

Computational Science, Engineering, and Mathematics Requirements for the Ph.D. Degree

The University of Texas at Austin offers the degree Doctor of Philosophy with a major in Computational Science, Engineering, and Mathematics (CSEM). Within this graduate studies program, each student must develop a program of study and research in Computational Science, Engineering, and Mathematics that includes a substantial component from each of the three CSEM Concentration Areas. These areas are Applicable Mathematics (Area A), Numerical Analysis and Scientific Computation (Area B), and Mathematical Modeling and Applications (Area C). The student must demonstrate breadth and proficiency in each of the three Concentration Areas. Research for CSEM dissertations must integrate elements of Areas A, B, and C, and must make an interdisciplinary contribution that advances the field of computational science and engineering.

1. Degree Options

CSEM has two degree options: the Computational and Applied Mathematics (CAM) option and the Computational Science and Engineering (CSE) option. Upon entering the program, each student must elect an option.

2. Advisors

Every student is required to have a faculty dissertation advisor (or co-advisors). The primary advisor must be chosen from the CSEM Graduate Studies Committee (GSC). The student must select an advisor willing to serve as a mentor, supervise the dissertation, and give advice on coursework. A dissertation advisor need not be selected until the end of the second long semester of the student's studies. Prior to the selection of a dissertation advisor, the CSEM Graduate Advisor will appoint a faculty mentor who, with the Graduate Advisor, will advise the student on coursework and progress in the program.

3. Coursework

The student's overall cumulative grade point average must be 3.25 or better. The student must satisfactorily complete requirements in the three CSEM concentration areas A, B, and C. These requirements include at least 36 hours of approved graduate level coursework taken for a grade, distributed across the three areas. Of these, at least 12 hours must be in each of two of the three areas, and at least 9 hours in the third area. The student must achieve a grade point average of 3.25 or better in those courses. Moreover, in one of Areas A, B, or C, the student must achieve a grade point average of 3.5 or better. The student must complete all required coursework by the end of the seventh long semester. (Note: specific course numbers below are subject to change.)

3.1. Area A coursework

During the first full academic year of the program, the student must complete the following first-year core sequence, depending on the degree option. For the CAM option,

- CSE 386C Methods of Applied Mathematics I *and*
- CSE 386D Methods of Applied Mathematics II,

and for the CSE option,

- CSE 386M Functional Analysis in Theoretical Mechanics *and*
- CSE 386L Mathematical Methods in Engineering and Science.

By the end of the seventh long semester, the student must complete graduate level Area A electives as required by section 3.4 and approved by the Graduate Advisor.

3.2. Area B coursework

Unless deferred under section 3.5, during the first full academic year of the program, the student must complete the first-year core sequence consisting of:

- CSE 383C Numerical Analysis: Linear Algebra
and *either*
- CSE 383L Numerical Analysis: Differential Equations *or*
- CSE 382M Foundational Techniques of Machine Learning and Data Sciences.

By the end of the seventh long semester, the student must complete graduate level Area B electives as required by section 3.4 and approved by the Graduate Advisor.

3.3. Area C coursework

Unless deferred under section 3.5, during the first full academic year of the program, the student must complete the first-year core sequence:

- CSE 389C Introduction to Mathematical Modeling in Science and Engineering I *and*
- CSE 389D Introduction to Mathematical Modeling in Science and Engineering II.

By the end of the seventh long semester, the student must complete graduate level Area C electives as required by section 3.4 and approved by both the student's dissertation advisor the Graduate Advisor. If the student will complete two or more elective courses in Area C, and if deemed appropriate by the student's advisor and the Graduate Advisor, up to 3 credit hours may be earned at the undergraduate level.

3.4. Distribution of additional coursework

To satisfy the additional course requirements described above for each area, the student must complete either two graduate level elective courses (6 credit hours) in each of the three areas, or, alternatively, the student must complete one graduate level elective course in one area, two in a second area, and three in the third area.

3.5. Deferral of first-year courses

In their first full academic year of CSEM studies, students are generally expected to complete all six first-year core courses defined in sections 3.1-3.3. However, if there are compelling reasons (e.g. heavy research engagement or the need to take a different course), then, with the approval of the Graduate Advisor, at most two of the first-year Area B or C core courses specified in sections 3.2 and 3.3 may be deferred to the second full academic year.

4. Preliminary Exams

At the end of the first full academic year, the student is required to demonstrate a graduate level proficiency in CSEM Areas A, B, and C by taking and passing a written preliminary examination in each area. These exams cover the subject material of the first year courses taken by the student.

A student failing any of the preliminary exams will be required by the examining committee to do one of the following: (1) take a make-up exam before the start of the Fall semester; (2) repeat that particular exam the following year; or (3) leave the program.

5. Ph.D. Dissertation Committee

Before the end of the student's fifth long semester, the student and dissertation advisor must recommend to the Graduate Advisor a dissertation committee to pose the qualifying exam and evaluate the dissertation. The dissertation committee must consist of the advisor and at least three additional faculty members. The committee must include at least one CSEM faculty member representing Area A, a second representing Area B, and a third representing Area C, including the student's advisor. Moreover, at least two of the committee members must represent distinct UT departments through positive time appointment. The Graduate Advisor must approve the composition of the committee.

6. Dissertation Proposal

Before the end of the sixth long semester, the student must propose research for the Ph.D. dissertation.

6.1. Abstract

The student must write a concise abstract of the dissertation proposal. The abstract must address how each of the three CSEM Concentration Areas A, B, and C will be part of the proposed research. The student must meet with each member of the dissertation committee to discuss the abstract, the expertise the committee member will contribute to the dissertation, and the background knowledge expected of the student as well as the types of questions that might be asked at the proposal presentation (Section 7 below). The abstract must be approved by the committee.

6.2. Proposal

The student must write the dissertation proposal and submit it to each member of the dissertation committee, and to the Graduate Coordinator, who will make it publicly available. The proposal must conform to a set of requirements that the Graduate Studies Committee will make available.

7. Dissertation Proposal Presentation

Approximately two weeks after submission of the written dissertation proposal, the student is required to give a private, oral presentation of the proposal to the dissertation committee. The presentation itself should be about 45 minutes in length. The committee will then examine the student to explore details of the proposal and to test the student's general background knowledge relevant to the proposed research, including the ability to integrate ideas from areas A, B, and C. The committee will expect somewhat greater depth and breadth in Area A as opposed to Area C for students in the CAM option, and the opposite for students in the CSE option.

The student's performance is deemed satisfactory if the committee agrees, with at most one dissenting vote, that the student developed a sufficiently rich, original, and interdisciplinary research program and demonstrated competence to complete the proposed research. In the event of an unsatisfactory performance, the committee is charged with explaining to the student the reasons the performance was not satisfactory. The committee may impose requirements on the student, such as requiring changes to the proposal, additional coursework, and/or another presentation to be given within one year.

8. Admission to Ph.D. Candidacy

After completing the coursework, examination, and proposal requirements, the student must prepare and submit a Graduate School application for candidacy.

9. Ph.D. Dissertation and Oral Defense

Generally, by the end of the tenth long semester, and definitely before the end of the fourteenth long semester, the student must prepare a written dissertation of the results of their research and give a copy to each member of the Ph.D. dissertation committee and to the Graduate Coordinator. This dissertation must be presented in a seminar of about 45 minutes that is open to the public, and it must be announced publicly to CSEM faculty and students within the Oden Institute. Immediately after the presentation, the student will meet privately with the dissertation committee to face questions and orally defend the work. The dissertation committee will judge whether the dissertation and the oral defense are acceptable.

Both the dissertation and the oral defense must follow appropriate Graduate School requirements and procedures.

10. Seminar Attendance

Each student is expected to regularly attend Oden Institute sponsored seminars. The GSSC will set the number required each semester.

11. Annual Progress Reports

Each student is required to prepare an annual progress report of coursework, research activities, and financial support. Students not making satisfactory progress to the degree will be given specific requirements that must be met to return to good standing in the program.

12. Probation

A student failing to satisfy the requirements of the program in a timely manner will be put on probation by the GSSC, and the student's progress will be monitored closely. The student will stay on probation until satisfactory progress is achieved. A student may stay on probation for a maximum of two long semesters. A student who has been on probation for a total of two long semesters and is found to be not in compliance with the timely requirements of the program will not be allowed to continue in the program.

13. Appeals and Petitions

The student may appeal to or petition the CSEM GSSC for a waiver or alteration of any CSEM requirement, except for a waiver of an exam or a waiver of a Graduate School degree requirement. Written appeals or petitions should be submitted to the GSSC through either the Graduate Advisor or the CSEM Graduate Studies Committee Chair.