

Graduate Programs in GEOTECHNICAL ENGINEERING

www.ou.edu/coe/cees/grad_programs/geotech/grad_program

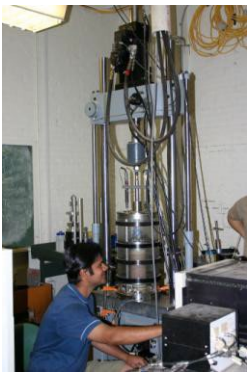
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PROGRAM FOCUS

The geotechnical engineering program in the School of Civil Engineering and Environmental Science (CEES) at the University of Oklahoma has two primary missions: provide quality education at both the undergraduate and graduate levels and develop and maintain strong research programs of regional and national significance in the areas of geotechnical engineering and geomechanics.

These programs are designed to provide students with fundamental understanding of the behavior of geologic media, of structures constructed on or using these geologic media and of the contributions of geologic media to environmental problems and solutions. The topics studied relate to static and dynamic behavior of soils; soil-structure interaction; constitutive modeling; unsaturated soil mechanics; large- and small-scale laboratory evaluations of soil properties; foundation engineering; the influence of physicochemical properties on mechanical behavior of soils and in situ testing and centrifuge modeling of static and dynamic behavior of soils, including pollutant transport processes. The program strongly encourages interaction between the various disciplines of soil mechanics, geomechanics and environmental engineering. The program emphasizes both analytical/numerical and experimental methods that aid in the advancement of modeling, analysis, and design.

RESEARCH FACILITIES



CEES maintains a **geotechnical engineering** laboratory and an **unsaturated soil mechanics** laboratory in the Carson Engineering Center as well as the **Ray Broce Materials Laboratory** in the Engineering Lab building. These laboratories are equipped with standard soil and pavement testing equipment as well as Triaxial Compression, Direct Residual Shear and six rear-loading oedometer testing stations. All laboratory equipment is connected to fully automated data acquisition systems. The unsaturated soil mechanics laboratory also houses a GDS Instruments Ltd. custom made automated triaxial testing system and a GCTS servo-controlled dynamic Hollow Cylinder Apparatus for testing saturated and unsaturated soils. An Asphalt Pavement Analyzer, an



Environmental Chamber for freeze-thaw testing and a 22-kip MTS load frame to conduct fully automated resilient modulus tests on soils and aggregates are housed in the Ray Broce Materials Laboratory. The geotechnical engineering laboratory also is fully equipped for clay mineralogy index testing and houses a Monosorb BET surface area analyzer and a Chittick Apparatus for determining carbonate content. X-Ray Diffraction, Scanning Electron Microscopy and Electron Microprobe testing are available for use through the geology and chemical engineering departments. CEES faculty also have access to various centrifuge testing facilities in the United States.



CEES also maintains the **Donald G. Fears Structural Engineering Laboratory** for large-scale structural/geotechnical testing purposes. The laboratory is equipped with such static and dynamic loading systems as a 200,000-pound universal testing machine, two 55,000-pound capacity closed-loop hydraulic testing systems, a 22,000-pound capacity actuator, an 11,000-pound capacity actuator and a 110,000-pound capacity load frame. The lab also contains a 4 – by – 6-foot shake table, a 12 – by – 12-foot environmental chamber and a sand pit used for shallow foundation tests. The lab contains several PC-based data acquisition systems and associated load, displacement, and strain transducers.

The **Poromechanics Institute** in the Sarkeys Energy Center houses a 55-kip tension-torsion and a 600-kip tension-compression material testing system with provisions to conduct tests at ambient and elevated temperatures and to measure pore pressure. Other rock testing facilities including equipment for acoustic tomography of rock samples are housed in this lab.



The **environmental laboratories** are well equipped with state-of-the-art analytical instruments, including chromatographs (GC's, HPLCs and ion) and atomic adsorption units.



CEES has facilities dedicated for studying advanced processes of aquifer restoration and soil remediation, subsurface transport, and fate processes, in situ waste treatment technologies and innovative pump and treat remediation processes. The Environmental Modeling and GIS Laboratory contains specialized computer facilities to support research in Geographic Information Systems, environmental process modeling and visualization.

Several computer systems within CEES and OU support numerical and analytical research and teaching. Computing hardware ranges from Intel- based PCs to supercomputers available through OU supercomputing Center for Education and Research. OU is part of the Internet 2 consortium and high-speed access to Internet is ubiquitously available on and off campus. Currently, OSCER maintains three high performance computing platforms, which together have a total peak performance of nearly 1.5 trillion calculations per second. These platforms include a Linux cluster consisting of 270 2.0 GHz Pentium4 Xeon processors. OU also supports a wireless network in many buildings and classrooms, allowing for interactive laptop applications in teaching.



Extensive library facilities exist on campus to provide reference materials for coursework and to keep the student abreast of current developments in his or her field of interest. OU libraries utilize state-of-the-art technology and offers a variety of services.

<https://libraries.ou.edu/services>. The Bizzell Memorial Library houses approximately 2.2 million volumes as well as an extensive collection of journals, periodicals, and government documents. A separate engineering library is in the engineering complex on the Norman campus.



DEGREE PROGRAMS

The geotechnical engineering program is individually tailored to meet the needs and interests of each student. Two advanced degrees are offered: Master of Science and Doctor of Philosophy.

Master of Science Degree (MS)

MSCE programs are open to students with undergraduate degrees in civil engineering or related engineering or science disciplines who have completed certain minimum undergraduate coursework. Both thesis and coursework only options are available for obtaining the master's degree. The coursework only option requires completion of 32 semester credit hours, of which 9 hours are geotechnical core courses and are listed on page 8 of this document. The thesis option requires completion of 30 semester credit hours, with the same core course options, five hours devoted to thesis research, and one hour to a course on technical communications. The thesis option also requires a final defense.

Doctor of Philosophy Degree (PhD)

A master's degree in a related discipline is typically required for admission to all CEES PhD degree programs, although students who have outstanding academic credentials and a documented record of research experience at the undergraduate level may occasionally be admitted to the doctoral program without a master's degree.

The doctoral program requires completion of research that expands their professional knowledge in the fundamental concepts of geotechnical engineering. The student is expected to produce a research dissertation of professional significance that could be the basis of two or more papers published in refereed journals. The doctoral degree requires a minimum of 48 hours of post-bachelor's coursework, a minimum of 4 and a maximum of 41 hours of dissertation research, and one hour of technical communications, all totaling at least 90 post bachelor's hours. Twenty-four hours of CEES courses or equivalent and at least 6 hours of courses outside CEES are required. The coursework required for the doctoral program is determined by each student with the approval of their advisor and a faculty committee and is based on the student's educational background and chosen research program.



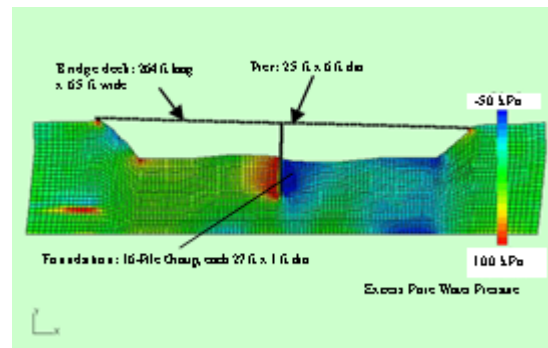
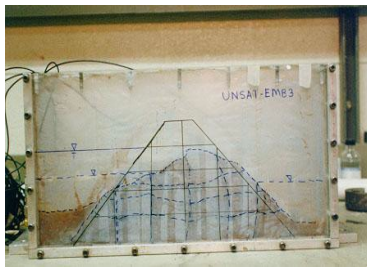
RESEARCH AREAS

Faculty research interests cover a broad spectrum of geotechnical engineering. Current research areas include constitutive modeling; soil- structure interaction; behavior of shallow and deep foundations; laboratory and in situ testing of soils; bridge approach settlement; resilient modulus; soil stabilization; pavement materials (asphalt and aggregates); dispersive and swelling clays; pore collapse in unconsolidated and poorly consolidated reservoir rocks; ground-surface subsidence and mine collapse; pavement dynamics including vehicle-guideway interaction and non-destructive testing, slope stability; soil liquefaction; application of numerical methods to complex geotechnical engineering problems; rock mechanics and mining problems; static and seismic design of landfills; physico-chemical behavior of soils; pollutant transport processes through soils and centrifuge modeling and soil behavior including saturated and unsaturated soils.



Current and recent research projects involving members of the geotechnical faculty include:

- causes and remedies of bridge approach settlement
- characterization of ground subsidence and mine collapse
- prediction of strength properties of unsaturated soils using cone penetration test data
- use of in situ tests for foundation design
- laboratory testing and constitutive modeling of cohesionless soil with emphasis on modeling of dilatant behavior
- resilient modulus of base and subgrade materials
- soil liquefaction, including soil-structure interaction effects
 - pore collapse in unconsolidated and poorly consolidated reservoir rocks
 - use of fly ash in soil stabilization
 - soil stabilization with cement kiln dust
 - centrifuge and finite element modeling of dynamic behavior of rock dike retaining structures
 - centrifuge modeling of pollution transport processes through soils
 - centrifuge modeling of unsaturated soil embankments
- constitutive and numerical modeling of unsaturated soils under static and dynamic loading
- railroad subgrade soil behavior under repeated load applications
- electrical properties of soil in the radio frequency domain
- behavior of piles in over consolidated and unsaturated clay
- use of helical anchors for anchoring small wind turbines in high- plasticity clay subject to a fluctuating water table
- use of raw chat (a lead mining waste product) in Hot Mix Asphalt for pavement applications
- airport pavement management
- surface area and fine-grained soil behavior
- carbonate content of fine-grained soils
- characterization and mitigation of landslides
- geosynthetic applications for static and dynamic problems
- coupled flow and deformation in fractured rock formations



ADMISSION REQUIREMENTS

Enrollment as a graduate student in CEES requires:

- an undergraduate degree in civil engineering **or** an undergraduate degree in an associated area, plus approved additional coursework
- a 3.0 GPA or above from an accredited university or college
- completed Statement of Goals or Purpose (500 words or less)
- two letters of reference (master's degree) or three letters of reference (doctoral degree) that address applicant's knowledge of engineering and scientific principles, analytical abilities, experimental abilities, initiative and communication skills, plus additional comments that would be beneficial in evaluating applicant's skills
- official Graduate Record Examinations scores (not older than five years)
- admission to the University of Oklahoma Graduate College
- TOEFL (iBT) score of at least 79 for students whose native language is not English

In addition, for admission to the doctoral program, applicants are encouraged to submit a sample of written research work, such as a refereed publication or abstract of a master's thesis.

TRANSFER CREDITS

No more than 8 hours of eligible graduate coursework may be transferred from another institution for the master's degree. No more than 30 hours of eligible graduate coursework, including a maximum of 5 hours of master's thesis research, may be transferred from another institution for the doctoral degree.

FINANCIAL ASSISTANCE

The University of Oklahoma provides research and teaching assistantships to qualified graduate students. These assistantships include a stipend, tuition waiver, and health benefits. Students with assistantships can enroll for a maximum of 9 credit hours per semester and are not subjected to tuition fees. OU fellowships may be available for highly qualified students pursuing the doctoral degree. CEES also has fellowships funded by the Grand River Dam Authority for students working on projects within the Grand Lake Watershed.

All applicants are considered for funding during admission review, and you may hear back from a faculty member once they begin to review applications. You may also contact a faculty member in your area of interest to see if financial assistance is available.

Research assistants typically write their thesis or dissertation on the subject for which financial support is received. Teaching assistants typically supervise laboratory sections, hold office hours, and grade assignments. Instructor positions are occasionally available for doctoral students, particularly those interested in an academic career. Graduate students whose native language is not English must first pass an English proficiency exam before being appointed as a teaching assistant or instructor with student contact.



Master's students receiving financial assistance are almost always those who pursue the thesis option. Because students with assistantships typically spend 10-20 hours per week on their teaching or research responsibilities, such students may take up to an additional year to complete their master's degree.

THE UNIVERSITY OF OKLAHOMA

Created by the Oklahoma Territorial Legislature in 1890, the University of Oklahoma is a doctoral degree-granting research university serving the educational, cultural, economic, and healthcare needs of the state, region, and nation. The Norman campus serves as home to all the university's academic programs except health-related fields. The OU Health Sciences Center, which is in Oklahoma City, is one of only four comprehensive academic health centers in the nation with seven professional colleges. Both the Norman and Health Sciences Center colleges offer programs at the Schusterman Center, the site of OU-Tulsa. OU enrolls approximately 30,000 students, has nearly 3,000 faculty members and has 20 colleges offering 152 majors at the baccalaureate level, 160 majors at the master's level, 75 majors at the doctoral level, and 20 majors at the professional level. The university's annual operating budget is approximately \$2.4 billion and is an equal opportunity institution.



THE COMMUNITY

Norman, Oklahoma is a community of about 124,000 located 18 miles south of Oklahoma City and 190 miles north of Dallas. A variety of recreational, cultural, and social activities are available in Norman and surrounding areas. Lake Thunderbird, 10 miles east of Norman, provides an excellent setting for numerous water activities. Norman was recognized as one of the most progressive cities in the state and the Norman Public School system has been acknowledged as one of the top school systems in Oklahoma.

Oklahoma City, with a metropolitan population of approximately 1.4 million, is the state's capital and largest city, and boasts a minor league ballpark and a canal that flows beside choice restaurants, shops, and quaint cafes in the historic Bricktown entertainment district. In the downtown Oklahoma City area, you'll find the Myriad Botanical Gardens, the Oklahoma City National Memorial, and the Oklahoma City Museum of Art. There's never a shortage of fun in the metro. With more than 50 attractions, you can catch a movie in the OmniDome large-format theater at the Science Museum Oklahoma (formerly called the Omniplex) or tour one of the nation's top zoos right next door. Don't miss a stroll through the National Cowboy and Western Heritage Museum, where galleries are full of priceless Western art and treasures.



APPLICATIONS

To apply, visit our application website at <https://www.ou.edu/coe/cees/apply> and then the university's Graduate College application website at <https://gograd.ou.edu/apply/>.

The University of Oklahoma in compliance with all applicable federal and state laws and regulations does not discriminate on the basis of race, color, national origin, sexual orientation, genetic information, sex, age, religion, disability, political beliefs, or status as a veteran in any of its policies, practices or procedures. This includes but is not limited to admissions, employment, financial aid, and educational services. For questions regarding discrimination, sexual assault, sexual misconduct, or sexual harassment, please contact the Office(s) of Institutional Equity as may be applicable – Norman campus at (405) 325-3546/3549, the Health Sciences Center at (405) 271-2110 or the OU-Tulsa Title IX Office at (918) 660-3107. Please see www.ou.edu/eoo.

Accommodations are available by contacting (405) 325-2344 or ceesgradstudies@ou.edu.

CEES FACULTY

Websites of individual faculty members can be accessed through www.ou.edu/coe/cees/people.

COURSE OFFERINGS

In addition to the required geotechnical curriculum (core courses), students are encouraged to take courses in such areas as structural engineering, mathematics, geology, and geophysics to strengthen and broaden their backgrounds.

LIST OF COURSES

¹ core courses for geotechnical engineering program

Course No. Title

CEES 4333G	Foundation Engineering ¹
CEES 5020	Constitutive Modeling of GeoMaterials
CEES 5020	Geotechnical Forensic Investigations
CEES 5303	Asphalt Pavement and Mix Design
CEES 5313	Engineering Geology
CEES 5323	Geosynthetics
CEES 5343	Advanced Soil Mechanics ¹
CEES 5353	Introduction to Soil Dynamics
CEES 5383	Earthquake Engineering
CEES 5404	Soil Stabilization
CEES 5413	Soil Structure Interaction
CEES 5423	Environmental Geotechnology
CEES 5433	In Situ Soil Testing ¹
CEES 5443	Unsaturated Soil Mechanics
CEES 5693	Structural Design of Pavement
CEES 6663	Advanced Finite Element Methods

Suggested Courses in Mathematics

MATH 3123	Engineering Mathematics
MATH 3693	Tensor and Vector Analysis
MATH 4073	Numerical Analysis I
MATH 4083	Numerical Analysis II
MATH 4163	Intermediate Partial Differential Equations
MATH 4753	Applied Statistical Methods
MATH 4773	Applied Regression Analysis
MATH 5403	Calculus of Variations