to specify, design, implement, test, and deploy computer and software systems. Core courses provide a foundation for all students in programming languages, data structures, software engineering, systems, the theory of computation, the basics of building secure software and systems, teaming and communication, and the social and ethical dimensions of the practice of computer science.

All Computer Science majors must complete a team project in Senior Design. Projects under the auspices of the department's Senior Design Center (<https://sdc.csc.ncsu.edu>) may have industrial sponsors, so student teams gain experience working jointly with industry representatives to achieve project goals. Senior Design teams are expected to solve a technical computing problem while effectively communicating their work and process to various audiences.

Artificial Intelligence Concentration

The AI concentration supports the overall goals of the National Artificial Intelligence Initiative, which seeks to advance American development of AI applications, management, and other areas. It supports the Engineering Grand Challenges (<http://www.engineeringchallenges.org/challenges.aspx>) of Advance Personalized Learning, Enhance Virtual Reality, Reverse-Engineer the Brain, and Engineer the Tools of Scientific Discovery.

The Artificial Intelligence (AI) Concentration provides the student with the opportunity to develop intelligent and autonomous systems in multiple domains, apply machine learning and data mining to address real-world problems, and incorporate intelligent behavior into computing platforms. Students complete 21 credit hours of focused work on AI topics.

Departmental Information

The Department of Computer Science is located in Engineering Building II on NC State's Centennial Campus.

Department of Computer Science (<https://www.csc.ncsu.edu/>)

Contact Computer Science Academic (<https://www.csc.ncsu.edu/academics/undergrad/advising/>) Advising

Plan Requirements

Code	Title	Hours
Major Field of Study Requirements		
Math		
MA 141	Calculus I ^{1,2}	4
MA 241	Calculus II ^{1,2}	4
MA 242	Calculus III	4
MA 305	Introductory Linear Algebra and Matrices	3
ST 370	Probability and Statistics for Engineers	3
Sciences		
CH 101 & CH 102	Chemistry - A Molecular Science and General Chemistry Laboratory ^{1,2}	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory ^{1,2}	4
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
Basic Science Elective (p. 2)		3
CSC Major		
CSC 116	Introduction to Computing - Java ²	3
CSC 216 & CSC 217	Software Development Fundamentals and Software Development Fundamentals Lab ²	4
CSC 226	Discrete Mathematics ²	3
CSC 230	C and Software Tools	3
CSC 246	Concepts and Facilities of Operating Systems for Computer Scientists	3
CSC 316	Data Structures and Algorithms	3
CSC 326	Software Engineering	4
CSC 333	Automata, Grammars, and Computability	3
CSC 379	Ethics in Computing	1
CSC 492	Senior Design Project	3
Other Major		
CSC Restricted Electives (p. 2)		3
Other Restricted Electives - Group B (p. 3)		3
ENG 331	Communication for Engineering and Technology	3
Concentration Courses/Groups/Electives		
CSC 411	Introduction to Artificial Intelligence ²	3
CSC 422	Automated Learning and Data Analysis ²	3
CSC AI Restricted Electives (p. 2) ²		6
AI Restricted Electives (p. 2)		9
College Requirements		
Orientation Course(s):		4
E 101	Introduction to Engineering & Problem Solving ^{1,3}	
E 102	Engineering in the 21st Century ³	
E 115	Introduction to Computing Environments ¹	
Other:		3
EC 205	Fundamentals of Economics	
or EC 201	Principles of Microeconomics	
or ARE 201	Introduction to Agricultural & Resource Economics	
General Education Program Requirements		
ENG 101 ^{1,3}		4

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 Elective (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)	3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)	2
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)	
GEP Foundations of American Democracy (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-fad/) (verify requirement)	
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)	
Total Hours	121

¹ College of Engineering CODA classes.

² A grade of C or higher is required.

³ A grade of C- or higher is required.

AI Restricted Electives

Code	Title	Hours
BUS 351	Introduction to Business Analytics	3
BUS 428	Financial Analytics	3
BUS 429	Financial Modeling	3
BUS 470	Operations Modeling and Analysis	3
BUS 476	Decision Modeling and Analysis	3
CSC 427	Introduction to Numerical Analysis I	3
CSC 428	Introduction to Numerical Analysis II	3
DSC 495	Special Topics in Data Science	1-3
EC 351	Econometrics I	3
EC 451	Econometrics II	3
ISE 361	Deterministic Models in Industrial Engineering	3
ISE 362	Stochastic Models in Industrial Engineering	3
ISE 417	Database Applications in Industrial & Systems Engineering	3
ISE 437	Data Analytics for Industrial Engineering	3
ISE 441	Introduction to Simulation	3
ISE 447	Applications of Data Science in Healthcare	3
MA 341	Applied Differential Equations I	3
MA 351	Introduction to Discrete Mathematical Models	3
MA 401	Applied Differential Equations II	3
MA 402	Mathematics of Scientific Computing	3
MA 421	Introduction to Probability	3
MA 430	Mathematical Models in the Physical Sciences	3
MA 432	Mathematical Models in Life Sciences	3
ST 307	Introduction to Statistical Programming- SAS	1

ST 372	Introduction to Statistical Inference and Regression	3
ST 430	Introduction to Regression Analysis	3
ST 431	Introduction to Experimental Design	3
ST 432	Introduction to Survey Sampling	3
ST 437	Applied Multivariate and Longitudinal Data Analysis	3
ST 440	Applied Bayesian Analysis	3
ST 445	Introduction to Statistical Computing and Data Management	3
CSC AI Restricted Electives (only 3 hours may count in the AI Restricted Electives from this list) (p. 2)		3

Basic Science Elective

Code	Title	Hours
BIO ***		
CH 201	Chemistry - A Quantitative Science	3
MEA ***		
PB ***		
PY 123	Stellar and Galactic Astronomy	3
PY 124	Solar System Astronomy	3
PY 328	Stellar and Galactic Astrophysics	3
PY 341	Relativity, Gravitation and Cosmology	3
PY 401	Quantum Physics I	3
PY 402	Quantum Physics II	3
PY 407	Introduction to Modern Physics	3
PY 411	Mechanics I	3
PY 412	Mechanics II	3
PY 413	Thermal Physics	3
PY 414	Electromagnetism I	3
PY 415	Electromagnetism II	3
ZOO ***		

CSC AI Restricted Electives²

Code	Title	Hours
CSC 440	Database Management Systems	3
CSC 442	Introduction to Data Science	3
CSC 455	Social Computing and Decentralized Artificial Intelligence	3
CSC 484	Building Game AI	3

CSC Restricted Electives

Code	Title	Hours
CSC 236	Computer Organization and Assembly Language for Computer Scientists	3
CSC 302 or CSC 580	Introduction to Numerical Methods Numerical Analysis I	3
CSC 342	Applied Web-based Client-Server Computing	3
CSC 401 or CSC 573	Data and Computer Communications Networks Internet Protocols	3
CSC 402	Networking Projects	3
CSC 405	Computer Security	3
CSC 406	Architecture Of Parallel Computers	3

or CSC 506	Architecture Of Parallel Computers	
CSC 408	Software Product Management	3
CSC 411	Introduction to Artificial Intelligence	3
or CSC 520	Artificial Intelligence I	
CSC 412	Compiler Construction	3
or CSC 512	Compiler Construction	
CSC 414	Foundations of Cryptography	3
or CSC 514	Foundations of Cryptography	
CSC 415	Software Security	3
or CSC 515	Software Security	
CSC 416	Introduction to Combinatorics	3
CSC 417	Theory of Programming Languages	3
CSC 418	Software Analysis and Design	3
CSC 419	DevOps: Modern Software Engineering Practices	3
or CSC 519	DevOps: Modern Software Engineering Practices	
CSC 422	Automated Learning and Data Analysis	3
or CSC 522	Automated Learning and Data Analysis	
CSC 431	File Organization and Processing	3
CSC 433	Privacy in the Digital Age	3
or CSC 533	Privacy in the Digital Age	
CSC 440	Database Management Systems	3
or CSC 540	Database Management Concepts and Systems	
CSC 442	Introduction to Data Science	3
CSC 447	Introduction to Cloud Computing	3
or CSC 547	Cloud Computing Technology	
CSC 450	Web Services	3
CSC 451	Robot Motion Planning	3
CSC 453	Introduction to Internet of Things (IoT) Systems	3
CSC 454	Human-Computer Interaction	3
or CSC 554	Human-Computer Interaction	
CSC 455	Social Computing and Decentralized Artificial Intelligence	3
or CSC 555	Social Computing and Decentralized Artificial Intelligence	
CSC 456	Computer Architecture and Multiprocessors	3
or CSC 506	Architecture Of Parallel Computers	
CSC 461	Computer Graphics	3
or CSC 561	Principles of Computer Graphics	
CSC 462	Advanced Computer Graphics Projects	3
or CSC 562	Introduction to Game Engine Design	
CSC 467	Introduction to Quantum Algorithms	3
CSC 469	Quantum Programming	3
CSC 471	Modern Topics in Cybersecurity	3
CSC 472	Cybersecurity Practicum	3
CSC 474	Network Security	3
or CSC 574	Computer and Network Security	
CSC 481	Game Engine Foundations	3
or CSC 581	Game Engine Foundations	
CSC 482	Advanced Computer Game Projects	3
CSC 484	Building Game AI	3
or CSC 584	Building Game AI	
CSC 486	Computational Visual Narrative	3

CSC 490	Independent Study in Computer Science	1-6
CSC 491	Special Topics in Computer Science	1-6
CSC 499	Independent Research in Computer Science	1-6
CSC 501	Operating Systems Principles	3
CSC 503	Computational Applied Logic	3
CSC 505	Design and Analysis Of Algorithms	3
CSC 510	Software Engineering	3
CSC 517	Object-Oriented Design and Development	3
CSC 530	Computational Methods for Molecular Biology	3
CSC 537	Systems Attacks and Defenses	3
CSC 541	Advanced Data Structures	3
CSC 542	Neural Networks and Deep Learning	3
CSC 546	Management Decision and Control Systems	3
CSC 548	Parallel Systems	3
CSC 563	Visual Interfaces for Mobile Devices	3
CSC 565	Graph Theory	3
CSC 568	Enterprise Storage Architecture	3
CSC 570	Computer Networks	3
CSC 572	Optimizations and Algorithms	3
CSC 575	Introduction to Wireless Networking	3
CSC 576	Networking Services: QoS, Signaling, Processes	3
CSC 577	Switched Network Management	3
CSC 578	LTE and 5G Communications	3
CSC 582	Computer Models of Interactive Narrative	3
CSC 583	Introduction to Parallel Computing	3
CSC 591	Special Topics In Computer Science	1-6
CSC 595	Cybersecurity Practicum	3
ECE 482	Engineering Entrepreneurship Senior Design I	3
ECE 483	Engineering Entrepreneurship Senior Design II	3
MA 414	Foundations of Cryptography	3
MA 416	Introduction to Combinatorics	3
ST 442	Introduction to Data Science	3

Other Restricted Elective - Group B

Code	Title	Hours
CSC Restricted Elective Courses		1-6
ACC 310	Intermediate Financial Accounting I	3
ACC 311	Intermediate Financial Accounting II	3
ACC 330	An Introduction To Income Taxation	3
ACC 340	Accounting Information Systems	3
ARS 306	Music Composition with Computers	3
BUS 320	Financial Management	3
BUS 340	Information Systems Management	3
BUS 360	Marketing Methods	3
BUS 4**		
CHE 435	Process Systems Analysis and Control	3
CHE 465	Colloidal and Nanoscale Engineering	3
CSC 427	Introduction to Numerical Analysis I	3
CSC 428	Introduction to Numerical Analysis II	3
DSC 405	Data Wrangling and Web Scraping	1
DSC 406	Exploratory Data Analysis for Big Data	1
DSC 410	Data Internship Preparation for Social Impact	1

DSC 412	Exploring Machine Learning	1
EC 3**		
EC 4**		
EC 5**		
ECE 3** (except for ECE 309)		
ECE 4**		
ECE 5**		
EED 401	Teaching Undergraduate Engineers	3
or EED 501	Teaching Undergraduate Engineers	
EED 411	Societal Foundations for Engineering Education	3
or EED 511	Societal Foundations for Engineering Education	
EED 414	Ethics for Engineering Education	3
or EED 514	Ethics for Engineering Education	
EED 495	Special Topics in Engineering Education	1-3
EED 502	Engineering Education : Content, Assessment, and Pedagogy	3
EED 509	Field Experiences in Engineering Education	3
EED 595	Special Topics in Engineering Education	1-3
EMS 480	Teaching Mathematics with Technology	3
GC 320	3D Spatial Relations	3
GC 350	Applied CAD/D and Geometric Controls	3
GC 420	Visual Thinking	3
GN 5**		
ISE 311	Engineering Economic Analysis	3
ISE 361	Deterministic Models in Industrial Engineering	3
ISE 4**		
ISE 5**		
LOG 335	Symbolic Logic	3
LOG 435	Advanced Logic & Metamathematics	3
LOG 535	Advanced Logic and Metamathematics	3
MA 302	Numerical Applications to Differential Equations	1
MA 341	Applied Differential Equations I	3
MA 351	Introduction to Discrete Mathematical Models	3
MA 401	Applied Differential Equations II	3
MA 402	Mathematics of Scientific Computing	3
MA 403	Introduction to Modern Algebra	3
MA 405	Introduction to Linear Algebra	3
MA 407	Introduction to Modern Algebra for Mathematics Majors	3
MA 408	Foundations of Euclidean Geometry	3
MA 410	Theory of Numbers	3
MA 412	Long-Term Actuarial Models	3
MA 413	Short-Term Actuarial Models	3
MA 425	Mathematical Analysis I	3
MA 426	Mathematical Analysis II	3
MA 427	Introduction to Numerical Analysis I	3
MA 428	Introduction to Numerical Analysis II	3
MA 430	Mathematical Models in the Physical Sciences	3
MA 432	Mathematical Models in Life Sciences	3
MA 437	Applications of Algebra	3
MA 5**		
MAE 3**		

MAE 4**		
MAE 5**		
MIE 3**		
MIE 4**		
MSE 3**		
MSE 4**		
MSE 5**		
MUS 306	Music Composition with Computers	3
NE 3**		
NE 4**		
NE 5**		
OR 5**		
PHI 425	Introduction to Cognitive Science	3
PSY 307	Industrial and Organizational Psychology	3
PSY 340	Human Factors Psychology	3
PSY 400	Perception	3
PSY 420	Cognitive Processes	3
PSY 425	Introduction to Cognitive Science	3
PY 4**		
PY 5**		
ST 372	Introduction to Statistical Inference and Regression	3
ST 4**		
ST 5**		

Semester Sequence⁴

First Year

Fall Semester		Hours
CH 101	Chemistry - A Molecular Science	4
& CH 102	and General Chemistry Laboratory ^{1, 2}	
E 101	Introduction to Engineering & Problem Solving ^{1, 3}	1
E 115	Introduction to Computing Environments ¹	1
ENG 101	Academic Writing and Research ^{1, 3}	4
MA 141	Calculus I ^{1, 2}	4
Hours		14

Spring Semester

CSC 116	Introduction to Computing - Java ²	3
MA 241	Calculus II ^{1, 2}	4
PY 205	Physics for Engineers and Scientists I	4
& PY 206	and Physics for Engineers and Scientists I Laboratory ^{1, 2}	
E 102	Engineering in the 21st Century ^{1, 3}	2
EC 205	Fundamentals of Economics	3
or EC 201	or Principles of Microeconomics	
or ARE 201	or Introduction to Agricultural & Resource Economics	
Hours		16

Second Year

Fall Semester		
CSC 216	Software Development Fundamentals	4
& CSC 217	and Software Development Fundamentals Lab ²	

CSC 226	Discrete Mathematics 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
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Hours		16

Spring Semester

CSC 230	C and Software Tools	3
CSC 316	Data Structures and Algorithms	3
CSC 333	Automata, Grammars, and Computability	3
MA 305	Introductory Linear Algebra and Matrices	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		15

Third Year**Fall Semester**

CSC 246	Concepts and Facilities of Operating Systems for Computer Scientists	3
CSC 411	Introduction to Artificial Intelligence ²	3
ST 370	Probability and Statistics for Engineers	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
AI Restricted Electives (p. 2)		3
Hours		15

Spring Semester

CSC 326	Software Engineering	4
CSC 379	Ethics in Computing	1
CSC 422	Automated Learning and Data Analysis ²	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
Other Restricted Electives - Group B (p. 3)		3
Hours		15

Fourth Year**Fall Semester**

CSC AI Restricted Elective (p. 2) ²		3
CSC Restricted Elective (p. 2)		3
AI Restricted Elective (p. 2)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Basic Science Elective (p. 2)		3
Hours		15

Spring Semester

CSC 492	Senior Design Project	3
CSC AI Restricted Elective (p. 2) ²		3
AI Restricted 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	121

¹ College of Engineering CODA classes.

² A grade of C or higher is required.

³ A grade of C- or higher is required.

⁴ One of the following two conditions regarding the major GPA is required: (1) the major GPA, which consists of all CSC courses attempted at NCSU, must be 2.0 or higher or (2) a student whose major grade point average is below 2.0 may graduate if no CSC course used to satisfy the major requirements has a grade below a C-.

Career Opportunities

Designing computer systems, and the software that runs on them is the job of computer scientists. Computer scientists find demand for their innovation, design, analysis, testing, and engineering skills across all domains. As a direct consequence of the increasingly critical role of computers in society, the discipline of computer science has enjoyed rapid growth for many years, with the trend likely to continue. Employment projections indicate a critical nationwide shortfall in the supply of people skilled in computing and information technology, and a resulting steady rise in demand and salaries, for decades to come. Computer Science graduates from NC State are in high demand, including by employers that are extremely selective in their national recruiting. The AI concentration provides a focus on artificial intelligence and machine learning that puts our graduates at the forefront of AI innovation.

Anchoring one corner of the world-famous Research Triangle Park, and located in modern state-of-the-art teaching and research facilities on NC State's Centennial Campus, the department and its students and faculty benefit from strong and active industry partnerships. NC State Computer Science is one of the top suppliers in the nation of new graduate hires to a number of high-tech companies, including several Fortune 500 companies, some with a substantial presence in the Research Triangle. Starting salaries for our undergraduates now average over \$86,000 and show a steady increase. Opportunities are also plentiful for graduate study for those who wish to pursue the field in more depth.

Career Titles

- Architectural Drafters
- Business Intelligence Analysts
- Clinical Data Managers
- Computer and Information Scientists
- Computer and Information Systems Managers
- Computer Hardware Engineers
- Computer Network Architects
- Computer Programmer
- Computer Science Professor
- Computer Systems Analyst
- Computer Systems Engineer
- Computer User Support Specialist
- Data Warehousing Specialists
- Database Administrator
- Information Security Analysts

- Information Technology Project Managers
- IT Administrator (Information Technology)
- Mathematician
- Project Management Specialists
- Robotics Engineers
- Scientific Linguist
- Software Developer
- Software Engineer
- Technical & Scientific Publications Editor
- Technical Publications Writer
- Video Game Designer
- Web Art Director
- Webmaster

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.

Professional Organizations & Societies

- Associate for Computing Machinery (<https://www.acm.org/>) (ACM)
- Association of Information Technology Professionals (<http://www.aitp.org/>) (AITP)
- Institute of Electrical and Electronics Engineers (IEEE) Computer Society
- National Association of Professional Engineers (<https://www.nspe.org/>) (NSPE)