Underground Construction and Tunnel Engineering

2016-2017

Degrees Offered

- Master of Science (Underground Construction and Tunnel Engineering), Thesis
- Master of Science (Underground Construction and Tunnel Engineering), Non-Thesis
- Doctor of Philosophy (Underground Construction and Tunnel Engineering)

Program Description

Underground Construction and Tunnel Engineering (UCTE) is an interdisciplinary field primarily involving civil engineering, geological engineering and mining engineering, and secondarily involving mechanical engineering, electrical engineering, geophysics, geology and others. UCTE deals with the design, construction, rehabilitation and management of underground space including caverns, shafts and tunnels for commercial, transportation, water and wastewater use. UCTE is a challenging field involving complex soil and rock behavior, groundwater conditions, excavation methods, construction materials, structural design flow, heterogeneity, and very low tolerance for deformation due to existing infrastructure in urban environments. Students pursuing a graduate degree in UCTE will gain a strong and interdisciplinary foundation in these topics.

The graduate degree program in UCTE is offered jointly by the Departments of Civil & Environmental Engineering (CEE), Geology & Geological Engineering (GEGN), and Mining Engineering (MN). UCTE faculty from each department are collectively responsible for the operations of the program. Participating students reside in one of these departments, typically the home department of their advisor.

Program coursework is selected from multiple departments at CSM (primarily CEE, GEGN, MN) and is approved for each student by the student’s advisor and graduate committee. To achieve the M.S. degree, students may elect the non-thesis option based upon coursework and an independent study report tied to a required internship. Students may alternatively select the thesis option comprised of coursework and a research project performed under the guidance of a UCTE faculty advisor and presented in a written thesis approved by the student’s thesis committee.

Ph.D. students are expected to complete a combination of coursework and novel, original research under the guidance of a UCTE faculty advisor and doctoral committee, which culminates in a significant scholarly contribution to a specialized field in UCTE. Full-time enrollment is encouraged and leads to the greatest success, although part-time enrollment is permissible for working professionals. All graduate students must complete the full-time, on-campus residency requirements described in the general section of the Graduate Bulletin.

Program Requirements

M.S. Non-Thesis Option:

| Coursework | 27.0 credit hours |
| Independent Study* | 3.0 credit hours |
| UCTE Seminar | 0.0 credit hours |
| Total Hours | 30.0 |

*M.S. non-thesis students are expected to complete an internship of approximately 3 months in duration (with a design firm, contractor, owner, equipment manufacturer, etc., and preferably on a UCTE job site). During the internship, each student completes a project-focused independent study related to an aspect of the internship. This is determined in consultation with the faculty advisor and internship sponsor. The independent study culminates with a project report and presentation. If an internship is not available or if the student has sufficient industry experience (determined by advisor and committee), the student may complete an industry-focused research project with a UCTE faculty member and industry partner. The research project culminates with a written report and final presentation.

M.S. Thesis Option:

| Coursework | 24.0 credit hours |
| Research (minimum) | 6.0 credit hours |
| UCTE Seminar | 0.0 credit hours |
| Total Hours | 30.0 |

M.S. Thesis students must write and successfully defend a thesis report of their research. Ideally, M.S. thesis research should be industry focused and should provide value to industry UCTE practice.

Ph.D. Option

| Coursework (beyond B.S. degree) | 42.0 credit hours |
| Independent Study* | 3.0 credit hours |
| Research (minimum) | 24.0 credit hours |
| UCTE Seminar | 0.0 credit hours |
| Total Hours | 72.0 |

Students must also successfully complete qualifying examinations, write and defend a dissertation proposal, and write and defend a doctoral dissertation. Ph.D. research is aimed at fundamentally advancing the state of the art in UCTE. Ph.D. students are expected to submit the dissertation work for publication in scholarly journals and disseminate findings throughout industry periodicals.

*Ph.D. students are expected to complete an internship of approximately 3 months in duration (with a design firm, contractor, owner, equipment manufacturer, etc., and preferably on a UCTE job site). If an internship is not available or if the student has sufficient industry experience (determined by advisor and committee), the student may complete an industry-focused research project via independent study with a UCTE faculty member and industry partner culminating with a written report and presentation.

Required Coursework

The following 19 credit hours are required for the M.S. (thesis and non-thesis) and Ph.D. degrees.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEGN468</td>
<td>ENGINEERING GEOLOGY AND GEOFICENIEHS</td>
<td>4.0</td>
</tr>
<tr>
<td>GEGN561</td>
<td>UNDERGROUND CONSTRUCTION</td>
<td>0.5</td>
</tr>
<tr>
<td>GEGN562</td>
<td>ENGINEERING LABORATORY 1</td>
<td>0.5</td>
</tr>
<tr>
<td>GEGN562</td>
<td>ENGINEERING LABORATORY 2</td>
<td>0.5</td>
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</tbody>
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All M.S. and Ph.D. students are required to attend the UCTE seminar series (0 h); no registration is required.

M.S. non-thesis and Ph.D. students must complete an internship-related project, registering as an independent study in the home department of the faculty advisor (CEEN599, GEGN599, or MNGN599). This requirement may be waived for students with sufficient UC&T industry experience.

**Elective Coursework**

The following courses may be taken as electives to complete the M.S. and Ph.D. course requirements. Students may petition for other courses not listed below to count towards the elective requirement. In addition, M.S. or Ph.D. students may petition one of the following courses to substitute for a required course if one of the required courses is not offered during the student’s course of study or if a student has sufficient background in one of the required course topics. All petitions must be made to the student’s advisor and thesis committee.

**Thesis Committee Requirements**

Students must meet the general committee requirements listed in the graduate bulletin. In addition, the student’s advisor or co-advisor must be a UCTE faculty member. For Ph.D. students, at least two committee members must be members of the UCTE faculty.

**Prerequisites**

Students will enter the UCTE programs with a variety of backgrounds. Because the UCTE degrees are engineering degrees, the required prerequisite courses for the UCTE programs include basic engineering coursework, and specifically: (1) Strength of Materials or Mechanics of Materials, and (2) Fluid Mechanics. These prerequisite courses may be completed during the first semester of the graduate program if approved by the UCTE program faculty. The required coursework includes graduate level soil and rock mechanics as well as aspects of structural analysis and groundwater engineering. It is permissible for students to take these courses without having completed undergraduate courses in soil mechanics, rock mechanics, structural analysis and groundwater engineering. However, students may choose to complete undergraduate courses in these topics prior to or concurrently during enrollment in the required graduate program courses. The prerequisite courses do not count towards the requirements of the M.S. or Ph.D. degrees. Students should consult with UCTE faculty for guidance in this matter.

**Director**

Michael Mooney, Grewcock Distinguished Chair & Professor

**Department of Civil & Environmental Engineering**

Marte Gutierrez, J.R. Paden Distinguished Chair & Professor
Reza Hedayat, Assistant Professor
Panos Kiousis, Associate Professor
Michael Mooney, Grewcock Distinguished Chair & Professor
Shiling Pei, Assistant Professor

**Department of Geology & Geological Engineering**

Jerry Higgins, Associate Professor
Paul Santi, Dept Head & Professor
Gabriel Walton, Assistant Professor
Wendy Zhou, Associate Professor

**Department of Mining Engineering**

Ray Henn, Adjunct Professor
Rennie Kaunda, Assistant Professor
Eunhye Kim, Assistant Professor
Hugh Miller, Associate Professor
Priscilla Nelson, Department Head & Professor
Ugur Ozbay, Professor