

Computer Science (BS): Artificial Intelligence Concentration

Program Overview & Accreditation

The Department of Computer Science in the College of Engineering at NC State University offers a Bachelor of Science in Computer Science degree. This program provides a comprehensive technical education and is accredited by the Computing Accreditation Commission of ABET (<https://www.abet.org>).

The First-Year Foundation

Students begin their academic journey by completing the standard Engineering First-Year curriculum. This foundational year includes essential coursework in the humanities, chemistry, mathematics, physics, and computing. Upon successful completion of these requirements, students apply to join the Department of Computer Science as degree-seeking students via the College's Change of Degree Application (CODA) process.

Core Curriculum & Skills

Our curriculum is designed to transform students into versatile problem solvers. Core courses provide a rigorous foundation in the social, ethical, and technical dimensions of the field, teaching students to specify, design, implement, and test complex software systems. Key areas of study include:

- Programming languages and data structures
- Software engineering and secure systems design
- Computer systems and architecture
- Theory of computation
- Teaming and professional communication

Advanced Specializations & Electives

Starting in the junior year, students consult with advisors to customize their degree through advanced electives. These courses allow for deep exploration into specialized fields, including:

- **Systems & Infrastructure:** Cloud computing, computer architecture, networks, sensor systems, and database management.
- **Intelligence & Data:** Artificial intelligence, data science, and social computing.
- **Security & Privacy:** Cryptography, privacy, and network/software security.
- **Interfaces & Media:** Computer graphics, human-computer interface design, game development, and web services.
- **Development:** Compilers, DevOps, and educational technology.

Artificial Intelligence Concentration

Aligned with the National Artificial Intelligence Initiative and the Engineering Grand Challenges (including Personalized Learning and Scientific Discovery), the AI concentration prepares students for the rapid expansion of AI across all sectors of the economy. Students complete 21 credit hours of specialized coursework focused on developing intelligent and autonomous systems, applying machine learning to real-world

datasets, and incorporating intelligent behavior into diverse computing platforms.

Capstone Experience: The Senior Design Center

All Computer Science majors complete their degree with a semester-long team project under the auspices of the Senior Design Center. Many of these projects are supported by industrial sponsors, allowing student teams to work directly with industry representatives. This capstone experience challenges students to solve real-world technical problems while mastering the communication and process skills required for professional success.

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://my.csc.ncsu.edu/undergrad-advising/>) Advising

Plan Requirements

Code	Title	Hours
Major Field of Study Requirements		
Math		
MA 141	Calculus I ¹	4
MA 241	Calculus II ¹	4
MA 242	Calculus III	4
MA 305	Introduction to 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	4
PY 205	Physics for Engineers and Scientists I ^{1,2}	4
PY 208	Physics for Engineers and Scientists II	4
CSC Major		
CSC 116	Introduction to Computing - Java ¹	3
CSC 216 & CSC 217	Software Development Fundamentals and Software Development Fundamentals Lab ¹	4
CSC 226	Discrete Mathematics ¹	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 201	Fundamentals of Applied AI ²	3
CSC 301	Problem Solving with Applied AI	3
Other Restricted Electives - Group B (p. 3)		
ENG 331	Communication for Engineering and Technology	3
Concentration Courses/Groups/Electives		

CSC 411	Introduction to Artificial Intelligence ¹	3
CSC 422	Automated Learning and Data Analysis ¹	3
CSC AI Restricted Electives (p. 2) ¹		6
AI Restricted Electives (p. 2)		9
College Requirements		
Orientation Course(s):		4
E 101	Introduction to Engineering & Problem Solving ²	
E 102	Engineering in the 21st Century ²	
E 115	Introduction to Computing Environments	
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 ²		4
GEP Humanities (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		6
GEP Social Sciences (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3
GEP Elective (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Interdisciplinary Perspectives (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		3
GEP Health and Exercise Studies (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		2
GEP Global Knowledge (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
GEP Foundations of American Democracy (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-fad/) (verify requirement)		
World Language Proficiency (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)		
Total Hours		121

¹ A grade of C or higher is required.

² A grade of C- or higher is required.

AI Restricted Electives

Code	Title	Hours
BUS 351	Introduction to Business Analytics	3
BUS 428	Advanced Corporate Finance	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
EC 351	Econometrics I	3
DSA 405	Data Wrangling and Web Scraping	1
DSA 406	Exploratory Data Analysis for Big Data	1
DSA 412	Exploring Machine Learning	1
DSA 435	Predictive Analytics for Improving Services	1

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

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	Introduction to Numerical Methods	3
or CSC 580	Numerical Analysis I	
CSC 342	Applied Web-based Client-Server Computing	3
CSC 401	Data and Computer Communications Networks	3
or CSC 573	Internet Protocols	
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	CSC 503	Computational Applied Logic	3
or CSC 512	Compiler Construction		CSC 505	Design and Analysis Of Algorithms	3
CSC 414	Foundations of Cryptography	3	CSC 510	Software Engineering	3
or CSC 514	Foundations of Cryptography		CSC 517	Object-Oriented Design and Development	3
CSC 415	Software Security	3	CSC 530	Computational Methods for Molecular Biology	3
or CSC 515	Software Security		CSC 537	Systems Attacks and Defenses	3
CSC 416	Introduction to Combinatorics	3	CSC 541	Advanced Data Structures	3
CSC 417	Theory of Programming Languages	3	CSC 542	Neural Networks and Deep Learning	3
CSC 418	Software Analysis and Design	3	CSC 546	Management Decision and Control Systems	3
CSC 419	DevOps: Modern Software Engineering Practices	3	CSC 548	Parallel Systems	3
or CSC 519	DevOps: Modern Software Engineering Practices		CSC 563	Visual Interfaces for Mobile Devices	3
CSC 422	Automated Learning and Data Analysis	3	CSC 565	Graph Theory	3
or CSC 522	Automated Learning and Data Analysis		CSC 568	Enterprise Storage Architecture	3
CSC 431	File Organization and Processing	3	CSC 570	Computer Networks	3
CSC 433	Privacy in the Digital Age	3	CSC 572	Optimizations and Algorithms	3
or CSC 533	Privacy in the Digital Age		CSC 575	Introduction to Wireless Networking	3
CSC 440	Database Management Systems	3	CSC 576	Networking Services: QoS, Signaling, Processes	3
or CSC 540	Database Management Concepts and Systems		CSC 577	Switched Network Management	3
CSC 442	Introduction to Data Science	3	CSC 578	LTE and 5G Communications	3
CSC 447	Introduction to Cloud Computing	3	CSC 582	Computer Models of Interactive Narrative	3
or CSC 547	Cloud Computing Technology		CSC 583	Introduction to Parallel Computing	3
CSC 450	Web Services	3	CSC 591	Special Topics In Computer Science	1-6
CSC 451	Robot Motion Planning	3	CSC 595	Cybersecurity Practicum	3
CSC 453	Introduction to Internet of Things (IoT) Systems	3	ECE 482	Engineering Entrepreneurship Senior Design I	3
CSC 454	Human-Computer Interaction	3	ECE 483	Engineering Entrepreneurship Senior Design II	3
or CSC 554	Human-Computer Interaction		MA 414	Foundations of Cryptography	3
CSC 455	Social Computing and Decentralized Artificial Intelligence	3	MA 416	Introduction to Combinatorics	3
or CSC 555	Social Computing and Decentralized Artificial Intelligence		ST 442	Introduction to Data Science	3
CSC 456	Computer Architecture and Multiprocessors	3	Other Restricted Elective - Group B		
or CSC 506	Architecture Of Parallel Computers		Code	Title	Hours
CSC 461	Computer Graphics	3	CSC Restricted Elective Courses 1-6		
or CSC 561	Principles of Computer Graphics		ACC 310	Intermediate Financial Accounting I	3
CSC 462	Advanced Computer Graphics Projects	3	ACC 311	Intermediate Financial Accounting II	3
or CSC 562	Introduction to Game Engine Design		ACC 330	An Introduction To Income Taxation	3
CSC 467	Introduction to Quantum Algorithms	3	ACC 340	Accounting Information Systems	3
CSC 469	Quantum Programming	3	ARS 306	Music Composition with Computers	3
CSC 471	Modern Topics in Cybersecurity	3	BUS 320	Financial Management	3
CSC 472	Cybersecurity Practicum	3	BUS 340	Information Systems Management	3
CSC 474	Network Security	3	BUS 360	Marketing Methods	3
or CSC 574	Computer and Network Security		BUS 4**		
CSC 481	Game Engine Foundations	3	CHE 435	Process Systems Analysis and Control	3
or CSC 581	Game Engine Foundations		CHE 465	Colloidal and Nanoscale Engineering	3
CSC 482	Advanced Computer Game Projects	3	CSC 427	Introduction to Numerical Analysis I	3
CSC 484	Building Game AI	3	CSC 428	Introduction to Numerical Analysis II	3
or CSC 584	Building Game AI		DSC 405	Data Wrangling and Web Scraping	1
CSC 486	Computational Visual Narrative	3	DSC 406	Exploratory Data Analysis for Big Data	1
CSC 490	Independent Study in Computer Science	1-6	DSC 410	Data Internship Preparation for Social Impact	1
CSC 491	Special Topics in Computer Science	1-6	DSC 412	Exploring Machine Learning	1
CSC 499	Independent Research in Computer Science	1-6	EC 3**		
CSC 501	Operating Systems Principles	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 Sequence³

First Year

Fall Semester		Hours
CH 101	Chemistry - A Molecular Science and General Chemistry Laboratory ¹	4
& CH 102		
E 102	Engineering in the 21st Century ²	2
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research ²	4
MA 141	Calculus I ¹	4
Hours		15

Spring Semester

CSC 116	Introduction to Computing - Java ¹	3
CSC 201	Fundamentals of Applied AI ²	3
E 101	Introduction to Engineering & Problem Solving ²	1
MA 241	Calculus II ¹	4
PY 205	Physics for Engineers and Scientists I ¹	4
Hours		15

Second Year

Fall Semester

CSC 216	Software Development Fundamentals and Software Development Fundamentals Lab ¹	4
& CSC 217		
CSC 226	Discrete Mathematics ¹	3
CSC 301	Problem Solving with Applied AI	3
MA 242	Calculus III	4
GEP Health and Exercise Studies (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
Hours		15

Spring Semester

CSC 230	C and Software Tools	3
---------	----------------------	---

CSC 316	Data Structures and Algorithms	3
MA 305	Introduction to Linear Algebra and Matrices	3
PY 208	Physics for Engineers and Scientists II	4
GEP Requirement (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		16
Third Year		
Fall Semester		
CSC 246	Concepts and Facilities of Operating Systems for Computer Scientists	3
CSC 333	Automata, Grammars, and Computability	3
CSC 411	Introduction to Artificial Intelligence ¹	3
ST 370	Probability and Statistics for Engineers	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 ¹	3
ENG 331	Communication for Engineering and Technology	3
GEP Health and Exercise Studies (https://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) ¹		3
AI Restricted Elective (p. 2)		3
GEP Requirement (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Requirement (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
EC 205 or EC 201 or ARE 201	Fundamentals of Economics or Principles of Microeconomics or Introduction to Agricultural & Resource Economics	3
Hours		15
Spring Semester		
CSC 492	Senior Design Project	3
CSC AI Restricted Elective (p. 2) ¹		3
AI Restricted Elective (p. 2)		3
GEP Requirement (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Requirement (https://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
Hours		15
Total Hours		121

¹ A grade of C or higher is required.

² A grade of C- or higher is required.

³ 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)