Department of Computer Science and Engineering

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The Department of Computer Science and Engineering is dedicated to maintaining quality programs in undergraduate teaching, graduate teaching, and research, and to the fruitful interaction between teaching and research. In research, we wish to maintain our present emphasis on applications (often pursued with colleagues from other disciplines), and upon the synergistic relationships between theory and applications in which the most meaningful advances often result. The department has identified six core competency areas in which we shall seek national prominence: artificial intelligence, computational science, human centered computing, graphics, systems, and software engineering. These core competencies support research applications in areas such as bio-informatics, high performance computing, computer security, computer forensics, computer science education, human-robotic interaction, and visualization. The Department of Computer Science and Engineering offers degree programs leading to the Bachelor of Science degree in Computer Science, Software Engineering, and (jointly with the Department of Electrical and Computer Engineering) Computer Engineering and the Master of Science in Cybersecurity. The department also offers study leading to the Master of Science and the Doctor of Philosophy degrees in Computer Science. An accelerated BS/MS program is also available.

Computer Science Major (CS)

Computer Science is the study of the principles, applications, and technologies of computing and computers. It involves the study of data and data structures and the algorithms to process these structures; principles of computer architecture-both hardware and software; problem solving and design methodologies; and language design, structure and translation techniques. Computer Science provides a foundation of knowledge for students with career objectives in a wide range of computing and computer-related professions.

The objectives for the department with respect to the Bachelor of Science Degree in Computer Science are as follows:

1. The graduate will demonstrate an understanding of computer science principles and an ability to solve unstructured computer science problems through the successful entrance into and advancement in the computer science profession.
2. The graduate will demonstrate an appreciation for lifelong learning and for the value of continuing professional development through participation in graduate education, professional education or continuing education opportunities, attainment of professional licensure, or membership in professional societies.
3. The graduate will demonstrate an understanding of professional and ethical responsibilities to the profession, society and the environment incumbent on a computer science professional.
4. The graduate will successfully interact with others of different backgrounds, educations, and cultures.
5. The graduate will demonstrate effective communication skills in their profession.

Computer Science graduates begin careers as computer programmers, system analysts, programmer/analysts, software engineers, systems programmers, computer system engineers and in a number of other computer-related jobs. A minor in computer science is available to students with major programs of study in other fields at the University.

The Bachelor of Science degree requires the completion of a total of 128 credit hours of general studies, computer science, mathematics and science, and supporting technical courses. To graduate, a student must have a "C" average in all MSU computer science and engineering courses attempted.

The B. S. program in Computer Science is accredited by the Computing Accreditation Commission of ABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Computer Science and similarly named computing programs.

Software Engineering Major (SE)

Software Engineering is the application of engineering practices to the design and maintenance of software. The Software Engineering degree program prepares students for careers in the engineering of large complex software systems and products. These systems often involve millions of lines of code and frequently operate in safety-critical environments. The Software Engineering major contains courses related to the study of software engineering in practice necessary to manage these development processes. The faculty for the Software Engineering program is drawn from the Department of Computer Science and Engineering and the Department of Industrial Engineering.

The objectives for the department with respect to the Bachelor of Science Degree in Software Engineering are as follows:

1. The graduate will demonstrate an understanding of engineering principles and an ability to solve unstructured engineering problems through the successful entrance into and advancement in the engineering profession.
2. The graduate will demonstrate an appreciation for lifelong learning and for the value of continuing professional development through participation in graduate education, professional education or continuing education opportunities, attainment of professional licensure, or membership in professional societies.

3. The graduate will demonstrate an understanding of professional and ethical responsibilities to the profession, society and the environment incumbent on an engineering professional.
4. The graduate will successfully interact with others of different backgrounds, educations, and cultures.
5. The graduate will demonstrate effective communication skills in their profession.

A minor in software engineering is available to students with major programs of study in other fields at the University.

The Bachelor of Science degree in Software Engineering requires the completion of a total of 128 credit hours of general studies, computer science, industrial engineering, mathematics and science, supporting technical courses, and free electives. To graduate, a student must have a "C" average in all MSU computer science and engineering courses attempted.

The B. S. program in Software Engineering is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Software and similarly named engineering programs.

Cybersecurity Major (Bachelor of Science)

The Bachelor of Science in Cybersecurity is designed for students who wish to help meet the challenges posed by increasing cyber-threats. Using a multidisciplinary approach, the program is designed to provide students with a focused education for evaluating, understanding, and solving cyber security problems.

The Bachelor of Science degree requires the completion of a total of 128 credit hours of general studies, computer science, mathematics and science, and supporting technical courses. To graduate, a student must have a "C" average in all MSU computer science and engineering courses attempted.

Cybersecurity Major (Bachelor of Applied Science)

The Bachelor of Applied Science in Cybersecurity is a comprehensive degree program designed to equip students with the knowledge, skills, and expertise required to become proficient cybersecurity analysts. This program delves deep into the world of cybersecurity, offering a blend of theoretical knowledge and hands-on experience to address the ever-evolving challenges in the digital realm. Designed with the working adult in mind, this program offers a flexible and comprehensive curriculum that combines theoretical knowledge with practical skills that will be offered in an online modality. This program ensures that graduates are not only well-versed in the theoretical aspects of cybersecurity but also possess the practical skills required to defend organizations against cyber threats. With a strong emphasis on real-world applications, hands-on training, and ethical considerations, this program is the ideal choice for those looking to make a significant impact in the field of cybersecurity. Students must possess an accredited Associate of Applied Science (AAS) in Cybersecurity, Cyber Defense, Information Systems Security, Network Security, or other computer-science related fields.

Artificial Intelligence Major

The Bachelor of Science in Artificial Intelligence is a comprehensive degree program designed to equip students with the knowledge, skills, and expertise required to become proficient in design and development of Artificial Intelligence systems. This program provides a strong foundation in computer science, statistics and probability theory, data analytics, cognitive science, machine learning, robotics, ethics in AI, and specialized electives. Students will gain the core theoretical knowledge and hands-on experience through collaborative projects., AI capstone, and research opportunities, thereby preparing them for a wide array of careers in industries ranging from tech to healthcare.

BS in Computer Science

General Education Requirements

English Composition

EN 1103	English Composition I	3
or EN 1104	Expanded English Composition I	
EN 1113	English Composition II	3
or EN 1173	Accelerated Composition II	
Creative Discovery		**3**
Select from General Education courses		
Humanities		**6**
Select from General Education courses		
Social/Behavioral Sciences		**6**
Select from General Education courses		
Quantitative Reasoning		
MA 1713	Calculus I	3
MA 1723	Calculus II	3
Natural Sciences		

CH 1213	Chemistry I	4
& CH 1211	and Investigations in Chemistry I	
Lab Science: choose from		3-4
BIO 1134	Biology I	
BIO 1144	Biology II	
PH 2223	Physics II	
Natural Science: choose from		3-4
BIO 1134	Biology I	
BIO 1144	Biology II	
CH 1223	Chemistry II	
PH 2213	Physics I	
PH 2223	Physics II	
Additional Requirements		
MA 3113	Introduction to Linear Algebra	3
Math elective		3
MA 2733	Calculus III	
or MA 3053	Foundations of Mathematics	
or MA 4143	Graph Theory	
or MA 4173	Number Theory	
Statistics Requirement		3
IE 4613	Engineering Statistics I	
or MA 4523	Introduction to Probability	
or MA 4543	Introduction to Mathematical Statistics I	
or BQA 2113	Business Statistical Methods I	
Major Core		
CSE 1011	Introduction to CSE	1
CSE 1284	Introduction to Computer Programming	4
CSE 1384	Intermediate Computer Programming	4
CSE 2213	Methods and Tools in Software Development	3
CSE 2383	Data Structures and Analysis of Algorithms	3
CSE 2813	Discrete Structures	3
CSE 3183	Systems Programming	3
CSE 3724	Computer Organization	4
CSE 3763	Ethical and Legal Issues in Computing	3
CSE 4714	Theory & Implementation of Programming Languages	4
CSE 4733	Operating Systems I	3
CSE 4833	Introduction to Analysis of Algorithms	3
Writing Requirement		
GE 3513	Technical Writing	3

General Concentration

The general concentration in computer science allows students the flexibility to take a broad range of courses. Students are not required to focus on a specific topic area and may take a variety of courses in areas that fit their individual interests. **(At least 18 hours of concentration courses, including technical electives, must be selected from upper-level CSE courses.)**

Technical Electives		**27**
Choose from the following:		
IE 3913	Engineering Economy I	
IE 4113	Human Factors Engineering	
IE 4123	Psychology of Human-Computer Interaction	
IE 4333	Production Control Systems I	
IE 4513	Engineering Administration	
IE 4533	Project Management	

IE 4573	Process Improvement Engineering	
IE 4623	Engineering Statistics II	
IE 4653	Industrial Quality Control	
IE 4713	Operations Research I	
IE 4733	Linear Programming	
IE 4773	Systems Simulation I	
BIS 4533	Decision Support Systems	
BIS 4523	Business Programming with COBOL	
Any upper-level CSE, ECE, or MA course		
Free Electives		**14**
Total Hours		**128**

Systems Concentration

Computer systems are the hardware and software that provide computing capability for digital devices. Computer systems can be for embedded applications, multi-core, or distributed platforms. These help to support high performance, real-time, secure systems, and analysis of digital media for forensic purposes. Computer systems research at MSU includes investigating the use of alternate hardware architectures to improve computational speed, secure networking, develop model-driven software architectures, improve energy efficiency, and improve system robustness and resiliency. **(At least 18 hours of concentration courses, including technical electives, must be selected from upper-level CSE courses.)**

Concentration Courses		**9**
Choose from:		
CSE 4153	Data Communications and Computer Networks	
CSE 4163	Designing Parallel Algorithms	
CSE 4503	Database Management Systems	
CSE 4723	Compiler Construction	
CSE 4743	Operating Systems II	
Technical Electives		**18**
Free Electives		**15**
Total Hours		**128**

Artificial Intelligence Concentration

Artificial intelligence is a branch of computer science that is concerned with developing algorithms and techniques that will allow computers to behave more like humans in the future. artificial intelligence is a broad term that incorporates a wide range of disciplines, including expert systems, natural language processing, computer vision, and robotics. Artificial intelligence is having a profound impact on a wide range of businesses. The Artificial intelligence concentration at MSU prepares students to take the next step into the field of artificial intelligence by supporting them in acquiring the information and abilities essential to improve their professional careers in the field. Instructors and students use these strategies to solve challenges in fields such as reasoning under uncertainty, bioinformatics, cyber security, geometric learning, and human-machine interfaces. **(At least 18 hours of concentration courses, including technical electives, must be selected from upper-level CSE courses.)**

Concentration Courses		**9**
Choose from:		
CSE 4633	Artificial Intelligence	
CSE 4643	AI Robotics	
CSE 4653	Cognitive Science	
CSE 4683	Machine Learning and Soft Computing	
Technical Electives		**18**
Free Electives		**15**
Total Hours		**128**

Computational Science Concentration

Computational science is concerned with constructing mathematical models, quantitative analysis techniques, numerical simulations, and optimization to solve scientific problems using computers. It is now widely regarded as a third mode of scientific discovery, after theory and experiment. Faculty members in this area are participating in projects that involve algorithm development for performance optimization in scientific computing, software synthesis for computational field simulations on high-end computing platforms, distributed interactive simulation frameworks, resource allocation on high-

end computing platforms, autonomic computing, uncertainty analysis in simulations, medical imaging analysis, and biological modeling. **(At least 18 hours of concentration courses, including technical electives, must be selected from upper-level CSE courses.)**

Concentration Courses		9
Choose from:		
CSE 4163	Designing Parallel Algorithms	
CSE 4623	Computational Biology	
MA 4243	Data Analysis I	
MA 4313	Numerical Analysis I	
MA 3253	Differential Equations I	
Technical Electives		**18**
Free Electives		**15**
Total Hours		**128**

Human and Visual Computing Concentration

Humans, individually or in groups, are involved in all stages of computing. From interacting with robots, using novel virtual and extended reality methods, or analyzing data with visualization, humans are central to computing. A student in the Human and Visualization Computing concentration studies the social, cognitive, and perceptual aspects of computing through the lens of design, graphical display, and advanced interaction modalities. **(At least 18 hours of concentration courses, including technical electives, must be selected from upper-level CSE courses.)**

Concentration Cources		9
Choose from the following:		
CSE 4413	Principles of Computer Graphics	
CSE 4453	Game Design	
CSE 4653	Cognitive Science	
CSE 4663	Human-Computer Interaction	
IE 4113	Human Factors Engineering	
Technical Electives		**18**
Free Electives		**15**
Total Hours		**128**

Software Engineering Major (SE)

General Education Requirements

English Composition		
EN 1103	English Composition I	3
or EN 1104	Expanded English Composition I	
EN 1113	English Composition II	3
or EN 1173	Accelerated Composition II	
Creative Discovery		
Select from General Education courses		3
Humanities		
Select from General Education courses		6
Social/Behavioral Sciences		
Select from General Education courses		6
Quantitative Reasoning		
MA 1713	Calculus I	3
MA 1723	Calculus II	3
Natural Sciences		
CH 1213 & CH 1211	Chemistry I and Investigations in Chemistry I	4
Choose 8 hours from:		8
BIO 1134	Biology I	
BIO 1144	Biology II	

CH 1223 & CH 1221	Chemistry II and Investigations in Chemistry II	
PH 2213	Physics I	
PH 2223	Physics II	

Additional Requirements

MA 3113	Introduction to Linear Algebra	3
Math elective		3
MA 2733	Calculus III	
or MA 3053	Foundations of Mathematics	
or MA 4143	Graph Theory	
or MA 4173	Number Theory	
Statistics Requirement		3
IE 4613	Engineering Statistics I	
Major Core		
CSE 1011	Introduction to CSE	1
CSE 1284	Introduction to Computer Programming	4
CSE 1384	Intermediate Computer Programming	4
CSE 2213	Methods and Tools in Software Development	3
CSE 2383	Data Structures and Analysis of Algorithms	3
CSE 2813	Discrete Structures	3
CSE 3183	Systems Programming	3
CSE 3213	Software Engineering Senior Project I	3
CSE 3223	Software Engineering Senior Project II	3
CSE 3724	Computer Organization	4
CSE 3763	Ethical and Legal Issues in Computing	3
CSE 4214	Introduction to Software Engineering	4
CSE 4223	Managing Software Projects	3
or IE 4533	Project Management	
CSE 4233	Software Architecture and Design Paradigms	3
CSE 4283	Software Testing and Quality Assurance	3
CSE 4733	Operating Systems I	3
CSE 4833	Introduction to Analysis of Algorithms	3
Writing Requirement		
GE 3513	Technical Writing	3
Technical Electives - Choose from:		15
IE 3913	Engineering Economy I	
IE 4113	Human Factors Engineering	
IE 4123	Psychology of Human-Computer Interaction	
IE 4333	Production Control Systems I	
IE 4513	Engineering Administration	
IE 4533	Project Management	
IE 4573	Process Improvement Engineering	
IE 4623	Engineering Statistics II	
IE 4653	Industrial Quality Control	
IE 4713	Operations Research I	
IE 4733	Linear Programming	
IE 4773	Systems Simulation I	
BIS 4523	Business Programming with COBOL	
BIS 4533	Decision Support Systems	
Any upper-level CSE, ECE, or MA course		

Free elective		9
Total Hours		**128**

BS in Artificial Intelligence

General Education Requirements

English Composition

EN 1103	English Composition I	3
or EN 1104	Expanded English Composition I	
EN 1113	English Composition II	3
or EN 1173	Accelerated Composition II	
Creative Discovery		
Select from General Education courses		3
Humanities		
Select from General Education courses		6
Social/Behavioral Sciences		
Select from General Education courses		6
Quantitative Reasoning		
MA 1713	Calculus I	3
Natural Sciences		
CH 1213	Chemistry I	4
& CH 1211	and Investigations in Chemistry I	
BIO 1134	Biology I	4

Major Core

CSE 1284	Introduction to Computer Programming	4
CSE 1384	Intermediate Computer Programming	4
CSE 2213	Methods and Tools in Software Development	3
CSE 2383	Data Structures and Analysis of Algorithms	3
CSE 2813	Discrete Structures	3
CSE 3613	AI Capstone I	3
CSE 3623	AI Capstone II	3
CSE 3683	AI Fundamentals	3
CSE 3763	Ethical and Legal Issues in Computing	3
CSE 4633	Artificial Intelligence	3
CSE 4643	AI Robotics	3
CSE 4653	Cognitive Science	3
CSE 4663	Human-Computer Interaction	3
CSE 4683	Machine Learning and Soft Computing	3
CSE 4693	Introduction to Machine Learning	3
CSE 4833	Introduction to Analysis of Algorithms	3
GE 3513	Technical Writing	3
MA 1723	Calculus II	3
MA 3113	Introduction to Linear Algebra	3
MA 4143	Graph Theory	3
IE 4113	Human Factors Engineering	3
IE 4613	Engineering Statistics I	3
IE 4623	Engineering Statistics II	3
IE 4733	Linear Programming	3
Cognitive Science Elective		
Choose 3 hours from the following;		3
PSY 4413	Cognitive Neuroscience	
PSY 4713	Language and Thought	

PSY 4733	Memory	
PSY 4753	Applied Cognitive Psychology	
AI Electives		
Choose 12 hours from the following:		12
CSE 4293	AI for Cybersecurity	
IE 4683	Machine Learning with Industrial Engineering Applications	
IE 4743	Engineering Design Optimization	
MA 4183	Mathematical Foundations of Machine Learning	
PSY 4413	Cognitive Neuroscience	
PSY 4753	Applied Cognitive Psychology (if not taken as Cognitive Science elective)	
PSY 4713	Language and Thought (if not taken as Cognitive Science elective)	
Total Hours		**121**

BS in Cyber Security

General Education Requirements

English Composition		
EN 1103	English Composition I	3
EN 1113	English Composition II	3
Creative Discovery		
Select from General Education courses		3
Humanities		
Select from General Education courses		6
Social/Behavioral Sciences		
Select from General Education courses		6
Quantitative Reasoning		
MA 1713	Calculus I	3
MA 1723	Calculus II	3
Natural Sciences		
CH 1213 & CH 1211	Chemistry I and Investigations in Chemistry I	4
Science: choose 2 from		6-8
BIO 1134	Biology I	
BIO 1144	Biology II	
PH 2213	Physics I	
PH 2223	Physics II	
CH 1223 & CH 1221	Chemistry II and Investigations in Chemistry II	
Additional Requirements		
MA 3113	Introduction to Linear Algebra	3
Math Elective - choose from the following:		
MA 2733	Calculus III	
MA 3053	Foundations of Mathematics	
MA 4143	Graph Theory	
MA 4173	Number Theory	
Statistics - Choose from the following:		
BQA 2113	Business Statistical Methods I	
IE 4613	Engineering Statistics I	
MA 4523	Introduction to Probability	
MA 4543	Introduction to Mathematical Statistics I	
Communication Requirement		
GE 3513	Technical Writing	3

Major Core

CSE 1011	Introduction to CSE	1
CSE 1284	Introduction to Computer Programming	4
CSE 1384	Intermediate Computer Programming	4
CSE 2213	Methods and Tools in Software Development	3
CSE 2383	Data Structures and Analysis of Algorithms	3
CSE 2813	Discrete Structures	3
CSE 3183	Systems Programming	3
CSE 3724	Computer Organization	4
CSE 3763	Ethical and Legal Issues in Computing	3
CSE 4153	Data Communications and Computer Networks	3
CSE 4173	Cryptography	3
CSE 4243	Information and Computer Security	3
CSE 4733	Operating Systems I	3
Cybersecurity Electives		
Choose five of the following:		
BIS 4113	Business Information Systems Security Management	
CSE 4253	Secure Software Engineering	
CSE 4273	Introduction to Computer Forensics	
CSE 4363	Software Reverse Engineering	
CSE 4383	Network Security	
CSE 4743	Operating Systems II	
CSE 4773	Introduction to Cyber Operations	
Technical Electives		
Any upper-level course in the following areas that is not already required in the Cybersecurity curriculum: CS, ECE, MA		
Free electives		**6**
Total Hours		**128**

Cybersecurity Major (Bachelor of Applied Science- requires an A.A.S. degree)

General Education Requirements

English Composition

EN 1103	English Composition I	3
or EN 1104	Expanded English Composition I	
EN 1113	English Composition II	3
or EN 1173	Accelerated Composition II	
Creative Discovery		
Select from General Education courses		3
Humanities		
Select from General Education courses		6
Social/Behavioral Sciences		
Select from General Education courses		6
Quantitative Reasoning		
MA 2113	Introduction to Statistics	3
or ST 2113	Introduction to Statistics	
Natural Sciences		
Select from General Education courses		6-8

Additional Requirements

BIS 3753	Business Database Systems	3
or TECH 2123	Database Management	
or CSE 4503	Database Management Systems	
CO 1003	Fundamentals of Public Speaking	3

or CO 1013	Introduction to Communication	
TECH 4563	Introduction to Data Networks	3
or CSE 4153	Data Communications and Computer Networks	
GE 3513	Technical Writing	3
Major Core		
CSE 1011	Introduction to CSE	1
CSE 1284	Introduction to Computer Programming	4
CSE 1384	Intermediate Computer Programming	4
CSE 2213	Methods and Tools in Software Development	3
CSE 3713	Introduction to Cybersecurity	3
CSE 3763	Ethical and Legal Issues in Computing	3
CSE 4243	Information and Computer Security	3
CIS 2713	System Administration	3
CIS 3263	Web Application Security	3
CIS 3613	Authorization & Accreditation	3
CIS 3713	IT Forensics	3
CIS 4623	Cyber Risk Analysis	3
CIS 4783	Cloud Computing and Security	3
CIS 4813	Capstone Project I	3
CIS 4823	Capstone Project II	3
Cybersecurity Electives		
Choose 5 from the following:		15
BIS 3233	Management Information Systems	
BIS 4113	Business Information Systems Security Management	
CSE 4253	Secure Software Engineering	
CSE 3724	Computer Organization	
CSE 4363	Software Reverse Engineering	
CSE 4773	Introduction to Cyber Operations	
CSE 4383	Network Security	
Electives		
Any upper-level CSE, CIS, ECE, MA courses		18
Total Hours		**120**

Computer Science Minor

Computer science has application in a broad range of disciplines, and students with majors in other fields of study may wish to complement their studies with a minor in computer science. Completion of the minor requirements should prepare the student to pursue a career as a computer applications specialist within his/her field of study or as an entry-level computer programmer in the general computing environment. The minor in computer science is not available to students majoring in computer engineering or software engineering since significant parts of these majors consist of computer science courses.

A minor in computer science consists of:

CSE 1284	Introduction to Computer Programming	4
CSE 1384	Intermediate Computer Programming	4
CSE 2383	Data Structures and Analysis of Algorithms	3
CSE 2813	Discrete Structures	3
Nine hours of approved upper-division courses		9

A list of approved courses is available from the Department of Computer Science and Engineering.

Software Engineering Minor

Software Engineering practices and skills are valuable in a wide range of disciplines, and students with majors in other fields of study may wish to complement their studies with a minor in software engineering. Completion of the minor requirements should prepare the student to pursue careers that involve the application and development of software systems in their field of study.

A minor in software engineering consists of

CSE 1284	Introduction to Computer Programming	4
CSE 1384	Intermediate Computer Programming	4
CSE 2383	Data Structures and Analysis of Algorithms	3
CSE 4214	Introduction to Software Engineering	4
Approved upper-division software engineering courses		9

A list of approved courses is available from the Department of Computer Science and Engineering.