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## Earth and Energy Sciences, Ph.D.



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The Ph.D. degree program in Earth and Energy Sciences prepares students to embrace an inter- and multi-disciplinary understanding of issues central to meeting the energy and environmental challenges of today and the future.

### Admission Requirements

In addition to meeting the general application and admission requirements of the Graduate School, applicants to the Ph.D. program in Earth and Energy Sciences must provide: 1) evidence of a B.S. in Chemistry, Environmental Science, Geology, Physics, or a related field of study; 2) a personal statement of interest in the program; and 3) official results of the Graduate Record Examination (GRE). If previous research experience exists, it should be emphasized in the personal statement. Official GRE scores must be sent directly from the test administrator to the Graduate School.

It is expected that admitted students will have completed Calculus I and II as well as a minimum of two courses and one laboratory in the following disciplines: Chemistry, Environmental Science, Geology, and Physics.

### Course Requirements

To earn the Ph.D. degree in Earth and Energy Sciences, students must complete a minimum of 72 graduate credit hours. That includes core courses (12 credit hours), specialized courses (30 credit hours), graduate seminar (6 credit hours), and dissertation research (24 credit hours), as detailed below.

#### Core Courses (12 credit hours)

- EESC 601 – Introduction to Earth Systems **3 Credit(s)**
- EESC 602 – Fundamentals of Environmental Science **3 Credit(s)**
- EESC 603 – Energy Systems **3 Credit(s)**
- EESC 604 – Research Challenges in Earth and Energy Sciences **3 Credit(s)**

#### Specialization Coursework (30 credit hours)

To ensure a strong multi-disciplinary background, in addition to the four core courses, students are required to take 30 credit hours in different disciplines. Of these, at least 18 credit hours must be in EES courses with emphasis in one discipline (EES 61X in Chemistry, EES 62X in Environmental Science, EES 63X in Geology, EES 64X in Physics) or traditional, CHEM, ENVS, GEOL, and PHYS, graduate courses, with a minimum of 3 credit hours in each of the four disciplines. The remaining 12 credit hours of specialization courses may be taken in any of the aforementioned disciplines or, upon approval by the graduate coordinator, in other disciplines such as Biology, Civil Engineering, Engineering Management, Mathematics, or Petroleum Engineering.

#### Graduate Seminar (6 credit hours)

The graduate seminar is to be taken starting in the second year of the program. In EESC 691 (1 credit hour) students attend seminars and in EESC 692 (1 credit hour) students attend seminars and present their research progress. EESC 691 and EESC 692 are both to be taken once a year for a total of three years. Equivalences with seminars in Chemistry, Environmental Science, Geology, and Physics are to be discussed with the graduate coordinator.

## Dissertation (24 credit hours)

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A minimum of 24 credit hours of EESC 699 – Dissertation Research and Dissertation, is required to satisfy the degree requirements. EESC 699 is taken with the research adviser.

## General Comprehensive Examination

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Each student is expected to complete a general comprehensive examination at the end of the third semester of the study. This exam will focus on the student's mastery of course content and the application of this content to structuring research and solving problems. Comprehensive exams are designed, administered, and assessed by a committee of three graduate faculty members in Earth and Energy Sciences who represent at least two of the program's distinct disciplines.

## Degree Progress

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At the start of the program, each student will meet with the Earth and Energy Sciences program graduate coordinator, who chairs the Graduate Advisory Committee for the EES program. An individual development plan (IDP) shall be created based on the student's initial plans and interests. This document will be updated every semester at the time of advising and before the advising hold is lifted. After choosing a research direction, the student will be further advised by the academic graduate coordinator of the discipline closest to their research direction. It is the student's responsibility to inform their current graduate coordinator of any changes in the IDP as their research progresses.

Before the end of the second year in the program and after the comprehensive exam has been successfully completed, each student must elect a field of specialization and a dissertation adviser from the graduate faculty in that field. The student is required to request meetings with faculty members to be able to choose a dissertation adviser and the problem to investigate. In consultation with the dissertation adviser, the student shall create a doctoral committee, which includes the student's dissertation advisor, as its chair, and a minimum of three other graduate-faculty members from the disciplines contributing to the EES program. At least two members must be from a discipline that is not represented by the dissertation adviser. Outside committee members (from other departments or institutions) are allowed and recommended. Upon creation, the dissertation committee will assume responsibility for monitoring the student's IDP and progress until graduation.

No later than the end of the third year of study, the student must convene the committee for a dissertation proposal defense. At the defense, the student presents and oral exposure of the problem to be investigated, motivation, preliminary results, and a detailed plan of action, in order to receive feedback from the committee. The student is expected to demonstrate an understanding of the relationships between fundamental research and applied research in relation to their chosen research topic. The doctoral committee can also suggest specific courses to be added to the student's IDP that are relevant to the research topic. Acceptance of the proposal by the research adviser and a majority vote of the dissertation committee is required for a satisfactory proposal dissertation defense. A second defense is allowed if the first attempt is unsuccessful. If the second defense is also unsuccessful, the student shall become ineligible to continue in the program and will be evaluated by the Earth and Energy Science Graduate Advisory Committee for M.S. degree program options in Chemistry, Environmental Science, Geology, or Physics.

## Final Examination

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The oral defense of the dissertation constitutes the final examination for the degree. A rigorous examination of the dissertation as well as discussions covering topics in related areas are to take place during the dissertation defense. The written dissertation must be reviewed by the doctoral committee prior to the defense. The dissertation is expected to represent original work by the student and to be of a quality acceptable for publication in peer-reviewed journals in the specific field of study. If the oral dissertation defense is unsatisfactory to fifty percent or more of the committee, a second defense shall be allowed within a year from the first attempt. If the second oral defense is unsatisfactory to fifty percent or more of the committee, the student shall become ineligible to continue in the program and will be evaluated by the Earth and Energy Science Graduate Advisory Committee for M.S. degree program options in Chemistry, Environmental Science, Geology, or Physics.

After completing all required revisions of the doctoral committee members, the candidate must prepare the final version of the dissertation in accordance with the requirements of the Graduate School.

## Notes

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Students should consult the Doctor of Philosophy Degree Checklist compiled by the Graduate School

Students should consult the Doctor of Philosophy Degree Checklist compiled by the Graduate School and included in the University Catalog.

With approval of the graduate coordinator, students with a M.S. degree may transfer up to 18 graduate credit hours to use toward the required 30 credit hours of specialization coursework.

The proposal and dissertation defense events are open to the public.

Submission of at least one manuscript to a peer-reviewed journal is a requirement for graduation.

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