



MCE Option Office
Department of Mechanical and Civil Engineering
Division of Engineering and Applied Science

To: Students planning to earn a Ph.D. in AM, CE, or ME
From: Nadia Lapusta, MCE Option Representative
Subject: MCE Ph.D. Candidacy exam
Date: May 9, 2018

The Ph.D. candidacy examinations in AM, CE, and ME are taken by PhD students in their second year of graduate study at Caltech and have two components, one based on coursework - quals, and one based on research - candidacy. The qualifying component of the examination is given at the beginning of the fall term. The candidacy component of the examination is given in the winter and spring terms.

Qualifying Examination

Each student is required to select three of the areas listed in the table below for the examination, one of the three areas must be mathematics. The exam in each area will include common questions to be asked of all students who have selected that area, regardless of students' individual fields of specialization. In addition, for each student, the examination will extend beyond the common questions in one of the areas that the student has designated as his or her major area of interest. The pre-approved areas are as follows:

Mathematics (required): ACM 100ab, ACM104

Select two:

- Complex Variables
- Ordinary Differential Equations
- Partial Differential Equations
- Linear Spaces

Fluid Mechanics: Ae/APh/CE/ME101abc

Solid Mechanics: Ae/AM/CE/ME 102abc

Thermal Sciences: ME 119ab

Dynamical Systems: AM/CE 151ab

Robotics & Autonomy: ME/CS 133ab

Control Theory: CDS231, CDS233

A student may petition the mechanical and civil engineering faculty to replace one of the specified areas (other than mathematics) with an area that is not on the list and is not a sub-specialty of one of the listed areas. The approval is not automatic; such petitions are submitted rarely and some of them have been denied in the past.

While the exam in each subject area need not be limited to the content of any particular course, the nominal level of preparation for the exam is suggested by the Caltech course or courses appearing opposite each area listed above. The attached subject area descriptions indicate the topics from which exam questions will be drawn.

The examination is offered during a single time window in the first term of the academic year. This window is approximately a week in length, depending on the number of candidates. This year the exams will be conducted the week before the fall term begins. A fixed set of examiners conduct the exams, all of which are oral. Exams in each area are approximately forty-five minutes in length, and each will be preceded by a fifteen-minute period during which the student will be allowed to review the written questions for that exam. The fifteen-minute period is for the student to collect their thoughts and there will be no consultation of reference material. The student may write some notes during this time to bring into the exam. In the exam in the student's designated major area, the examiners will probe more deeply into the issues raised in the questions.

Students must notify the Options Manager in writing of their math choices and the other two subject areas (other than Mathematics) for the exam, and which of these is the major area. A student who intends to petition for an area not on the pre-approved list should seek and obtain approval of the mechanical and civil engineering faculty of the area to be substituted at least three months prior to the exam.

Research component of the candidacy examination

It is the responsibility of the student to (1) find a research advisor by the end of the third term of their first year of graduate study at Caltech, and (2) in consultation with this advisor, identify a research topic that is appropriate and adequate for a doctoral thesis in Applied Mechanics, Civil Engineering, or Mechanical Engineering.

Scope of the Examination

The scope of this examination is to demonstrate that the student has the ability and is adequately prepared to undertake Ph.D. level research in the proposed area. This preparation includes necessary knowledge of the chosen subject, a review of the literature, identification of promising directions to pursue for the rest of the PhD study, and

preparatory theory or experiments as applicable. It is not necessary to have conclusive results or the final thesis outline.

Eligibility

Students who are in good standing in the Ph.D program and who have passed the course-work component of the candidacy examination are eligible to take this examination.

Examination Committee

The membership of the examination committee is usually the same as the Ph.D. dissertation supervision committee. The committee shall elect a chair other than the research advisor who is an MCE faculty member.

The student shall propose the committee in consultation with the advisor in writing to the Option Office (Holly Golcher) by the end of the fourth term of their first year of graduate study at Caltech. The student is to seek the consent of the members in writing before proposing them.

Any changes must be approved by the Option Representative, at least one week prior to the exam.

Scheduling

The examination shall be scheduled to occur before June 7, of the student's second year of graduate study at Caltech. The time should be acceptable to the committee. The faculty members will make every reasonable effort to make themselves available for the examination. The student is responsible for reserving the room and necessary equipment.

The examination date, time and place must be communicated to the Option Office (Holly Golcher) by April 1. Exceptions must be approved by the faculty and the Option Representative by April 1.

The Examination

The student shall submit a 5-10 page written Candidacy Report to the Option Office (Holly Golcher) and to the three members of the committee at least one week before the examination. The candidacy report should describe the proposed topic of research, relevant survey of the literature, and any preliminary results or laboratory preparation. The report cannot be longer than 10 pages (excluding references but including figures).

The student shall bring the following to the exam:

1. Current Caltech Transcripts (unofficial) can be obtained on-line via REGIS.
2. Copy of Research Report

The student shall make a half-hour oral presentation of the research proposal, followed by questions from the committee consistent with the scope of the examination. The examination is expected to last for approximately one hour.

The Result

The examination committee makes one of the following recommendations to the MCE Graduate Studies Committee. The final decision shall be made by the MCE Graduate Studies Committee in consultation with the examination committee.

1. Pass. This recommendation is made if the student satisfies the criteria that form the scope of this examination.
2. Pass subject to remedial action. This recommendation is made if the student satisfies the criteria that form the scope of this examination except for an isolated deficiency. No further examination is required. The examination committee shall propose the remedial action, specify criteria to demonstrate that the student has taken this action and a time-table to complete this action. Examples include but are not limited to (a) taking an additional course or (b) conducting additional literature survey in a specified area.
3. No Pass. This recommendation is made if the student fails to satisfy the criteria that form the scope of this examination. (A re-examination may be allowed by the MCE Graduate Studies committee as discussed below.)

The chair of the examination committee shall communicate the recommendation (1) orally to the student at the end of the examination and (2) in writing to the Option Representative through the Option Office (Holly Golcher).

The student is encouraged to discuss the exam and recommendation with the examination committee members to get any additional feedback. Such discussions are especially important if the recommendation is "No Pass," in which case the student should also discuss the exam with the Option Representative.

Based on the recommendation and in consultation with the examination committee, the MCE Graduate Studies Committee determines the final outcome of the exam from the following options:

1. Pass. The student shall be admitted to candidacy on fulfillment of the remaining requirements.
2. No Pass subject to remedial action. The student shall be admitted to candidacy on fulfillment of remaining requirements and the remedial action. The MCE Graduate Studies committee reviews and approves the remedial action and the timetable to complete it. If the remedial action is not completed in time, the outcome of the exam changes to “No Pass.”
3. No Pass with an option for re-examination. This determination is made if the MCE Graduate Studies committee judges that the student may be able to pass the examination in the near future with additional study. The committee shall specify the time-table for the re-examination; the re-examination cannot be later than six months from the time of the examination. Further, the committee will suggest a faculty member (chair of the examination committee, thesis advisor or another faculty member, as appropriate) to counsel the student regarding the re-examination. The result of any re-examination can only be a pass or no pass (with no second re-examination).
4. No Pass. This determination is made if the MCE Graduate Studies committee judges that the student is unlikely to be able to pass the examination in the near future. The student shall not be allowed to continue in the Ph.D program.

The MCE Graduate Studies committee decision is communicated to the student in writing by the end of the examination period (June 7) or within two weeks from the examination date, whichever is later.

Honor Code

The faculty and the students are reminded that the examination is administered under the Caltech Honor Code.