

Welcome to the UCA

and UC&T

Fall Kick-Off and Info

Session!

WEDNESDAY, August 24th

UC&T = Caverns + Shafts + Adits + Excavations + Tunnels



Manhattan Caverns New York City (10 blocks long; under Grand Central Terminal)

Olympic Cavern Hall (Gjøvik, Norway)



UC&T = Caverns + Shafts + Adits + Excavations + Tunnels



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Tunnels: Water Conveyance



Niagara Falls Hydroelectric Tunnel

Tunnels: Wastewater



Tunnels: Transportation

Road



Transit



Tunnels: Multiple Use



SMART Tunnel – Stormwater Management & Road Tunnel (Kuala Lumpur, Malaysia)



Tunnels: Mining





What is Underground Construction and Tunneling and what is UCA?

https://www.youtube.com/watch?v=KBgvBEtzQq4

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Center for Underground Construction & Tunneling



Center for Underground Construction & Tunneling (UC&T)

Developing Leaders. Advancing Knowledge.



A Little Bit about Us...

We are a collaborative, interdisciplinary group of faculty and students from:

- Civil and Environmental Engineering
- Geology and Geological Engineering
- Mining Engineering

Additional involvement from: Geophysics, Mechanical Engineering, Electrical Engineering, Computer Science, Economics and Business



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UC&T Core Faculty Fall 2016



Mike Mooney Grewcock Chair & Center Director, Professor of Civil Engineering and UC&T



Gabriel Walton Assistant Professor of Geological Engineering and UC&T



Reza Hedayat Assistant Professor of Civil Engineering and UC&T



Rennie Kaunda Assistant Professor of Mining Engineering



Eunhye Kim Assistant Professor of Mining Engineering and UC&T



Wendy Zhou Associate Professor of Geological Engineering



Priscilla Nelson Department Head and Professor of Mining Engineering



Marte Gutierrez Paden Distinguished Chair, Professor of Civil Engineering



Jamal Rostami Alacer Gold Chair, Associate Professor of Mining Engineering

UC&T Center Staff



Begoña Ruiz Center Administrator



Jacob Grasmick PhD Student and



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Rick Bearce Post Doc

Research Associate



Mike Mooney

Grewcock Chair & Professor, UC&T Center Director Teaching: Tunnel Design & Construction; Earth Retaining Structures Research:



TBM Vibration



Soil Conditioning



Learning from Data



Jet Grout Monitoring



Reza Hedayat

Teaching Interests:

- Mechanics of Materials
- Civil Engineering Materials
- Earth Retaining Structures
- Tunnels in Hard Rocks

Research Interests:

- Geomechanics
- Rock Mechanics
- Fracture Mechanics
- Ground-Support
 Interaction
- Geophysics
- Flow in Porous Media

Priscilla P. Nelson

Teaching: CSM Courses:

- Tunneling
- Underground Engineering and Construction
- Earth Materials and Resources

Education Innovation at CSM:

- Development of a Tunnel "Geo-Wikipedia"
- Development of graduate field course in geological engineering
- CELERY a web site for kids to write their own books about engineering (mycelery.org)
- Develop new short courses for the construction and mining industries
- STEM+C: Pathways to the Future for K-12 Education

Research:

- Sustainability of Urban
 Infrastructure
- Surface and Underground Excavation
 - Geologic Uncertainty and Risk
- Subsurface Research in Geothermal Energy
- Microwave damage of rock
- History of underground infrastructure development and the growth of the United States

Rennie Kaunda

Teaching:

- Rock Slope Engineering
- Computational Neural Networks in Mining
- Mine Water & Environment
- Mining Equipment Maintenance and Automation

Research:

- Mining Geotechnics and Rock Mechanics
- Artificial Neural Networks
- Slope Stability and Internal Erosion
- Rock Fragmentation
 Optimization
- Mechanical Excavation
 and Tunneling
- Environmental aspects in Mining

Eunhye Kim

Academic Activities:

- MNGN 408 "Underground Design and Construction"
- MNGN 404 "Tunneling"
- MNGN 504 "(Advanced) Tunneling"
- MNGN 559 Underground Construction Engineering in Hard Rock
- MNGN X99 Independent Study

Research Activities:

- Mechanical and hydraulic properties of geomaterials
- Mechanical interactions between cutting tools and geomaterials (cutting tool design)
- Stability of geo-structures

Also, interested in helping students who pursue independent study (rock mechanics/UCTE topics). Please ask me (BB 214 or ekim1@mines.edu).

Marte Gutierrez

J.R. Paden Distinguished Professor, Civil and Environmental Engineering

Teaching:

- Soil Mechanics
- Foundation Engineering
- Soil Behavior

Research Interests:

- Geomechanics
- Environmental and Energy Sustainability

Current Research:

- Enhanced Geothermal Systems (EGS)
- CO2 Geological Sequestration
- Tunneling in Rocks
- Low Impact Hydro



Geological field work, Arctic Circle



Rifle training as self defense for Polar Bears



True-triaxial apparatus



Geological field work, Major rock slide, The Philippines



High-pressure and high temperature triaxial apparatus

Gabriel Walton

Teaching:

Geological Data Management Engineering Geology Applied Numerical Modelling



Research:

Post-yield behaviour of hard rock Lab-field relationships Rockmass characterization





Earth Mechanics Institute Mining Engineering Department - Brian Asbury

Mechanical Excavation Tunneling, Mining, Drilling, etc. Rock Mechanics Testing Laboratory Full-Scale Testing Machine Performance Modeling



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Novel Excavation Methods (water jet, thermal/chemical/laser

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How Can You Get Involved in UC&T??

- Courses and Degrees
- Research Projects and Positions
- Field Trips
- Scholarships: Information and Deadlines at uct.mines.edu
- Internships: Career Center and Diggernet



Education

- 20+ UC&T Courses
- Undergraduate Minor
- M.S. (Thesis and Non-Thesis)
- Ph.D.

(Only UC&T advanced degrees offered in North America!)

 See CSM Bulletin (link on uct.mines.edu)



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Area of Special Interest - ASI

The Underground Construction & Tunneling ASI consists of a minimum of 12 credit hours

Required Courses

CEEN312	SOIL MECHANICS
MNGN321	INTRODUCTION TO ROCK MECHANICS
MNGN404	TUNNELING

Electives Offered This Semester

CEEN314	STRUCTURAL THEORY
CEEN415	FOUNDATIONS
GEOL309	STRUCTURAL GEOLOGY AND TECTONICS
MNGN408	UNDERGROUND DESIGN AND CONSTRUCTION

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- 2.0 *Offered This Semester



Undergraduate Minor

The Underground Construction & Tunneling minor consists of a minimum of 18 credit hours

Required Courses

CEEN312	SOIL MECHANICS
MNGN321	INTRODUCTION TO ROCK MECHANICS
MNGN404	TUNNELING
GEGN466	GROUNDWATER ENGINEERING
or GEGN467	GROUNDWATER ENGINEERING
GEGN468	ENGINEERING GEOLOGY AND GEOTECHNICS

Electives Offered This Semester

CEEN314	STRUCTURAL THEORY
CEEN415	FOUNDATIONS
GEOL309	STRUCTURAL GEOLOGY AND TECTONICS
MNGN408	UNDERGROUND DESIGN AND CONSTRUCTION

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- 3.0 *Offered This Semester
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- 3.0 *Offered This Semester
- ^{3.0} *Offered This Semester
- 3.0 *Offered This Semester
- 2.0 *Offered This Semester

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Required Minor Courses this Fall



- Soil Mechanics (CEEN 312) Alexandra Wayllace
 - MWF 9-9:50 + Lab
 - Prerequisites: Mechanics of Materials



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- Intro to Rock Mechanics (MNGN 321) Ugur Ozbay
 - MW 9-9:50 + T 1-3:50
 - Prerequisites: Statics or Dynamics for Mining Engineers



- Groundwater Engineering (GEGN466) Kamini Singha
 - TR 2-3:15

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• Prerequisites: Calculus, Differential Equations, Structural Geology, Sedimentology & Stratigraphy, Geologic Fluid Mechanics or Fluid Mechanics

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- Engineering Geology and Geotechnics (GEGN468) Jerry Higgins
 - MWF 10-10:50 + R 11-1:50
 - Prerequisites: Intro to Rock Mechanics and Soil Mechanics

MS and/or PhD in UC&T

Required Courses for M.S. Thesis, M.S Non-Thesis and Ph.D. Degrees

The following 21 credit hours are required. Students are required to attend the UC&T seminar series and 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 (CEEN 599, GEGN 599, or MNGN 599)

GEGN 468	Engineeing Geology
GEGN 561	UCE Lab I
GEGN 562	UCE Lab II
CEEN 513	Adv. Geomaterial Mechanics
CEEN 523	Underground Construction Engineering in Soft Ground
MNGN 504	Underground Construction Engineering in Hard Rock
MNGN 509	Construction Engineering and Management

- *Offered This Semester *Offered This Semester
- 0.5
- *Spring 2017 0.5
- *Offered This Semester 4.0
- *Spring 2017 4.0
- *Spring 2017 3.0
- 3.0 *Spring 2017



MS and/or PhD in UC&T

Example Elective Courses

CEEN510	ADVANCED SOIL MECHANICS	3.0	*Offered This Semester
CEEN541	DESIGN OF REINFORCED CONCRETE STRUCTURES	3.0	*Offered This Semester
GEGN466	GROUNDWATER ENGINEERING	3.0	*Offered This Semester
GEGN563	APPLIED NUMERICAL MODELING FOR GEOMECHANICS	3.0	
GEGN573	GEOLOGICAL ENGINEERING SITE INVESTIGATION	3.0	*Offered This Semester
GEGN673	ADVANCED GEOLOGICAL ENGINEERING DESIGN	3.0	
MNGN424	ADVANCED MINE VENTILATION	3.0	*Offered This Semester
MNGN506	DESIGN AND SUPPORT OF UNDERGROUND EXCAVATIONS	3.0	
MNGN507	ADVANCED DRILLING AND BLASTING	3.0	
MNGN598C	GROUTING IN UNDERGROUND CONSTRUCTION	3.0	*Offered This Semester

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Example Elective UC&T Grad Degree Courses this Fall







- Applied Numerical Modelling for Geomechanics Gabe Walton
 - F 1-3:50
 - Prerequisites: Engineering Geology, Soil Mechanics, or Rock Mechanics
- Groundwater Engineering (GEGN466) Kamini Singha
 - TR 2-3:15
 - Prerequisites: Calculus, Differential Equations, Structural Geology, Sedimentology & Stratigraphy, Geologic Fluid Mechanics or Fluid Mechanics
- Grouting in Underground Construction (MNGN598C) Ray Henn
 - F 5-7:50
 - Prerequisites: none
- Advanced Mine Ventilation (MNGN524) Juergen Brune
 - M 5-7:50
 - Prerequisites: Mine Ventilation



Research Projects – UC&T Undergraduates Fall 2016

- LiDAR-based Underground Deformation Measurements
- Finite-Element Modeling of Liner Deformation
- Geological Controls on Rock Strength
- Decorative Stone Mining Database
- Rock Joint Roughness Quantification
- Geophysical Imaging of Rock Joints
- Development of an Apparatus for Soil Testing
- TBM/EPBM Performance in Weak/Sensitive Rock
- Fracture Mechanics
- Cutting Tool Wear
- Rock Mechanics Database
- Computer Numerical Simulation



Research Projects – UC&T Undergraduates Fall 2016

Undergraduates in Civil, Geological, Mining, Mechanical, Electrical, Geophysics, Computer Science, etc. - join us and participate in applied research such as site investigation and characterization, ground imaging, numerical modeling, tunnel boring machine performance prediction and more!

5-15 hours per week; \$11-\$14/hr; flexible schedule; possible site visits

See flyer for full information, sign up for email notification or email uct@mines.edu

Applications due September 2, 2016









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Previous Undergraduate Researchers - Examples



Christopher Britschge Major: Mechanical Engineering Project: TBM performance in weak/sensitive rock



Joseph Gibson Major: Applied Physics Project: Development of a geophysical measurement system



Grayson Sander-Olhoeft Major: Geophysics Project: Jet grout monitoring



Morgan Sander-Olhoeft Major: Geophysics Project: Slurry Infiltration



Sean Cowie Major: Geological Engineering Project: Geological controls on rock strength



Tasha Markley Major: Geophysical Engineering Project: Impact of Artificial Fractures on Rock Strength and Deformation

Scholarships – UC&T Students

Scholarships related to the field of UC&T will be listed on the website at **uct.mines.edu**. Examples:

UCA of SME Scholarship - Application Deadline ~ December-January

Established to encourage undergraduate and graduate academic pursuits and careers in the field of tunneling and underground construction and associated disciplines involved in the development, planning, design, and construction of underground infrastructure.

RETC Attendance Award

The RETC Attendance Award provides selected students with an opportunity to attend the RETC Conference. Applicants must be full-time sophomore, junior, senior, or graduate students with a designated major in an applicable field of engineering (civil, mechanical, mining, electrical, geological) or construction management. Applicants must have a demonstrated interest in the underground construction or tunneling industry.



Internships

Many companies support UC&T student internships:

- Kiewit
- J.F. Shea Construction
- Jay Dee
- Traylor Bros.
- Arup
- Golder Associates
- Atkinson Construction
- Moretrench
- USGS
- CTL Thompson











Example Internships - 2015



Next Seminar: Monday 8/29 @ Noon

Günther Meschke

Recent Advances in Computational Simulation in Mechanized Tunneling - From material flow in the pressure chamber to real time TBM steering support





What is the UCA?

- UCA is the Underground Construction Association
- Subsection of the Society for Mining, Metallurgy and Exploration (SME)
- CSM has the only student chapter in the nation
- Through the UCA student chapter you can:
 - Learn about projects and technologies in the tunneling industry

Center for Underground Construction & Tunneling

- Network with industry professionals
- Learn about tunneling research at CSM



New UCA officers for the 2016-2017

school year:

- President: Shrey Arora
- Vice President & Outreach: Ali Nazem

Center for Underground Construction & Tunneling

- Secretary: Lucila Dunnington
- Treasurer: Bradley Meyer



Plans for the 2016-2017 school year:

- Celebration of Mines
- Field trips to underground construction and tunneling projects
- 2 Community service events
- Tunneling short courses
- Networking events
- Biweekly seminars



