

# Doctor of Philosophy Degree

## Requirements & Procedures

The primary focus of the Doctor of Philosophy Degree (PhD) in the Computer of Engineering Program is a dissertation describing publishable quality research (directed by a faculty advisor) of significant depth. The time limit for completion of the Ph.D. is seven years after admission to the doctoral program. Please see the Curriculum Distribution Requirements for an outline of the exact course credit requirement. Degree requirements set by the School of Engineering and Applied Science (SEAS) are given in the SEAS Graduate Record and are additional to the following CpE Graduate Program requirements.

The PhD degree requires at least 24 hours of CS/CpE/ECE 9999 – Dissertation, and at least 9 hours of graduate-level coursework beyond the master's degree.

Although a Masters degree in CpE is not required, a student is required to meet a set of "pre-requisite coursework requirements," defined to include the architecture/design course requirement, Computer Science course requirements, and Electrical & Computer Engineering course requirements (see the Curriculum Distribution Requirements). For the courses meeting the three area requirements, a Ph.D. student must receive a minimum grade of A-. Petitions for substitution of the required courses by courses taken outside the university will be considered by the CpE Graduate Director. While submitting a petition, the student may be asked to submit transcripts, detailed course syllabus, and sample homework assignments and examinations. If such a petition is not approved, the CpE Graduate Director may recommend that the student register for courses needed to fulfill their missing requirements. Alternatively, the student may be given the option to demonstrate core competency in the subject matter by taking the final examination of an appropriate course with the approval of the course instructor.

## Transfer Credit

Subject to approval from the CpE Graduate Director, PhD candidates may transfer PhD-level courses and dissertation credit hours from other schools of recognized standing. Students may only transfer courses in which they earned a grade of B or better. Requests for transfer credit should be accompanied by a Distribution Course Form. Students should discuss courses acceptable for transfer of credit with their advisor, at the same time the Distribution Course Form is developed.

## Ph.D. Qualifying Examination

Student desiring a PhD should take the qualifying examination as soon as possible. Students entering with a master's degree should take the exam no later than the beginning of their third semester. Students entering with a bachelor's degree should ideally take the exam by the beginning of their third semester, but no later than the beginning of the fourth semester. (The exam should not be postponed in order to finish a master's degree first.)

The objective of the qualifying examination is to assess the student's potential to begin doctoral-level research. The latter requires the student to demonstrate the following in their primary research area and two secondary research areas:

- an ability to state a problem clearly, provide its motivation, and the requirements for a solution.
- an ability to determine if a solution is correct.
- an ability to assess to what extent a (presumably correct) solution meets the requirements (solves the problem).
- an ability to describe how a problem and its solution fits into the big picture (and to understand the big picture).
- an ability to communicate effectively (both in writing and speaking) and to answer questions relating to the problem and its solution and the broader research context.

The qualifying exams are administered at least twice a year, typically in January and August. Students must pass the qualifying examination before

beginning their fourth academic semester after admission to the doctoral program, unless otherwise approved by the CpE Graduate Committee.

## Ph.D. Qualifying Exam Format

We have identified a set of six research areas from which each candidate will be required to select a primary research area and two secondary areas for the examination. The areas are:

- Computer Architecture
- VLSI, Switching Theory
- Operating Systems, Real-Time and Embedded Systems
- Compiler, Software Systems and Software Engineering
- Dependable Computing and Reliability Engineering
- Networks, Distributed Systems & Security

The CpE qualifying committee will announce one paper for each area two months prior to the date set for an examination. One month before the examination date, students will provide the CpE administrative coordinator their selections for the primary and secondary areas. The paper for the primary area is expected to be studied in depth. Students will be required to read and understand papers cited by the paper in the primary area as well as follow-on work. The committee will ask questions to gauge the students' detailed understanding of the primary paper and related work. For the secondary areas, students should study the selected papers and be prepared to answer general questions on these papers and related background information. Our goal for testing the student on these secondary areas is to determine the students' multi-disciplinary abilities, a key factor that is becoming increasingly important in today's research environment.

Two weeks before the oral exam date, the student will submit a written report (maximum of 3 pages in IEEE standard format at <http://www.ieee.org/portal/pages/pubs/transactions/stylesheets.html>) on the paper in the primary area to the head of the CpE qualifiers committee.

This report should demonstrate the five abilities listed at the start of this section. The student should also prepare a 20-minute (max) presentation on the primary paper, and a 10-minute (max) presentation on each

secondary paper summarizing their salient points, for delivery at the oral examination.

The oral examination will be in two parts:

Part I: Primary area test is a 1-hour examination, which will start with the student's 20-minute presentation on the paper selected by the student in the primary research area. The committee will then ask in-depth questions on the presentation, the assigned paper, related papers, and other topics in the selected primary area.

Part II: Secondary area test is a 1-hour examination, each half of which starts with the student's 10-minute presentation on the two secondary papers selected by the student. The committee will then ask broad questions on the presentation, the assigned papers and other topics in the selected secondary areas.

Students will be evaluated on the combined written submission and oral examination. The result will be a clear-cut pass or fail for the entire exam; no remedial work will be allowed to alter the outcome. A student who does not pass the qualifying exam on the first try must retake it at the next offering. A student who fails the examination twice will lose financial support and must leave the program at the end of that semester.

The assessment of the qualifying exam performance is recorded on the program specific assessment form. The assessment form must be submitted with the PhD Examination Report form that records the result of the examination. The student prepares the forms with the assistance of the Graduate Coordinator and presents the forms to the chair of the examination committee prior to the start of the exam. After the chair and the committee have completed the forms, they are then returned to the student who is responsible for filing the forms with the Graduate Coordinator.

### Advancement to candidacy and Dissertation Proposal

After a student has successfully passed the qualifying examination, the student should put together a Proposal Examining Committee of five members including the research advisor. The Committee will be composed of at least two members from the ECE department and at least two

members from the CS department. The outside member must come from a department that is different from the adviser's department. The student should prepare an acceptable dissertation proposal done under the guidance of the student's advisor. This proposal should be presented before any extensive research is undertaken, in order to receive early faculty approval of the suitability of the proposed research. The written proposal document should be prepared according to the following guidelines:

The proposal must be limited to 20 single-spaced pages including figures exclusive of bibliography. The document should succinctly describe the problem, relationship to other work in the field, the research plan including specific research activities, and the expected contributions.

An example of an organization that meets these four requirements is:

- What is the problem?
- Why is it important?
- What is the "shape" of a solution?
- What is the research agenda?
- Why will the agenda work (produce a solution)?

A comprehensive literature review (not subject to page limitations) may be included as an appendix. Any departure from these guidelines must be approved in advance by the student's proposal examining committee.

The student should prepare a public oral presentation of the proposal, which should be made within two semesters after successfully completing the Ph.D. qualifying examination. The student should provide the proposal examining committee the written proposal document at least two weeks prior to the oral presentation. The presentation should be limited to 30 minutes and will be followed by questions from the audience and the proposal examining committee.

Successful completion of the dissertation proposal examination will result in elevation to candidacy for the degree. The assessment of the dissertation proposal is performed by the advisory committee at the time of the defense of the proposal. The examining committee completes the dissertation proposal assessment form at the time of the proposal defense and it is submitted with the Dissertation Proposal form. The student must complete at least one full semester as a candidate before the degree is awarded.

In the event that a suitable proposal is not presented but the faculty believes the student has sufficient research potential, another research presentation will be scheduled within 6 months. If a suitable proposal is still not presented, the student is subject to dismissal from the program.

## Publication requirements

At a minimum, all Ph.D. candidates are required to submit an advisor-approved article related to their research to a refereed journal or conference, prior to completing their dissertation defense. If the student's advisor is not a co-author of the paper, the advisor must provide the CpE graduate committee with a note indicating the advisor's approval of the paper.

## The Dissertation Defense

The culmination of the PhD program is the defense of the dissertation. This dissertation will be the result of the final research outlined in the dissertation proposal. It is expected that the work be of sufficient quality to warrant journal publication. The dissertation defense, which is announced publicly, is an oral defense before the student's Ph.D. final examining committee as well as any other interested faculty, students or other persons. The examining committee should meet the same guidelines as the examining committee for the proposal. The student presentation portion should not exceed 45 minutes. Follow the SEAS rules with regards to the format of the dissertation and the number of copies required for distribution.

The assessment form for dissertation work is completed at the time of the defense and is submitted with the Report on Final Examination form. Also required is a list of publications. Both the Report on Final Examination and the assessment form are to be completed by the examining committee at the conclusion of the examination and defense. Steps for completing the Dissertation following the defense can be found on the Degree Requirements Website at SEAS.

## Graduate Teaching Requirement

Students are strongly encouraged to complete one semester of guided undergraduate teaching experience with the approval and supervision of a faculty member. The faculty supervisor may or may not be the student's advisor.

## Assessment Requirements

Outcome assessment for the PhD degree occurs at three different points in the program: the qualifying exam, the proposal and the dissertation defense.

## English Language Proficiency

All new graduate students whose native language is not English are tested for English proficiency near the beginning of their first semester at UVa. All non-native speakers of English must pass the Virginia Language Proficiency Exam (administered by the Center for American English Language and Culture) at this time. Students must pass this test before:

- Taking the Qualifying Examination
- Being appointed to a Graduate Teaching Assistant position (CS 8897, CS 9897, ECE 8897, ECE 9897) or commencing a doctoral-program Graduate Teaching Experience.
- Applying for a graduate degree.

If a pass grade is not achieved on the SPEAK test, CAELC offers a program of courses of instruction in preparation for a repeat test at a later date. If a student takes the SPEAK Test in the fall, portions of the Virginia Language Proficiency Exam and the SPEAK Test are merged into a single composite exam.