Graduate Programs in
GEOTECHNICAL ENGINEERING
www.geotech.ou.edu

PROGRAM FOCUS

The Geotechnical Engineering program in the School of Civil Engineering and Environmental Science 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 geotechnical engineering and unsaturated soil mechanics laboratories in the Carson Engineering Center and 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 offer such services as Online Catalog and Library Online Resource Access. The Bizzell Memorial Library houses approximately 2.2 million volumes as well as an extensive collection of microfilms, periodicals and government documents. A separate engineering library is located in the engineering complex on the Norman campus.

DEGREE PROGRAMS

Master of Science Degree

Both thesis and non-thesis options are available for obtaining the master’s degree. The non-thesis option requires 32 semester credit hours, of which two hours must be devoted to the completion of a special topics study and one hour to a course on technical communications. The thesis option requires completion of 30 semester credit hours, with five or six hours devoted to thesis research and one hour to a course on technical communications. Both options include a final examination or defense and have a minimum residency requirement of one academic year.

Doctor of Philosophy Degree

The doctoral program is tailored to the specific interests of the student and focuses on expanding 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 one or more papers published in refereed journals. The doctoral degree requires a minimum of 48 hours of graduate (post-Bachelor of Science) coursework and a maximum of 41 hours of dissertation research. One hour must be devoted to a course on technical communications. Thirty hours of CEES courses and at least 12 hours outside CEES are required.
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 overconsolidated 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 Departmental Supplemental Application for Graduate Student and Financial Support Forms
- 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 for students whose native language is not English

Applicants to the doctoral program are encouraged to submit a sample of such written research work as a refereed publication or abstract of a master’s thesis.
FINANCIAL ASSISTANCE

The University of Oklahoma provides competitive research and teaching assistantships to qualified graduate students. These assistantships include a stipend, tuition waiver and health benefits. Applications for financial assistance should be directed to the School of Civil Engineering and Environmental Science. Research assistants typically write their thesis or dissertation in the subject in which financial support is received. Teaching assistants often teach laboratory sections and grade papers. Students with assistantships can enroll for a maximum of 12 credit hours per semester and are not subjected to nonresident tuition fees.

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 health care needs of the state, region and nation. The Norman campus serves as home to all of the university’s academic programs except health-related fields. Both the Norman and Health Sciences Center colleges offer programs at the Schusterman Center, the site of OU-Tulsa. The OU Health Sciences Center, which is located in Oklahoma City, is one of only four comprehensive academic health centers in the nation with seven professional colleges. OU enrolls more than 30,000 students, has more than 2,000 full-time faculty members, and has 19 colleges offering 150 majors at the baccalaureate level, 142 majors at the master’s level, 76 majors at the doctoral level, 30 majors at the first professional level and five graduate certificates. The university’s annual operating budget is more than $1 billion. The University of Oklahoma is an equal opportunity institution.

THE COMMUNITY

Norman, Okla., is a community of about 105,000 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. Oklahoma City, with a metropolitan population of approximately 1 million, is the state’s capital and largest city and boasts a new 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 also find the Myriad Botanical Gardens, the Oklahoma City National Memorial and the new Oklahoma City Museum of Art. There’s never a shortage of fun in Oklahoma City. With more than 50 attractions, you can catch a movie in the brand-new IWERKS large-format theater at the Omniplex or tour one of the nation’s top 10 zoos right next
door. And don't miss a stroll through the National Cowboy and Western Heritage Museum, where galleries are full of priceless Western art and treasures.

APPLICATIONS

For additional information and application materials, visit our Web site at www.kees.ou.edu.

Return all completed applications to:
Ms. Susan Williams, Graduate Programs Assistant
School of Civil Engineering and Environmental Science
University of Oklahoma
202 West Boyd St., Room 318
Norman, OK 73019-1024

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 on the basis of disability are available by contacting Susan Williams at (405) 325-2344 or FAX (405) 325-4217.

GEOTECHNICAL ENGINEERING FACULTY

Web sites of individual faculty members can be accessed through http://www.ou.edu/coe/cees.html.
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;

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<thead>
<tr>
<th>Course No.</th>
<th>Title</th>
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<tbody>
<tr>
<td>CEES 4333G</td>
<td>Foundation Engineering¹</td>
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<tr>
<td>CEES 5020</td>
<td>Constitutive Modeling of GeoMaterials</td>
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<tr>
<td>CEES 5020</td>
<td>Geotechnical Forensic Investigations</td>
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<tr>
<td>CEES 5303</td>
<td>Asphalt Pavement and Mix Design</td>
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<tr>
<td>CEES 5313</td>
<td>Engineering Geology</td>
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<tr>
<td>CEES 5323</td>
<td>Geosynthetics</td>
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<tr>
<td>CEES 5343</td>
<td>Advanced Soil Mechanics¹</td>
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<td>CEES 5353</td>
<td>Introduction to Soil Dynamics</td>
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<td>CEES 5383</td>
<td>Earthquake Engineering</td>
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<td>CEES 5404</td>
<td>Soil Stabilization</td>
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<tr>
<td>CEES 5413</td>
<td>Soil Structure Interaction</td>
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<td>CEES 5423</td>
<td>Environmental Geotechnology</td>
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<td>CEES 5433</td>
<td>In Situ Soil Testing</td>
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<td>CEES 5443</td>
<td>Unsaturated Soil Mechanics</td>
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<td>CEES 5693</td>
<td>Structural Design of Pavement</td>
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<td>CEES 6663</td>
<td>Advanced Finite Element Methods</td>
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Suggested Courses in Mathematics

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<tr>
<th>Course No.</th>
<th>Title</th>
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<tbody>
<tr>
<td>MATH 3123</td>
<td>Engineering Mathematics</td>
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<tr>
<td>MATH 3693</td>
<td>Tensor and Vector Analysis</td>
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<tr>
<td>MATH 4073</td>
<td>Numerical Analysis I</td>
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<tr>
<td>MATH 4083</td>
<td>Numerical Analysis II</td>
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<tr>
<td>MATH 4163</td>
<td>Intermediate Partial Differential Equations</td>
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<td>MATH 4753</td>
<td>Applied Statistical Methods</td>
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<tr>
<td>MATH 4773</td>
<td>Applied Regression Analysis</td>
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<tr>
<td>MATH 5403</td>
<td>Calculus of Variations</td>
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¹core courses for geotechnical engineering program;