Department of Computer Science and Engineering

Department Head: Dr. Shahram Rahimi
Associate Department Head and Undergraduate Coordinator: Dr. Andy Perkins
Graduate Coordinator: Dr. T. J. Jankun-Kelly
Office: 300 Butler Hall

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:

a. 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.

b. 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.

c. The graduate will demonstrate an understanding of professional and ethical responsibilities to the profession, society and the environment incumbent on a computer science professional.

d. The graduate will successfully interact with others of different backgrounds, educations, and cultures.

e. 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:

a. 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.

b. 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.
c. The graduate will demonstrate an understanding of professional and ethical responsibilities to the profession, society and the environment incumbent on an engineering professional.
d. The graduate will successfully interact with others of different backgrounds, educations, and cultures.
e. 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**

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.

**Computer Science Major (CS)**

<table>
<thead>
<tr>
<th>English Composition</th>
<th>EN 1103</th>
<th>English Composition I</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EN 1113</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Fine Arts</td>
<td>See General Education courses</td>
<td>3</td>
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<tr>
<td>Humanities</td>
<td>See General Education courses</td>
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<td>Social/Behavioral Sciences</td>
<td>See General Education courses</td>
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<tr>
<td>Writing Requirement</td>
<td>GE 3513</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>Departmental Requirements</td>
<td>MA 1713</td>
<td>Calculus I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA 1723</td>
<td>Calculus II</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>MA 3113</td>
<td>Introduction to Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>Math elective</td>
<td>MA 2733</td>
<td>Calculus III</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>or MA 3053</td>
<td>Foundations of Mathematics</td>
<td></td>
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<tr>
<td></td>
<td>or MA 4143</td>
<td>Graph Theory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or MA 4173</td>
<td>Number Theory</td>
<td></td>
</tr>
<tr>
<td>Statistics Requirement</td>
<td>IE 4613</td>
<td>Engineering Statistics I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>or MA 4523</td>
<td>Introduction to Probability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or MA 4543</td>
<td>Introduction to Mathematical Statistics I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or BQA 2113</td>
<td>Business Statistical Methods I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CH 1213</td>
<td>Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>CH 1211</td>
<td>Investigations in Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>Science electives</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab Science - Choose from:</td>
<td>BIO 1134</td>
<td>Biology I</td>
<td>3-4</td>
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<tr>
<td></td>
<td>BIO 1144</td>
<td>Biology II</td>
<td></td>
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</tbody>
</table>
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.

Technical Electives

Choose from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IE 3913</td>
<td>Engineering Economy I</td>
</tr>
<tr>
<td>IE 4113</td>
<td>Human Factors Engineering</td>
</tr>
<tr>
<td>IE 4123</td>
<td>Psychology of Human-Computer Interaction</td>
</tr>
<tr>
<td>IE 4333</td>
<td>Production Control Systems I</td>
</tr>
<tr>
<td>IE 4513</td>
<td>Engineering Administration</td>
</tr>
<tr>
<td>IE 4533</td>
<td>Project Management</td>
</tr>
<tr>
<td>IE 4573</td>
<td>Process Improvement Engineering</td>
</tr>
<tr>
<td>IE 4623</td>
<td>Engineering Statistics II</td>
</tr>
<tr>
<td>IE 4653</td>
<td>Industrial Quality Control</td>
</tr>
<tr>
<td>IE 4713</td>
<td>Operations Research I</td>
</tr>
<tr>
<td>IE 4733</td>
<td>Linear Programming</td>
</tr>
<tr>
<td>IE 4773</td>
<td>Systems Simulation I</td>
</tr>
<tr>
<td>BIS 4533</td>
<td>Decision Support Systems</td>
</tr>
<tr>
<td>BIS 4523</td>
<td>Business Programming with COBOL</td>
</tr>
</tbody>
</table>

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.

Concentration Courses

Choose from:
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.

Concentration Courses

Choose from:

- CSE 4633 Artificial Intelligence
- CSE 4643 AI Robotics
- CSE 4653 Cognitive Science
- CSE 4683 Machine Learning and Soft Computing

Technical Electives

Free Electives

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.

Concentration Courses

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

Free Electives

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.

Concentration Courses

Choose from the following:

- CSE 4413 Principles of Computer Graphics
- CSE 4453 Game Design
- CSE 4653 Cognitive Science
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 4663</td>
<td>Human-Computer Interaction</td>
<td></td>
</tr>
<tr>
<td>IE 4113</td>
<td>Human Factors Engineering</td>
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<tr>
<td></td>
<td><strong>Free Electives</strong></td>
<td>15</td>
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<td><strong>Total Hours</strong></td>
<td>128</td>
</tr>
</tbody>
</table>

**Software Engineering Major (SE)**

**English Composition**
- EN 1103 English Composition I 3
- EN 1113 English Composition II 3

**Fine Arts**
- See General Education courses 3

**Humanities**
- See General Education courses 6

**Social/Behavioral Sciences**
- See General Education courses 6

**Writing Requirement**
- GE 3513 Technical Writing 3

**Departmental Requirements**
- MA 1713 Calculus I 3
- MA 1723 Calculus II 3
- MA 3113 Introduction to Linear Algebra 3
- MA elective 3
  - MA 2733 Calculus III
  - or MA 3053 Foundations of Mathematics
  - or MA 4143 Graph Theory
  - or MA 4173 Number Theory

**Statistics Requirement**
- IE 4613 Engineering Statistics I 3
- CH 1213 Chemistry I 3
- CH 1211 Investigations in Chemistry I 1

**Science electives**
Choose from:
- BIO 1134 Biology I
- BIO 1144 Biology II
- CH 1223 Chemistry II
- & CH 1221 and Investigations in Chemistry II
- PH 2213 Physics I
- PH 2223 Physics II
- 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
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

Cybersecurity Major

English Composition
EN 1103  English Composition I  3
EN 1113  English Composition II  3

Fine Arts
See General Education courses  3

Natural Sciences
CH 1213  Chemistry I  3
CH 1211  Investigations in Chemistry I  1

Science Electives
Choose from the following (6 hours minimum):  6
BIO 1134  Biology I
PH 2213  Physics I
PH 2223  Physics II
CH 1223 & CH 1221  Chemistry II and Investigations in Chemistry II
BIO 1144  Biology II

Math
MA 1713  Calculus I  3
MA 1723  Calculus II  3
MA 3113  Introduction to Linear Algebra  3

Math Elective
Choose from the following:  3
MA 2733  Calculus III
MA 3053  Foundations of Mathematics
MA 4143  Graph Theory
MA 4173  Number Theory

Humanities
### Major Core Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
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<tbody>
<tr>
<td>CSE 1011</td>
<td>Introduction to CSE</td>
<td>1</td>
</tr>
<tr>
<td>CSE 1284</td>
<td>Introduction to Computer Programming</td>
<td>4</td>
</tr>
<tr>
<td>CSE 1384</td>
<td>Intermediate Computer Programming</td>
<td>4</td>
</tr>
<tr>
<td>CSE 2213</td>
<td>Methods and Tools in Software Development</td>
<td>3</td>
</tr>
<tr>
<td>CSE 2383</td>
<td>Data Structures and Analysis of Algorithms</td>
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</tr>
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<td>CSE 2813</td>
<td>Discrete Structures</td>
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</tr>
<tr>
<td>CSE 3183</td>
<td>Systems Programming</td>
<td>3</td>
</tr>
<tr>
<td>CSE 3724</td>
<td>Computer Organization</td>
<td>4</td>
</tr>
<tr>
<td>CSE 3763</td>
<td>Ethical and Legal Issues in Computing</td>
<td>3</td>
</tr>
<tr>
<td>CSE 4153</td>
<td>Data Communications and Computer Networks</td>
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<tr>
<td>CSE 4173</td>
<td>Cryptography</td>
<td>3</td>
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<tr>
<td>CSE 4243</td>
<td>Information and Computer Security</td>
<td>3</td>
</tr>
<tr>
<td>CSE 4733</td>
<td>Operating Systems I</td>
<td>3</td>
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<td>or MA 4543</td>
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<td>or BQA 2113</td>
<td>Business Statistical Methods I</td>
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### Communication Requirement

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>GE 3513</td>
<td>Technical Writing</td>
</tr>
</tbody>
</table>

### 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

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### 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:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
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</thead>
<tbody>
<tr>
<td>CSE 1284</td>
<td>Introduction to Computer Programming</td>
<td>4</td>
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<td>CSE 1384</td>
<td>Intermediate Computer Programming</td>
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<tr>
<td>CSE 2383</td>
<td>Data Structures and Analysis of Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CSE 2813</td>
<td>Discrete Structures</td>
<td>3</td>
</tr>
</tbody>
</table>

Nine hours of approved upper-division courses

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 1284</td>
<td>Introduction to Computer Programming</td>
<td>4</td>
</tr>
<tr>
<td>CSE 1384</td>
<td>Intermediate Computer Programming</td>
<td>4</td>
</tr>
<tr>
<td>CSE 2383</td>
<td>Data Structures and Analysis of Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CSE 4214</td>
<td>Introduction to Software Engineering</td>
<td>4</td>
</tr>
</tbody>
</table>

Approved upper-division software engineering courses 9

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