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 Energy Engineering
- Illumination Engineering
- Materials and Carbon
- Construction Engineering and Management

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

Requirements

Course Requirements

A total of 30 credit hours of graduate-level coursework plus 30 dissertation credit hours are required for the program.

Focus areas include:

- Building Energy Engineering
- Illumination Engineering
- Materials & Carbon
- Construction Engineering & Management

There is no requirement for picking a specific focus area and students can select from courses under any of the four focus areas. Students must complete a minimum of 9 credit hours from the list of courses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREN 5001</td>
<td>Building Science and Engineering I</td>
<td>3</td>
</tr>
<tr>
<td>AREN 5002</td>
<td>Building Science and Engineering II</td>
<td>3</td>
</tr>
<tr>
<td>AREN 5890</td>
<td>Sustainable Building Design</td>
<td></td>
</tr>
<tr>
<td>AREN 5900</td>
<td>Compu Fluid Dynamics (CFD) Analysis for Built/Natural Environments</td>
<td></td>
</tr>
<tr>
<td>AREN 5830</td>
<td>Architectural Engineering Special Topic (Building Systems Modeling and Simulation)</td>
<td></td>
</tr>
<tr>
<td>AREN 5030</td>
<td>Data Science for Energy and Buildings</td>
<td></td>
</tr>
<tr>
<td>CVEN 5836</td>
<td>Special Topics for Seniors/Grads (Construction Engineering Fundamentals)</td>
<td></td>
</tr>
</tbody>
</table>

Focus Area: Building Energy Engineering

- 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 5090 Optimizing Grid Connected Systems
- AREN 5110 HVAC System Design
- AREN 5570 Building Electrical Systems Design 1
- AREN 5830 Architectural Engineering Special Topic (Modeling and Simulation of Community Energy Systems)
- ECEN 5007 Special Topics (Data Analytics and Decision-making for Power Systems)
- ECEN 5007 Special Topics (Renewable Energy Future of Power Grid)
- ECEN 5007 Special Topics (Power Systems Planning and Optimizations)

Focus Area: Illumination Engineering

- AREN 5830 Architectural Engineering Special Topic (Illumination 2)
- AREN 5130 Optical Design for Illumination and Solid State Lighting
- AREN 5560 Luminous Radiative Transfer
- AREN 5580 Daylighting
- AREN 5620 Adaptive Lighting Systems
- AREN 5830 Architectural Engineering Special Topic (Advanced Lighting Design)

Focus Area: Materials and Carbon

- AREN 5650 Forensic Engineering
- CVEN 5835 Special Topics for Seniors/Grads (Design of Wood Structure)
- AREN 4315 Design of Masonry Structures (must enroll in CVEN 5849, independent study, to receive graduate credit)
- AREN 5660 Embodied Carbon in Buildings
- CVEN 5831 Special Topics (Construction Materials)

Focus Area: Construction Engineering & Management

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

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 two 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 24 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.