# Computer Science and Engineering

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Graduate study is offered in the Department of Computer Science and Engineering leading to the degrees of Master of Science in Computer Science, Master of Science in Cyber Security and Operations, and Doctor of Philosophy in Computer Science. Several teaching and research assistantships are available. Application forms for admission to graduate studies, departmental assistantships, information regarding the graduate programs, faculty and their research interests, and courses are available from the CS Department's Graduate Handbook and website (http://www.cse.msstate.edu).

## Master's and Ph.D. Degrees in Computer Science

The program of study of a Master of Science in Computer Science (MS CS) degree includes advanced courses in computer science that are selected according to the goals of the student. The program of study includes a thesis option, a professional project option, or courses-only option. The program of study of a Doctor of Philosophy (Ph.D.) in Computer Science degree includes advanced courses in computer science and significant scholarly research in computer science, presented in a dissertation.

The department’s core research areas include the following.

- Artificial intelligence
- Computational science
- Graphics
- Human-centered computing
- Software engineering and systems

These core competencies support research applications in areas such as bioinformatics, visualization, computer security and forensics, human-computer interactions, robotics, and high performance computing. Faculty, research assistants, thesis students, and dissertation students participate in a wide variety of research projects. Many research projects are multi-disciplinary or multi-specialty in nature.

## Master's Degree in Cyber Security and Operations

The Master of Science in Cyber Security and Operations (MS CYSO) is designed for students who wish to help met the challenges posed by increasing cyber-threats. The Cyber Defense concentration will focus on those aspects of cyber security needed to prepare an enterprise level system to protect itself, while the Cyber Operations concentration will focus on those aspects of cyber security that are needed to operate in the cyber domain. Using a multidisciplinary approach, the program is designed t provide students with a focused education within a broad analytical framework for evaluating, understanding, and solving cyber security problems. Either concentration will allow a thesis or non-thesis option.

## Requirements

M.S. CS and CYSO applicants are required to have a 3.00/4.00 GPA in overall undergraduate work and complete the GRE with a competitive score before admission. International students require a suitable demonstration of English proficiency. Candidates for the master's degree must have completed all prerequisite courses or their equivalent. For additional details, consult the CS Department's Graduate Handbook.

An entering Ph.D. student with an M.S. degree should have a 3.50/4.00 grade point average in M.S. work, while a Ph.D. student entering with only a B.S. degree is expected to have a 3.50/4.00 grade point average on overall undergraduate work. A student with a lower GPA may still be eligible for admission based on outstanding qualifications in other areas. A student must complete the GRE with a competitive score before admission. International students require a suitable demonstration of English proficiency. Candidates for the Ph.D. degree must have completed all prerequisite courses or their equivalent. Finally, a student must possess those qualifications and research interests that indicate to the Computer Science and Engineering Graduate Studies Committee that the applicant will be successful in the computer science doctoral program. For additional details, consult the Computer Science Department's Graduate Handbook.

## Accelerated Program

Highly qualified undergraduates are encouraged to consider applying to the Accelerated Program enabling the undergraduate student in a bachelor's degree program in Computer Science or Software Engineering to earn up to 9 hours of graduate-level coursework during the final year of undergraduate studies. The student takes graduate-level courses and earns both undergraduate and graduate credit simultaneously. The student

needs to consult with a potential graduate advisor to ensure graduate credit could be applied to a program of study for the graduate degree. Application to this program may be made as early as the end of the junior year (i.e., after completion of 90 or more hours of graded undergraduate courses). See Accelerated Programs (http://catalog.msstate.edu/archives/2019-20/graduate/colleges-degree-programs) for complete information. Students interested in applying should also contact the department's Graduate Coordinator, Dr. T J. Jankun-Kelly for more details.

## Master of Science in Computer Science - Thesis

| | | |
|---|---|---|
| **CS Core** | | 4 |
| CSE 8011 | Graduate Seminar | |
| Select one of the following: [1, 2] | | |
| CSE 8813 | Theory of Computation | |
| CSE 8843 | Complexity of Sequential and Parallel Algorithms | |
| CSE 8833 | Algorithms | |
| **Primary Specialization** [2, 3, 4] | | 9 |
| CSE 6XXX Specialization Required Course | | |
| CSE 6/8XXX Specialization Course | | |
| CSE 8XXX Full Graduate Specialization Course | | |
| **Secondary Specialization** [2, 3, 4] | | 6 |
| CSE 6XXX Specialization Required Course | | |
| CSE 6/8XXX Specialization Course | | |
| **Additional Coursework** [3, 4] | | 6 |
| CSE 6/8XXX Graduate Coursework, possibly including directed project | | |
| **Research/Thesis** | | 6 |
| CSE 8000 | Thesis Research/ Thesis in Computer Science and Engineering | |
| Total Hours | | 31 |

1 Classes designated as theory in advance by the faculty can be used to substitute for the theory requirement on a case-by-case basis.

2 Any required courses in the Core or a Specialization previously completed by a student may be applied for completion and replaced with another free course of the student's and committee's choosing.

3 Courses applying directly to the student's specializations and approved by the student's Graduate Committee may be included, even if they are offered from another area or by another department. The majority of hours must be from CSE.

4 A minimum of 15 credit hours of the courses in the total program of study must be at the full graduate level (numbered 8000 or 9000).

## Master of Science in Computer Science - Non-Thesis

| | | |
|---|---|---|
| **Core Courses** | | 4 |
| CSE 8011 | Graduate Seminar | |
| Select one of the following: [1, 2] | | |
| CSE 8813 | Theory of Computation | |
| CSE 8843 | Complexity of Sequential and Parallel Algorithms | |
| CSE 8833 | Algorithms | |
| **Primary Specialization** [2, 3, 5] | | 9 |
| CSE 6XXX Specialization Required Course | | |
| CSE 6/8XXX Specialization Course | | |
| CSE 8XXX Full Graduate Specialization Course | | |
| **Secondary Specialization** [2, 3, 5] | | 6 |
| CSE 6XXX Specialization Required Course | | |
| CSE 6/8XXX Specialization Course | | |
| **Additional Coursework** [3, 4, 5] | | 12 |
| CSE 6/8XXX Graduate Coursework, possibly including directed project | | |
| Total Hours | | 31 |

1 Classes designated as theory in advance by the faculty can be used to substitute for the theory requirement on a case-by-case basis.

2 Any required courses in the Core or a Specialization previously completed by a student may be applied for completion and replaced with another free course of the student's and committee's choosing.

[3] Courses applying directly to the student's specializations and approved by the student's Graduate Committee may be included, even if they are offered from another area or by another department. The majority of hours must be from CSE.

[4] Students, in cooperation with their committee, can choose to do a directed project to replace some of these additional 12 hours. A directed project requires taking course CSE 8080 under the direction of the student's major professor or other member of the student's committee.

[5] A minimum of 15 credit hours of the courses in the program of study must be at the full graduate level (numbered 8000 or 9000).

Students who complete a directed project present the results of the directed project to his/her Graduate Committee at the time of the comprehensive examination. All M.S. students must perform satisfactorily on an oral comprehensive examination. The master's comprehensive examination is held in conjunction with the student's project presentation.

## Master of Science in Cyber Security and Operations with a Concentration in Cyber Defense or Cyber Operations - Thesis

| | | |
|---|---|---|
| **CYSO Core** [1] | | 10 |
| CSE 8011 | Graduate Seminar | |
| CSE 6243 | Information and Computer Security | |
| CSE 6273 | Introduction to Computer Forensics | |
| CSE 6383 | Network Security | |
| **Choose One Concentration:** [3] | | 15 |
| **Cyber Defense** [1] | | |
| BIS 6113 | Business Information Systems Security Management | |
| Advanced Cyber Defense Electives | | |
| **Cyber Operations** [1] | | |
| CSE 8713 | Advanced Cyber Operations | |
| Advanced Cyber Operations Electives [2] | | |
| **Thesis Option** | | 6 |
| CSE 8000 | Thesis Research/ Thesis in Computer Science and Engineering | |
| Total Hours | | 31 |

[1] Any required courses in the Core or a Concentration previously completed by a student may be applied for completion and replaced with another free course of the student's and committee's choosing.

[2] Electives are listed in the CS Graduate Handbook.

[3] A minimum of 15 credit hours of the courses in the total program of study must be at the full graduate level (numbered 8000 or 9000).

## Master of Science in Cyber Security and Operations with a Concentration in Cyber Defense or Cyber Operations - Non-Thesis

| | | |
|---|---|---|
| **CYSO Core** [1] | | 10 |
| CSE 8011 | Graduate Seminar | |
| CSE 6243 | Information and Computer Security | |
| CSE 6273 | Introduction to Computer Forensics | |
| CSE 6383 | Network Security | |
| **Choose One Concentration:** [4] | | 15 |
| Cyber Defense [1] | | |
| BIS 6113 | Business Information Systems Security Management | |
| Advanced Cyber Defense Electives | | |
| Cyber Operations [1] | | |
| CSE 8713 | Advanced Cyber Operations | |
| Advanced Cyber Operations Electives [2] | | |
| **Non-Thesis Option** | | 6 |
| CSE or ECE electives [4] | | |
| Total Hours | | 31 |

[1] Any required courses in the Core or a Concentration previously completed by a student may be applied for completion and replaced with another free course of the student's and committee's choosing.

2 Electives are listed in the CS Graduate Handbook.

3 Students, in cooperation with their committee, can choose to do a directed project to replace some or all of these additional 6 hours. A directed project requires taking course CSE 8080 under the direction of the student's major professor or other member of the student's committee.

4 A minimum of 15 credit hours of the courses in the total program of study must be at the full graduate level (numbered 8000 or 9000).

## Doctor of Philosophy in Computer Science - Students admitted directly from Bachelor's Degree

| | | |
|---|---|---|
| **CS Core** [2] | | 7 |
| CSE 8011 | Graduate Seminar | |
| Select two of the following: [1] | | |
| CSE 8813 | Theory of Computation | |
| CSE 8833 | Algorithms | |
| CSE 8843 | Complexity of Sequential and Parallel Algorithms | |
| **Primary Specialization** [2, 3, 5] | | |
| CSE 6XXX Specialization Introductory Course | | 3 |
| CSE 6/8XXX Specialization Courses | | 6 |
| CSE 8XXX Ful Graduate Specialization Courses | | 6 |
| **Secondary Specilization** [2, 3, 5] | | |
| CSE 6XXX Specialization Introductory Course | | 3 |
| CSE 6/8XXX Specialization Course | | 3 |
| CSE 8XXX Full Graduate Specialization Course | | 3 |
| **Additional Coursework** [5] | | 12 |
| CSE 6/8XXX Graduate Coursework | | |
| **Dissertation** [4] | | 20 |
| CSE 9000 | Dissertation Research/ Dissertation in Computer Science and Engineering | |
| Total Hours | | 63 |

1 Classes designated as Theory in Advance by the faculty can be used to substitute for the theory requirement on a case-by-case basis.

2 Any required courses in the Core or a Specialization previously completed by a student may be applied for completion and replaced with another free course of the student's and committee's choosing.

3 Courses applying directly to the student's Specializations or research and approved by the student's Graduate Committee may be included, even if they are offered from another area or by another department. The majority f hours must be from CSE.

4 A student may enroll in dissertation hours only with the approval of his/her major proessor, who is the instructor of record and will assign a grade (S or U).

5 A minimum of 21 credit hours of the courses in the total program of study excluding dissertation must be at the full graduate level (numbered 8000 or 9000).

## Doctor of Philosophy in Computer Science - Students admitted with Master's Degree

| | | |
|---|---|---|
| **CS Core** [1] | | 3 |
| Select one of the following: [2] | | |
| CSE 8813 | Theory of Computation | |
| CSE 8843 | Complexity of Sequential and Parallel Algorithms | |
| CSE 8833 | Algorithms | |
| **Primary Specialization** [3, 4, 6] | | |
| CSE 6XXX Specialization Introductory Course | | 3 |
| CSE 8XXX Full Graduate Specialization Courses | | 3 |
| **Secondary Specialization** [3, 4, 6] | | |
| CSE 6XXX Specialization Introductory Course | | 3 |
| **Dissertation:** [5] | | 20 |
| CSE 9000 | Dissertation Research/ Dissertation in Computer Science and Engineering | |
| Total Hours | | 32 |

1 A student who did not complete CSE 8011 Seminar must also complete this Core course.

2 Classes designated as Theory in advance by the faculty can be used to substitute for the theory requirement on a case-by-case basis.

3 Amy required courses in the Core or a Specialization previously completed by a student may be applied for completion and replaced with another free course of the student's and committee's choosing,

4 Courses applying directly to the student's Specializations or research and approved by the student's Graduate Committee may be included, even if they are offered from another area of by another department. The majority of hours must be from CSE.

5 A student may enroll in dissertation hours only with the approval of his/her major professor, who is the instructor of record and will assign a grade (S or U).

6 A minimum of 21 credit hours of the courses in the total program of study excluding dissertation must be at the full graduate level (numbered 8000 or 9000).

## Examination Procedure

During preparation for the doctoral degree, the student will be required to complete three examinations and present an oral dissertation proposal. The examinations are the qualifying examination, typically taken during the student's first year of study; a preliminary examination, taken after the student has completed (or is within 6 hours of having completed) all coursework and has had a dissertation topic approved; and the final examination, taken when all other examinations and the dissertation have been completed.

At the time that the student takes the qualifying examination, the graduate faculty will conduct a review of the student's status in the program. This review will include, as a minimum, the following:

- performance on the qualifying examination
- progress and performance in courses
- possible serious impediments to further progress toward the doctorate

Such a review could result in binding recommendations from the graduate faculty or strong recommendations that the student address a problem within a certain time frame or could even result in dismissal from the program.

# Minor in Computer Science, Master's Degree Program

The Graduate Council requires that a student who wishes to earn a minor in computer science in a master's degree program complete at least 9 semester hours of computer science graduate credit, not to include CSE 6613. In addition, the Department of Computer Science and Engineering requires that the following requirements be satisfied:

- At least 3 semester hours must be at the full graduate (8000) level.
- At least 6 semester hours must be in one of the research focus areas, or theory.
- CSE 2383 or CSE 6753 or equivalent must have been completed by the student. This required background may have been completed during undergraduate study. CSE 6753 may count toward the minor.
- The student must pass a comprehensive examination over minor coursework, as determined by the minor professor. This may be in conjunction with an examination for the primary degree program.

The student must be accepted by a minor professor in the Department of Computer Science and Engineering and have the approval of both the minor professor and the Graduate Coordinator in Computer Science and Engineering of the minor program of study. The minor professor will be included in the student's supervisory committee.

# Minor in Computer Science, Doctoral Degree Program

The Graduate Council requires that a student who wishes to earn a minor in computer science in a Ph.D. degree program complete at least 12 semester hours of computer science graduate credit, not to include CSE 6613. In addition, the Department of Computer Science and Engineering requires that the following requirements be satisfied:

- At least 3 semester hours must be at the full graduate (8000) level.
- At least 6 semester hours must be in one of the research focus areas, or theory.
- CSE 2383 or CSE 6753 or equivalent must have been completed by the student. This required background may have been completed during undergraduate study. CSE 6753 may count toward the minor.
- The student must pass a comprehensive examination over minor coursework, as determined by the minor professor. This may be in conjunction with an examination for the primary degree program.

The student must be accepted by a minor professor in the Department of Computer Science and Engineering and have the approval of both the minor professor and the Graduate Coordinator in Computer Science and Engineering of the minor program of study. The minor professor will be included in the student's supervisory committee.

University policy on graduate minors is located in the Master of Science and Doctor of Philosophy sections in this publication.