

# 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 demonstrate an interdisciplinary theme and draw on knowledge from the CSEM disciplines and each of the three Concentration Areas.

**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. Advisers.** Every student is required to have a faculty dissertation adviser (or co-advisers). The primary adviser must be chosen from the CSEM Graduate Studies Committee (GSC). The student must select an adviser willing to mentor him or her, supervise his or her dissertation, and give advice on course work. A dissertation adviser need not be selected until the end of the second long semester of the student's studies. Prior to the selection of a dissertation adviser, the CSEM Graduate Adviser will appoint a faculty mentor who, with the Graduate Adviser, will advise the student on his or her course work and progress in the program.

**3. Course Work.** The student's overall cumulative grade point average must be 3.25 (B) or better. The student must satisfactorily complete requirements in the three CSEM concentration areas A, B, and C. These requirements include 12 hours of approved graduate level course work in each area taken for a grade. The student must achieve a grade point average of 3.25 (B) 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 (B+/A-) or better. The student must complete all required course work by the end of the seventh long semester. (Note: specific course numbers below are subject to change.)

**3.1. Area A course work.** During the first full academic year of the program, the student must complete the following first year 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 two additional courses (6 credit hours) of graduate level course work approved by the Graduate Adviser. At least six credit hours of Area A course work must be earned in courses listed or cross-listed with the Mathematics Department.

**3.2. Area B course work.** During the first full academic year of the program, the student must complete the following course

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 two additional courses (6 credit hours) of graduate level course work approved by the Graduate Adviser.

**3.3. Area C course work.** During the first full academic year of the program, the student must complete the first year 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 two additional courses (6 credit hours) of graduate level course work in some application area consistent with the student's proposed research area, and as approved by both the student's dissertation adviser the Graduate Adviser. If deemed appropriate by the student's adviser and the Graduate Adviser, up to 3 credit hours may be earned at the undergraduate level.

**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.** The student and dissertation adviser must recommend to the Graduate Adviser a dissertation committee to pose the qualifying exam and evaluate the dissertation. The dissertation committee must consist of the adviser and at least four 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, not including the student's adviser. Moreover, at least three of the committee members must represent distinct UT departments through positive time appointment. The Graduate Adviser must approve the composition of the committee.

**6. Dissertation Proposal.** Before the end of the sixth long semester, the student must propose research for their 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 addressed in and form an integral part of the proposed research. The student must meet with each member of his or her 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 signed by each member of the committee. Before the dissertation proposal presentation may be scheduled, this abstract must be submitted to and approved by the Graduate Studies Subcommittee (GSSC).

**6.2. Proposal.** The student must write his or her 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 it to his or her 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 his or her 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 CSE Option students.

The student's performance is 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 that his or her performance was not satisfactory. The committee may impose requirements on the student, such as requiring changes to the proposal, additional course work, 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 his or her research and give a copy to each member of his or her 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 ICES. 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 attend regularly 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 his or her 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 waiver or alteration of any CSEM requirement, except for waiver of an exam or waiver of a Graduate School degree requirement. Written appeals or petitions should be submitted to the GSSC through either the Graduate Adviser or the CSEM Graduate Studies Committee Chair.