ARCHITECTURAL ENGINEERING - DOCTOR OF PHILOSOPHY (PHD)

Graduate studies in architectural engineering are offered through the Department of Civil, Environmental and Architectural Engineering. The department offers a PhD degree with study emphases in several major areas:

- building systems engineering
- construction engineering and management
- engineering for developing communities

For more information, visit the department’s Graduate Studies webpage.

Requirements
Course Requirements
For a Doctor of Philosophy degree (PhD) in architectural engineering, students need at least 30 hours of graduate-level coursework plus a dissertation.

Courses offered in the architectural engineering graduate program may be separated into four tracks, one specific to the Construction Engineering & Management discipline and three related to the Building Systems Engineering discipline. Students may decide to concentrate in one of these track areas, or they may wish to take a broad selection from the courses; there is no requirement for picking any specific track under the general track option.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>AREN 5001</td>
<td>Building Energy Systems: Thermal, Electrical &amp; Lighting Sys</td>
<td>3</td>
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<td>Applied Math course</td>
<td>3</td>
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<td>Electives</td>
<td>9</td>
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Building Energy Engineering Focus Area
Select 15 credits from the following:

- AREN 5010 Energy System Modeling and Control
- AREN 5020 Building Energy Audits
- AREN 5060 Distributed Electricity Generation
- AREN 5080 Computer Simulation of Building Energy Systems
- AREN 5110 HVAC System Design
- AREN 5570 Building Electrical Systems Design 1
- AREN 5830 Architectural Engineering Special Topic (Grid Connected Systems)
- AREN 5830 Architectural Engineering Special Topic (Modeling and Simulation of Community Energy Systems)
- AREN 5890 Sustainable Building Design
- AREN 5990 Compu Fluid Dynamics (CFD) Analysis for Built/Natural Environments

Illumination Engineering Focus Area
Select 15 credits from the following:

- AREN 5130 Optical Design for Illumination and Solid State Lighting
- AREN 5580 Daylighting
- AREN 5620 Adaptive Lighting Systems
- AREN 5830 Architectural Engineering Special Topic (Illumination 2)
- AREN 5830 Architectural Engineering Special Topic (Luminous Radiative Transfer)

Materials and Resources Focus Area
Select 15 credits from the following:

- AREN 5560 Forensic Engineering
- AREN 5660 Embodied Carbon in Buildings
- CVEN 5565 Life-Cycle Engineering of Civil Infrastructure Systems
- CVEN 5831 Special Topics (Construction Materials)
- CVEN 5835 Special Topics for Seniors/Grads (Design of Wood Structures)
- CVEN 5835 Special Topics for Seniors/Grads (Masonry Design)

Construction Engineering & Management Focus Area
Select 15 credits from the following:

- CVEN 5226 Construction Safety
- CVEN 5246 Legal Aspects of Construction
- CVEN 5276 Engineering Risk and Decision Analysis
- CVEN 5286 Design Construction Operations
- CVEN 5346 Managing Construction and Engineering Projects and Organizations
- CVEN 5836 Special Topics for Seniors/Grads (Infrastructure Asset Management)
- CVEN 5836 Special Topics for Seniors/Grads (Construction Engineering and Management Fundamentals)

Residency Requirements
For an entrant from another university, up to 21 hours of acceptable graduate courses may be transferred, leaving at least 9 hours of coursework to be completed at the University of Colorado upon the approval of their advisors. The transfer credits are transferable at the discretion of the research advisor, and students may be asked to take additional courses toward the completion of their degree. Work already applied toward a graduate degree received from the University of Colorado or another institution cannot be accepted for transfer toward another graduate degree of the same level at the University of Colorado. All courses accepted for transfer must be graduate-level courses. A course in which a grade of B- or lower was received will not be accepted for transfer.

For students already in the MS program in the CEAE department, 30 hours of graduate coursework performed at CU is applicable towards the PhD degree upon the approval of their advisors. The PhD also requires that 30 hours of dissertation credit be taken, with a minimum residency of 2 years. After passing the comprehensive exam, PhD candidates are
required to maintain continuous registration. Candidates must register for at least 5 hours of dissertation credits each semester.

**Preliminary Examination**
Each doctoral student shall take a preliminary examination as determined by the faculty of the specialty area in which the student is enrolled, normally not later than 12 months from the time the student is first enrolled in the doctoral program. Each CEAE group has a designated time for PhD students to take the exam. Students should discuss the schedule, date and format of the exam with their academic adviser.

**Comprehensive Examination**
Before admission to candidacy for the doctoral degree, students must pass a comprehensive examination, which shall consist of a written and an oral examination in the field of concentration and related fields. At the comprehensive examination, the student shall present a plan for the dissertation research to the Advisory Committee for approval.

**PhD Dissertation**
Students must write a dissertation based on original research conducted under the supervision of a graduate faculty member. The dissertation must fulfill all Graduate School requirements. After the dissertation is completed, an oral final examination on the dissertation and related topics is conducted by the student's doctoral committee.

**Time Limit**
All degree requirements must be completed within six years of the date of commencing coursework.

**Graduate Certificate in Global Engineering**
Students admitted to the Graduate Certificate in Global Engineering (https://catalog.colorado.edu/graduate/colleges-schools/engineering-applied-science/programs-study/civil-engineering/engineering-developing-communities-graduate-certificate/) program must fulfill the coursework and practicum requirements of that program. For AREN students, up to 6 credits of the required certificate coursework can count as coursework needed for the PhD degree.