



University of Colorado at Colorado Springs
College of Engineering and Applied Science

Guidelines for
Doctor of Philosophy in Engineering
Focus Area: Security
Last Updated March 2008.

I. INTRODUCTION

The College of Engineering and Applied Science (EAS) at the University of Colorado at Colorado Springs (UCCS) offers the Doctor of Philosophy (Ph.D.) degree in Engineering with a new specialty in Security, in addition to the existing specialty options in Electrical Engineering, Computer Science, and Mechanical and Aerospace Engineering.

The Security concentration option is multi-disciplinary. As its core, it requires a broad and in-depth understanding of cyber security and physical security technologies. It is also related to the policy, management, mechanics, and engineering of wide variety of systems for homeland security. This doctoral concentration combines breadth of knowledge in Computer Science, Electrical and Computer Engineering, Aerospace Engineering, and Homeland Security with the depth of technical knowledge in technology-based support of security and mastery of independent research, performance analysis, synthesis, and design skills in security engineering.

The purpose of this set of guidelines is to help prospective students enter their PhD program and to assist admitted students in meeting the requirements of the program. The degree requirements are determined by the graduate faculty of the College of Engineering and Applied Science at Colorado Springs. Other regulations may be imposed by the College of Engineering and Applied Science and Graduate School of the university. It is the student's responsibility to know and satisfy all relevant requirements.

Graduate students are encouraged to participate in the professional activities of the college. This includes attending seminars and colloquia, suggesting improvements in curricula (both undergraduate and graduate), suggesting new teaching techniques and participating in the enhancement of hardware and software facilities within the college.

The Security concentration program is research-oriented with more course taking flexibility. The mode of study can be full time, part time, and distance learning, with the concurrence of [the Ph.D. in Engineering with a focus in Security Committee \(PESC\)](#). Beyond the traditional learning component, the students in the program will be required to have at least three months of operational security experience (as internship, training, etc.), as determined by the [PESC](#).

II. ADMISSION

Students may be admitted in one of two categories:

A. Regular Degree Students

A student can be admitted as a regular degree student if the student satisfies the following conditions:

- 1. The student holds a bachelor's degree or a master's degree in any of the branches of science, technology, engineering and mathematics (STEM), homeland security, or closely related field from a college or university of recognized standing. Depending on the PhD track, program candidates may be required to complete prerequisite courses in STEM and/or homeland security policy.

A student who is admitted without a master's degree may earn that degree as a part of the Ph.D. studies.

2. The student has at least a 3.3 grade point average (on a scale of 4.0) in the bachelor or master degree program attempted. Graduate students in the University's Homeland Defense Certificate program must complete the certificate with a 3.3 GPA or better prior to starting Security PhD studies.

3. If the student is not a graduate of a program of recognized standing, he or she must take the Graduate Record Examination (general). GRE scores at or above the 70% level are considered favorable for admission.

4. Students whose previous education was not in the English language must take the TOEFL examination and receive a score of at least 550 on the paper based examination, or a minimum of 213 of the computer based examination, or have been enrolled in an accredited U.S. university for at least one year and have performed satisfactorily.

B. Provisional Degree Students

A student who does not meet requirements for admission as regular students may be admitted as provisional students upon recommendation of the [PESC](#). Applicants will be evaluated on the strength of their academic background and experiences. With the concurrence of the chair(s) of [Ph.D. Governance Committee \(PGC\)](#), the PESC may admit provisional students for a probationary period. After completing nine semester hours of courses, the provisional student will be considered for regular admission. If admission is denied at this time, the student will be dismissed from the program.

Recommendation for change from provisional status to regular degree status will be based on grades received in all courses taken during provisional status. Credit earned while in provisional status will count towards the Ph.D. if and when the student moves from provisional to regular status.

Transfer Policy

Nine credit hours of course work may be transferred from other universities. This includes courses taken at UCCS before the student is accepted into the Ph.D. program. Only courses at the graduate level that have not been applied to another degree, that were taken during the previous five years, and in which the student has received a grade of B or above are eligible for transfer. No hours of dissertation credit may be transferred. The chair of the [PESC](#) and the chair(s) of the [PGC](#) must approve all transfers.

Admission Materials

Admission materials are available in the EAS College Office. Generally, applicants should hold a technical degree in STEM or homeland security policy studies. The application materials and supporting documentation (transcripts and letters of recommendation) should be sent directly to [Ph.D. in Engineering with a focus in Security Committee \(PESC\)](#), Department of Computer Science, 1420 Austin Bluffs Parkway, Colorado Springs, CO 80933-7150. They should not be sent to Admissions and Records or to the Graduate School Office.

The [PESC](#) meets periodically for action on completed applications. It is the responsibility of the applicant to ensure that all materials are received in a timely manner. Files are kept in the College of EAS Office and inquiries can be directed to 262-3544. The applicant being considered for admission will be notified in writing of the results of the decision.

Applicants for *regular admission* should have all application materials into the EAS College Office at UCCS by June 15 for Fall Semester and by November 15 for Spring Semester. These deadlines permit time for the Department Graduate Study Committee (DGSC), the College and the Graduate School to process the application. It is the student's responsibility to follow up to make sure all materials are received on time. If these deadlines are not met, an application for regular admission will be considered for the following semester.

International students applying for the program should have all application materials into the EAS College Office at UCCS by March 1 for Fall Semester and by September 1 for Spring Semester. Applications sent later than these dates or incomplete by these dates may be considered for the following semester. It is the student's responsibility to follow up to make sure all materials are received on time.

III. DEGREE REQUIREMENTS

Curriculum Description

The Doctor of Philosophy is a degree that is conferred on a student who has demonstrated proficiency in some broad area of learning, and who has proven that he or she has the capability to evaluate work in the security field critically. In addition, the student must have demonstrated the ability to work independently and make original contributions to the field. No single prescribed set of courses can be established that, when completed, guarantee the student has attained this high level. Rather, the degree is conferred after the student has satisfied both a course work and an independent study requirement under the supervision of a committee.

Minimum course work and independent study requirements and the composition of the advisory committee for the Ph.D. program are described below.

Credit Hours

For candidates entering the program with a bachelor's degree in STEM and/or homeland security, a minimum of 48 credit hours of course work at the 500-level or above, including independent study taken as distance learning, is required. For candidates entering with an M.S. degree in STEM and/or homeland security, a minimum of 24 additional credit hours at the 500-level or above, including independent study taken as distance learning, is required. In all cases, 30 semester hours of dissertation credits are required. Beyond the traditional learning component, the students in the program will be required to have at least three months of operational security experience (as internship, training, etc.), as determined by the [PESC](#). All students in the program will be required to attend security workshops on campus at least once

a year (around qualifying examination times), meeting with the advisor and giving a seminar about the research progress of the past year and the research plan of the next year.

Some prerequisite courses may be required for students who have not taken these courses or their equivalents before. The specific required courses will be determined by the [Ph.D. advisor and the Ph.D. Advisory Committee](#) according to the study area and research topic.

No more than 10 dissertation hours can be taken prior to the semester in which the Comprehensive Examination is passed.

A minimum registration of three hours each semester is required after admission but before becoming a candidate for the Ph.D. degree; at least seven credit hours registration per semester is required after becoming a candidate. A student becomes a candidate after passing the Comprehensive Examination.

Brief descriptions of the courses that may directly support the Ph.D. program are listed in Graduate Courses. There is no foreign language requirement.

Plan of Study

A Ph.D. plan of study is a document that lists the courses that a student will take to fulfill degree requirements. It also lists course deficiencies and transferred courses. A student must develop a plan of study by the end of the first semester after the semester in which the qualifying examination is passed. The plan is developed with the assistance of the student's Advisory Committee, and must be approved and signed by all members of the Committee. Any subsequent changes of the plan must be approved by all members of the Committee.

Two reference plan models are provided in the appendix A.

Advisory Committee

Once the qualifying examination has been successfully completed, the advisory committee will be formed. The advisory committee shall be formed early in the dissertation research so that the committee can guide the research. The student will select a dissertation advisor from the graduate faculty as approved by the EAS College. The dissertation advisor will assume the role of the academic advisor and the advisor for the dissertation research.

The student and dissertation advisor will then form the advisory committee subject to the following requirements:

- A. The advisory committee consists of five members. Three of the members must be from the EAS College with at least one member of the committee being from outside the EAS College.
- B. A maximum of two members from outside the college of EAS may serve on the committee. They must be members of the graduate faculty.
- C. The committee should reflect the focus area of the dissertation work and be able to support and evaluate the student's work.
- D. The student and advisor will propose the committee to the PESC and the PGC for approval.

Advisory Committee Authority: Subject to the requirements for the PGC, the committee is fully responsible for all aspects of the student's academic program.

Examinations

Satisfactory performance of the student is judged not only by course grades and dissertation credit, but also by performance on a series of examinations as described below.

Qualifying Examination (Preliminary Examination)

The qualifying examination is a written examination consisting of three distinct parts, cyber security, physical security, and homeland security. Students admitted with an M.S. degree or equivalent must take this examination within two years of the time of admission to the program; students admitted with a B.S. or equivalent must take this examination within three years of the time of admission.

The examination is formally defined by the syllabus of material it will cover. The syllabuses are in the appendix B. It will be updated each year. Students may take courses to help prepare for the examination, but the syllabus, not the course, defines the expectations for the exam. Students should be aware that the standard will be all self study as if no courses exist in the area.

The examination of the cyber security part covers the material in the following three areas: [Computer Communications](#), [Fundamentals of Computer/Network Security](#), and [Applied Cryptography for Secure Communications](#). Courses including CS 522, CS 591, and CS 592 can help prepare for the areas. The examination is offered once a year during the spring semester.

The examination of the physical security part covers the material in the following four areas: Probability and Statistics, [Critical Infrastructure Protection](#), [Vision/Image/Sensor Processing for Security](#), and [Physical Security Standards](#), all formally defined by a syllabus of 300-500 pages of reading materials. Courses (on-campus or online if available) including Psy 581, CS 505, CS 584, CS 613, INFS 682 may help prepare for the areas, though may not provide complete coverage of the material.

The examination of the homeland security part covers the material in the following two areas: [Introduction to Homeland Security and Defense](#), and [Understanding the Threat](#). Courses including PAD 5950 and PSC 598 may help prepare for the areas.

The combined examination of the physical security part and the homeland security part is offered once a year during the fall semester. Students should take Probability and Statistics and choose any three out of the other five areas for the exam, with at least one from the physical security part and one from the homeland security part.

Students can retake a failed qualifying examination once within one year of the first attempt. The contents of the examinations will come from textbooks and papers.

Comprehensive Examination

The purpose of the comprehensive examination, which must be taken before more than 10 hours of dissertation credit is earned, is to ensure that the student possesses the following:

1. Sufficient grasp of the fundamentals of the chosen dissertation area to begin research, normally achieved through a thorough study of the current literature on the topic
2. Ability to conduct innovative research
3. Ability to exchange ideas and information with members of the Advisory Committee

Comprehension of existing literature and course material pertinent to the dissertation research, as well as the reasonableness of the unknown or undeveloped concepts that the student proposes, will be assessed by the Advisory Committee. The responsibility of the Advisory Committee is to review the research proposal and the qualifications of the student to complete the research successfully. If the research and the approach are found to be significant and appropriate and the student is judged capable of completing the research, the Advisory Committee will approve the research direction. If the Advisory Committee does not find the student ready to begin dissertation research, it must suggest further preparation by the student and plan on a subsequent taking of the comprehensive examination.

A passing grade in the examination is given if at least four of the five members of the public Committee including the student's advisor vote affirmatively.

Final Examination (Dissertation Defense)

The final examination can only be applied after at least three months of operational security experience (as internship, training, etc.), as determined by the [PESC](#).

The dissertation must be based on original investigation. It must demonstrate mature scholarship and critical judgment, as well as a familiarity with the tools and methods of research. It must be written on the subject approved in the comprehensive examination.

Although the publication is not the only criterion, generally, it is expected that a Ph.D. candidate at the dissertation defense stage has at least one significant article published or accepted for publication in peer-reviewed sources, such as journals and recognized international conference proceedings. Other justifiable criteria include well-deployed security software packages and technologies, grants, patents, etc. All those achievements should be largely based on the study and research during the degree work.

After the dissertation has been completed, a final examination on the dissertation and related topics is conducted. This examination, which is conducted by the Advisory Committee, is oral and is open to anyone who wants to observe. More than one negative vote by members of the Advisory Committee disqualifies the candidate in the final exam. In case of failure, the final examination may be retaken after a period of time determined by the Advisory Committee.

IV. TIME LIMIT FOR COMPLETION OF DEGREE

Individuals who are admitted as doctoral students normally are expected to complete all degree requirements within six years from the date of the start of course work in the doctoral program. For students who fail to complete the degree in the six-year period, the PESC must file an annual statement with the Graduate Dean giving the reasons why the Program Director believes that the student is making adequate progress and should be allowed to continue in the program. This request must be signed by three members of the graduate faculty who serve on the student's Advisory Committee. If the Graduate Dean approves this statement, the student may continue his/her studies for one additional year.