

## Computational and Applied Mathematics Requirements for Advancement to Ph.D. Candidacy

Each student must develop a program of study in Computational and Applied Mathematics (CAM) that includes a substantial component from each of the three CAM 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 CAM dissertations must demonstrate an interdisciplinary theme and draw on knowledge from the CAM disciplines and each of the three Concentration Areas.

**1. Degree Options.** The Computational and Applied Mathematics (CAM) Ph.D. Graduate program of The University of Texas at Austin has two degree options, the Computational and Applied Mathematics (CAM) Option and the Computational Engineering and Sciences (CES) Option. Upon entering the program, each student must elect an option. Transfer from one option to the other is permitted only by petition to and approval by the CAM Graduate Studies Subcommittee (GSSC).

**2. Advisors.** Every student is required to have a faculty dissertation advisor (or co-advisors), chosen from the CAM Graduate Studies Committee. The student must select an advisor willing to supervise his or her dissertation and give advice on course work. A dissertation advisor need not be selected until the end of the

CAM: third

CES: second

long semester of the student's studies. Prior to the selection of a dissertation advisor, the Graduate Advisor will appoint a faculty mentor who, with the Graduate Advisor, 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 CAM 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 have achieved 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.

**3.1. Area A course work.** During the first full academic year of the program, the student must complete basic functional analysis

CAM: CAM 385C/M 383C Methods of Applied Mathematics I,

CES: CAM 386M/EM 386M Functional Analysis in Theoretical Mechanics, or

CAM 385C/M 383C Methods of Applied Mathematics I,

and one of a selection of additional courses. These additional courses are

CAM: Continuum mathematics: CAM 385D/M 383D Methods of Applied Mathematics II,

CES: Operational mathematics: EM 386L Mathematical Methods in Applied Mechanics,

CAM 381N/PHY 381M Methods of Mathematical Physics, or

CAM 385D/M 383D Methods of Applied Mathematics II,

Probability: CAM 384K/M 385C Probability, or

EE 381J Probability and Stochastic Processes I,

Discrete mathematics: CS 388C Combinatorics and Graph Theory, or

M<sup>1</sup> Discrete Mathematics.

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<sup>1</sup>The course number will be substituted here when it becomes available.

Moreover, the student must complete two additional courses (6 credit hours) of graduate level course work chosen from the list above or approved by the Area A subcommittee.

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 basic numerical linear algebra

CAM 383C/CS 383C Numerical Analysis: Linear Algebra  
and one of

Numerical analysis: CAM 383D/CS 383D Numerical Analysis, or  
CAM 397/PGE 383 Scientific Computation,

Numerical differential eqns.: CAM 386K/M 383G Numerical Treatment of Differential Equations,  
CAM 394F/EM 394F/AE 384P Finite Element Methods,

Algorithms: CS 388G, Algorithms: Techniques and Theory.

Moreover, the student must complete two additional courses (6 credit hours) of graduate level course work chosen from the list above or approved by the Area B subcommittee.

**3.3. Area C course work.** Within the first two semesters of the program, the student must complete basic applications and modeling

CAM<sup>2</sup> Fundamentals of Mathematical and Computational Modeling

The student must satisfactorily complete 3 additional credit hours of area C course work by the end of the

CAM: third

CES: second

long semester of study. These 3 credit hours may be at the undergraduate level if it is deemed appropriate by the student's advisor and the Graduate Advisor.

The student must complete additional graduate level Area C course work to total 12 credit hours as approved by both their dissertation advisor and the Graduate Advisor in some application area consistent with the student's proposed research area.

**4. Preliminary Exams.** At the end of the first full academic year, the student is required to demonstrate a graduate level proficiency in CAM Areas A, B, and C by taking and passing a written preliminary exam in each area. The area A and B exams cover the subject material of the first year courses taken, and the Area C exam covers the material of the required basic applications and modeling course. These exams will be administered by the Area A, Area B, and Area C subcommittees, respectively.

A student failing any of the preliminary exams will be required by the examining committee to do one of the following: (1) leave the program; (2) repeat that particular exam the following year; or (3) take a make-up exam within 4 weeks.

**5. Ph.D. Dissertation Committee.** 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 four additional faculty members. The committee must include at least one CAM faculty member representing Area A, a second representing Area B, and a third representing Area C, not including the student's advisor. Moreover, at least three of the committee members must represent distinct UT departments through positive time appointment. The Graduate Advisor must approve the composition of the committee.

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<sup>2</sup>The course numbers will be substituted here when they become available

**6. Dissertation Proposal.** Before the end of the seventh 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 CAM Concentration Areas A, B, and C will be addressed in and form an integral part of the proposed research. Before the dissertation proposal presentation may be scheduled, this abstract must be submitted to the Graduate Advisor and approved by the GSSC, either by a no-protest vote or at its next regularly scheduled meeting.

**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 Advisor, who will make it publicly available. The goals of the proposal are to:

1. Deliver a statement of research problems, including motivation for their solution;
2. Demonstrate the technical background needed for the problem, including a bibliography;
3. Sketch at least one potentially successful method to attack an unsolved research problem;
4. Describe preliminary work on a problem indicating research competence;
5. Describe the stages of future research.

**7. Dissertation Proposal Presentation and Qualifying Examination.** Approximately two weeks past submission of the dissertation proposal, the student is required to present and obtain acceptance of the dissertation proposal and pass a qualifying examination. The presentation is to be announced publicly to CAM faculty and students and within the Institute for Computational Engineering and Sciences (ICES).

The first portion, the presentation of about 45 minutes in length, is open to the general public. The second portion is the examination and it is restricted to the student's qualifying examination committee. This committee consists of the dissertation committee, minus the student's advisor (or primary advisor, in the case of co-advisors), and one additional representative chosen by the GSSC. The exam will test the depth and breadth of the student's knowledge relevant to the proposed research, including material in areas A, B, and C and supporting material. The questions shall be weighted to reflect the appropriate CAM/CES Option. For this exam, somewhat greater depth and breadth will be expected in

CAM: Area A as opposed to Area C.

CES: Area C as opposed to Area A.

The dissertation proposal and exam performance is satisfactory if the student's qualifying examination committee, plus the advisor, agree 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 a failing performance, the examining committee is charged with explaining to the student the reasons that his or her performance was not satisfactory and the improvements that are needed. The committee may require additional course work and/or another presentation. A follow-up examination must be taken within one year. The student may not fail the follow-up exam and continue in the program.

**8. Admission to Ph.D. Candidacy.** Following passage of the Qualifying Examination, the student must prepare and submit a Graduate School application for candidacy.

**9. 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.

**10. Appeals and Petitions.** The student may appeal to or petition the CAM GSSC for waiver or alteration of any CAM 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 Advisor or the CAM Chair.

Effective November 1, 2001