The program incorporates components aimed at training students for research-oriented professions in both industry and academia, encompassing traditional Civil Engineering pathways, including Geotechnical-geosystem Engineering. By fostering a symbiotic relationship between academia and industry, it will establish a model of a technology-enhanced Civil Engineering program.

Application Requirements

The items listed below are required for admission consideration for applicable semesters of entry during the current academic year. Submission instructions, additional details, and changes to admission requirements for semesters other than the current academic year can be found on The Graduate College's website (http://www.gradcollege.txstate.edu). International students should review the International Admission Documents page (http://mycatalog.txstate.edu/graduate/admission-documents/international/) for additional requirements.

- completed online application
- $55 non-refundable application fee

  or

- $90 non-refundable application fee for applicants with international credentials
- exceptional applicants with a bachelor's degree in Civil Engineering or a closely related discipline, from a regionally accredited university, will be considered for admission but will be required to complete an additional 24 semester credit hours of master's level courses when admitted
- official transcripts from **each institution** where course credit was granted
- competitive GPA
- official GRE (general test) with a preferred score of 146 or higher for verbal and 160 or higher for quantitative.
- resume/CV outlining education, work experience, scholarships/grants, publications/presentations, other accomplishments
- statement of purpose outlining the applicant's personal history and goals that are relevant to obtaining this doctoral degree, explaining why the applicant wants to purse this degree at TXST
- three letters of recommendation evaluating applicant's skill and potential in this degree program, preferably from academic sources
- interview for top ranked applicants who meet the minimum preferred credentials; interviewed by the Ph.D. program director and other committee members via online tools such as Zoom or MS Teams

TOEFL, PTE, or IELTS Scores

Non-native English speakers who do not qualify for an English proficiency waiver:

- official TOEFL iBT scores required with a 78 overall
- official PTE scores required with a 52 overall
- official IELTS (academic) scores required with a 6.5 overall and minimum individual module scores of 6.0
- official Duolingo Scores required with a 110 overall
- official TOEFL Essentials scores required with an 8.5 overall

Additional Information:

The program will admit full-time and part-time Ph.D. students twice a year.

Degree Requirements

The Doctor of Philosophy (Ph.D.) degree with a major in Civil Engineering concentration Geotechnical-Geosystem Engineering requires 78 semester credit hours.

Course Requirements

Code	Title	Hours
Required Courses		
CE 7393	Artificial Intelligence Applications in Civil Engineering	3
MSEC 7301	Practical Skills in Commercialization and Entrepreneurship	3
Bachelor's Entry		
Choose 24 hours from the following:		24
CE 5320	Water Quality Management	
CE 5331	Computational Methods in Geosystems	
CE 5340	Advanced Infrastructure Materials	
CE 5360	Pavement Design	
CE 5370	Urban Stormwater Management	
CE 5390	Infrastructure Systems Analysis	
CE 5391	Advanced Mechanics of Materials	
ISAN 5357	Computing for Data Analytics	
ISAN 5367	Machine Learning	
CS 5316	Data Mining	
CS 5346	Advanced Artificial Intelligence	
CSM 5366	Soils in Construction	
CSM 5368	Sustainable Construction	
EE 5323	Digital Image Processing	
EE 5331	Machine Learning for Engineering Applications	
ENGR 5310	Probability, Random Variables, & Stochastic Processes for Engineers	
ENGR 5321	Environmental Chemistry	
ENGR 5322	Low Impact Development and Green Infrastructure	
ENGR 5323	Soil and Groundwater Remediation	
ENGR 5330	Advanced Soil Mechanics	
ENGR 5332	Earth retaining structures and slopes	
ENGR 5333	Fluid Flow in Porous Media	
ENGR 5334	Advanced Foundation Engineering	
ENGR 5341	Advanced Bituminous Materials	
ENGR 5351	Advanced Reinforced Concrete Members	
ENGR 5352	Advanced Prestressed Concrete	
ENGR 5361	Pavement Asset Management	
ENGR 5362	Advanced Traffic Engineering	
ENGR 5363	Road Infrastructure Safety	
ENGR 5384	Problems in Engineering	
GEO 5309	Geographical Analysis	
GEO 5336	Transportation Systems	
GEO 5352	Air Quality Management	
GEO 5367	Exploring Spatial Databases	
GEO 5393K	Advanced Web Cartography and Data Visualization	

GEO 5418	Geographic Information Systems I	
IE 5310	Advanced Statistical Design of Experiments for Engineers	
IE 5330	Advanced Quality Control and Reliability Engineering	
MATH 5315	Mathematical Statistics	
MATH 5345	Regression Analysis	
MATH 5376A	Design and Analysis of Experiments	
Concentration		
CE 7330	Advanced Soil Mechanics	3
CE 7395	Finite Element Modeling in Civil Engineering	3
Choose 3 hours from the following:		3
CE 7322	Low Impact Development and Green Infrastructure	
CE 7340	Advanced Infrastructure Materials	
CE 7351	Advanced Reinforced Concrete Members	
CE 7361	Pavement Asset Management	
CE 7363	Road Infrastructure Safety	
CE 7394	Climate Change Impact and Adaptation in Civil Engineering	
Presribed Electives		
Choose 15 hours from the following:		15
MSEC 7302	Leadership Skills in Commercialization and Entrepreneurship	
MSEC 7395H	Environmental Chemistry	
CE 7320	Water Quality Management	
CE 7323	Soil and Groundwater Remediation	
CE 7332	Earth Retaining Structures and Slopes	
CE 7333	Fluid Flow in Porous Media	
CE 7334	Advanced Foundation Engineering	
CE 7336	Discrete Element Methods for Granular Materials	
CE 7340	Advanced Infrastructure Materials	
CE 7341	Advanced Bituminous Materials	
CE 7350	Highway Bridge Design	
CE 7351	Advanced Reinforced Concrete Members	
CE 7352	Advanced Prestressed Concrete	
CE 7353	Earthquake Engineering	
CE 7360	Pavement Design	
CE 7361	Pavement Asset Management	
CE 7362	Advanced Traffic Engineering	
CE 7363	Road Infrastructure Safety	
CE 7364	Non Destructive Testing and Forensic Studies	
CE 7366	Advanced Statistical and Econometric Modeling	
CE 7370	Urban Stormwater Management	
CE 7371	Remote Sensing in Hydrology	
CE 7372	Water, Climate, and Disasters	
CE 7390	Infrastructure Systems Analysis	
CE 7391	Advanced Mechanics of Materials	
CE 7394	Climate Change Impact and Adaptation in Civil Engineering	
CE 7396	Life Cycle Assessment of Infrastructure	
CS 7312	Advanced Data Mining	
CS 7313	Advanced Machine Learning and Pattern Recognition	
CS 7323	Image Processing and Computer Vision	
GEO 7316	Remote Sensing and the Environment	
GEO 7368	Lidar and SfM Data Processing and Analysis	
MATH 7335	Statistics II: Linear Modeling	
MATH 7375C	Time Series Analysis	
MATH 7375D	Advanced linear Modeling	
Dissertation		
Choose a minimum of 24 hours from the following:		24
CE 7199	Dissertation	
CE 7299	Dissertation	
CE 7399	Dissertation	
CE 7599	Dissertation	
CE 7699	Dissertation	
CE 7999	Dissertation	
Total Hours		**78**

Qualifying Exam

The Qualifying (preliminary) Exam is required for doctoral students entering with a bachelor's degree. It usually consists of a written and/or oral exam in a given area of Civil Engineering and related field, administered by a committee consisting of at least three members, with at least two members from Civil Engineering. It will typically be taken after completion of 24 semester credit hours. The students will take the exam through the individual concentration of study. The qualifying exam is a 3-hour written exam that is offered at the end of each academic year or scheduled based on needs. A list of the general topics to be covered, along with a corresponding reading list, will be available to the students. This exam has any of three possible outcomes: 1-Pass, 2-Pass with recommendations regarding the student's program of work, 3-No Pass but one re-examination permitted.

Candidacy Criteria

Students will advance to candidacy after they have completed all required and elective course work (except for dissertation credit hours), passed their qualifying exam (entering with a bachelor's degree), passed the comprehensive exam, and successfully defended their dissertation proposal. It is expected that the students will enter their candidacy three years after they are enrolled into the program.

When all requirements for admission to candidacy have been met, the doctoral program director forwards the Application for Advancement to Candidacy to the Dean of The Graduate College for review and approval. This application form is available on The Graduate College's website.

A minimum GPA of 3.0 on all coursework undertaken in the doctoral program is required for admission to candidacy. Grades below a B on any graduate coursework cannot be applied toward the doctoral degree. Incomplete grades must have been cleared before approval for advancement to candidacy can be granted. No more than 6 semester credit hours of dissertation research can be taken before advancing to candidacy. No credit will be applied toward a student's doctoral degree for coursework completed more than five years before the date on which the student is admitted to candidacy. This time limit applies to course credit earned at TXST as well as course credit transferred to TXST from other institutions.

All doctoral students must complete a dissertation that consists of original research and demonstrates mature scholarship and critical judgment in addition to familiarity with tools and methods in the chosen

area. The dissertation project must adhere to the dissertation proposal and cover the topic approved by the student's dissertation committee.

After being admitted to candidacy, students must be continuously enrolled for dissertation hours each fall and spring semester until the defense of their dissertation. At least 18 semester credit hours of dissertation research must be taken after having advanced to candidacy. If a student is receiving supervision on a dissertation during the summer or if the student is graduating in the summer, the student must be enrolled in dissertation hours for the summer. All candidates for graduation must be enrolled in dissertation hours during the semester in which the degree is to be conferred, even if they have already satisfied the minimum dissertation hours.

Comprehensive Exam

Each doctoral student must pass a comprehensive examination consisting of a written and an oral component. This should be done by the time the student has completed 36 semester credit hours of 7000-series courses if admitted with a master's degree, (or 60 if admitted with the bachelor's degree), identified the dissertation committee, passed the qualifying exam (entering with a bachelor's degree), and fulfilled the programming requirement. Any student who does not pass the comprehensive exam by the time 45 semester credit hours for students entering with a master's degree (or 69 for students entering with a bachelor's degree) have been accrued will be dismissed from the program. If the comprehensive exam is not passed, the student will have the option of taking a second and final comprehensive exam in the following long semester. Students will be dismissed from the program if they do not pass the comprehensive exam the second time.

The comprehensive examination consists of a written and an oral component. The oral component is administered by the dissertation committee, typically right after the dissertation proposal (see below). The exam consists of questions covering Civil Engineering knowledge from all the Civil Engineering courses in the student's concentration. To pass the oral exam, the student's dissertation advisor and a majority of the remaining members on the dissertation committee must agree that the student has passed. The student's dissertation committee members must indicate the result on the Doctoral Comprehensive Form, which is to be submitted to The Graduate College. This form is available on The Graduate College's website.

Dissertation Proposal and Proposal Defense

Each Ph.D. student must prepare a written dissertation proposal and defend it orally. This should be done by the time the student has completed 36 semester credit hours and after identifying the dissertation committee, passing the comprehensive exam, and completing all required courses and Boot Camp. Any student who does not defend his/her dissertation proposal by the time 45 semester credit hours have been accrued will be dismissed from the program. If the proposal defense is not passed, the student will have the option of taking a second and final defense in the following long semester. Students will be dismissed from the program if they do not pass the proposal defense the second time.

The proposal must outline the substance and scope of the planned dissertation research and explain its merits. It must include at least a short introduction to the topic, an overview of the methodology to be used, a preliminary survey of the relevant literature, and preliminary results that demonstrate the feasibility of the project to be undertaken. The goal of the proposal is to establish that the student has a sufficient grasp of the fundamentals of the chosen dissertation topic to execute the research.

The proposal defense entails a public presentation of the student's dissertation proposal followed immediately by a closed defense of the proposal attended only by the student and his/her dissertation committee. The dissertation proposal must be approved by the student's dissertation advisor and a majority of the remaining members on the dissertation committee. The student's dissertation committee members must indicate their approvals on the doctoral Dissertation Proposal Form as well as on the Defense of Dissertation Proposal Form. These forms are available on The Graduate College's website.

A final copy of the dissertation proposal, accompanied by the signed approval forms, must be turned in to the doctoral program director, who will forward them to the dean of The Graduate College for review and final approval.

Dissertation Research and Writing

All doctoral students must complete a dissertation that must represent an original contribution to scholarship based on independent investigation. The style, organization, and mechanics of the dissertation should follow the *Graduate College Guide to Preparing and Submitting a Thesis or Dissertation*. Referencing guidelines should either follow the American Anthropological Association or the guidelines from an appropriate professional journal, as deemed acceptable by the dissertation committee.

Dissertation Committee

The initial dissertation committee chair assignment, and its continuation, is subject to the approval of both parties. A dissertation committee chair can be changed with the approval of a student's assigned dissertation committee chair, a student's new dissertation committee chair, and the doctoral program director. If a dissertation committee chair withdraws mentorship, the student must secure a new dissertation committee chair within one long semester to stay on track in the program. Failure to do so will result in dismissal from the program.

The Dissertation Committee will be responsible for administering the Comprehensive Exam and the Dissertation Proposal Defense and will oversee the research and writing of the student's dissertation. The committee will consist of 4 members, including the student's dissertation committee chair who must be a regular graduate faculty member in the program, two other graduate faculty members from the School of Engineering, and one doctoral graduate faculty from another department at TXST or from outside TXST. All members must have a Ph.D. degree. The student's dissertation committee chair will chair the committee. The student, the dissertation committee chair, and the Dean of The Graduate College will approve the composition of the dissertation committee.

As per Graduate College policy, the Dissertation Committee Chair Assignment form and the Dissertation Committee Request form must be completed and approved by the Dean of The Graduate College to form the dissertation committee. Any changes to the dissertation committee must be submitted using the Dissertation Committee Chair/Committee Member Change Request form for approval of the dissertation committee chair, the doctoral program director, and the Dean of The Graduate College. Committee changes must be submitted no later than 60 days before the dissertation defense.

Dissertation Committee Chair

The Ph.D. program director serves as initial advisor of each student accepted into the program. The director then works with the student and the faculty to identify possible dissertation advisors. By the time 18 semester credit hours have been accrued, each doctoral student is

expected to have secured a qualified dissertation advisor who agrees to advise and mentor the student. The mentoring by the dissertation advisor should include providing regular feedback to students and supervising them throughout the Ph.D. program – specifically in the execution of the dissertation research – and helping them identify short- and long-term career goals. The Ph.D. Dissertation Committee Chair Form must be completed by the student and the dissertation committee chair and approved by Doctoral Program Director and Department Chair or School Director, and the Dean of The Graduate College. This form may be downloaded from The Graduate College's website. If a student has not identified a willing and qualified dissertation committee chair by the time he/she has accrued 27 semester credit hours, the student will be dismissed from the program.

Committee Changes

Any change to the dissertation committee must be submitted using the Dissertation Advisor/Committee Member Change Request Form for approval by the dean of The Graduate College. Committee changes must be submitted no later than 60 days before the dissertation defense. The "Dissertation Advisor/Committee Member Change Request form" may be downloaded from The Graduate College's website. The initial dissertation committee chair assignment, and its continuation, is subject to the approval of both parties. A dissertation committee chair can be changed with the approval of a student's assigned dissertation committee chair, a student's new dissertation committee chair, and the Ph.D. program director. If a dissertation committee chair withdraws mentorship, the student must secure a new dissertation committee chair within one long semester to stay on track in the program. Failure to do so will result in dismissal from the program.

Dissertation Defense

Once the dissertation has been completed, a final exam (referred to as the dissertation defense) on the dissertation must be conducted. The dissertation defense cannot be scheduled until all other academic and program requirements have been fulfilled. A complete draft of the dissertation must be given to the members of the dissertation committee at least one month before the defense. However, students are highly encouraged to provide drafts earlier so that the committee members can provide feedback, which the student, in consultation with the dissertation advisor, will address in later drafts to ensure that the dissertation is defendable, and each committee member is satisfied before the dissertation defense takes place.

The dissertation defense consists of two parts. The first part is a public presentation of their dissertation research. The second part of the defense immediately follows the public presentation. It is restricted to participation of the student's dissertation committee and entails an oral examination of the dissertation research. Approval of the dissertation requires positive votes from the student's dissertation advisor and from the majority of the remaining members of the dissertation committee. Notice of the defense presentation will be publicly posted at least two weeks in advance.

If the dissertation defense is not approved, the student will have the option of taking a second and final dissertation defense in the following long semester. Students who do not pass the dissertation defense the second time will be dismissed from the program.

The results of the dissertation defense must be recorded in the Dissertation Defense Report Form and submitted to The Graduate College before the Dean of The Graduate College can give final approval of the dissertation. This form can be downloaded from The Graduate College's website. The student must submit his/her dissertation to The Graduate College for final approval. The guidelines for submission and approval of the dissertation can be obtained from The Graduate College.

Students must pass the dissertation defense by the time 90 semester credit hours have been accrued. The doctoral program will review each student annually to ascertain his/her progress towards the degree and will consult the student's dissertation advisor and dissertation committee on this matter as needed. Any student who does not pass the dissertation defense by the time 90 semester credit hours have been accrued will be dismissed from the program.

Approval and Submission of the Dissertation

Following approval and signing of the Thesis/Dissertation Committee Approval form by the members of the dissertation committee, the student must submit one copy of the dissertation to the office of The Graduate College for final approval. Specific guidelines for approval and submission of the dissertation can be obtained from the office of The Graduate College. Dissertations must be submitted in electronic format.

Doctoral level courses in Civil Engineering: CE (p. 4)

Courses Offered

Civil Engineering (CE)

CE 7199. Dissertation.
This course includes original research and writing in civil engineering, to be accomplished under direct supervision of the PhD research advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CE 7299. Dissertation.
This course includes original research and writing in civil engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CE 7320. Water Quality Management.
This course is an advanced study of the processes used to monitor, measure, and manage water quality for municipal, commercial, or industrial use. The use of technology to enhance water quality management processes is also investigated.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7322. Low Impact Development and Green Infrastructure.
This course covers the principles and practices of Low Impact Development and Green Infrastructure (LID/GI) for sustainable development including water sustainability through rain harvesting, small systems, resource recovery, and technology-enhanced innovation.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7323. Soil and Groundwater Remediation.
This course covers various remediation technologies to clean up contaminated soil and groundwater. Topics include, but are not limited to, subsurface hydrology, contaminant fate and transport, physicochemical and biological remediation, monitoring, and brownfield redevelopment. The significance of subsurface contamination and importance of environmental health will also be addressed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7330. Advanced Soil Mechanics.
This course is a fundamental graduate-level geotechnical engineering course, covering the physical, mechanical, hydraulic, and electrical properties of soil. The mandatory laboratory component will provide hands-on experience with characterizing soils for engineering purposes (stress-deformation and strength characteristics) and help to familiarize students with ASTM geotechnical laboratory testing procedures and standards.
3 Credit Hours. 2 Lecture Contact Hours. 1 Lab Contact Hour.
Grade Mode: Standard Letter

CE 7332. Earth Retaining Structures and Slopes.
The course will cover the design and analysis of various earth retaining structures as well as slope stability analysis. Fundamental lateral earth pressure theories will be taught, followed by application through design for gravity walls, cantilever walls, mechanically stabilized earth walls, soil nails, and tiebacks. Slope stability analysis will include infinite methods, methods of slices, chart methods, and finite element methods with commercial software. Additional topics include slope remediation techniques and geosynthetics for slope stabilization.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7333. Fluid Flow in Porous Media.
In this course, the fundamental theory of transport and fluid flow in heterogeneous porous media will be presented. First, the equations that govern transport and fluid flow processes will be derived. Both analytical and numerical methods will be used to solve these equations in order to characterize and predict flow fields in porous media. These skills will then be applied to practical problems that involve porous media such as soils, rocks, biological tissues, concrete, etc. The knowledge gained from studies of fluid flow in natural porous materials will be employed to design/optimize systems with engineered porous media.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7334. Advanced Foundation Engineering.
This course examines advanced topics in foundations design including design, analysis and construction of shallow and deep foundations. Deep foundations include driven piles, drilled shafts, micropiles, and auger cast in place piles. The course will cover bearing/axial capacity, settlement, pile group effects, and lateral capacity of the various foundation types. Additional topics include subsurface exploration and analysis of pile behavior using wave equation analysis.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7336. Discrete Element Methods for Granular Materials.
This course is an introduction to discrete element methods (DEM) as applicable to a range of problems in physics and engineering that deal with granular materials. It brings together various methods and skills for particle-scale or discrete-element numerical simulation of granular media. It covers a broad range of topics from basic concepts and methods towards more advanced aspects and technical details applicable to the current research on granular materials. This course particularly focuses on the transient motion of hard and soft particles encountered in geotechnical, geomechanical, geomaterial, and hydrological engineering.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7340. Advanced Infrastructure Materials.
This course provides a comprehensive presentation of advanced infrastructure materials including cement concrete, asphalt concrete, wood, steel, and others. Emphasis is placed on a fundamental understanding of the raw ingredients of cement concrete and how these ingredients affect concrete fresh and hardened properties. A brief introduction of other common infrastructure materials is also included in this course. Students will be asked to solve an infrastructure material related problem using advanced analytical and simulation tools.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7341. Advanced Bituminous Materials.
This course provides a comprehensive presentation of bituminous materials, mix design procedures, and construction techniques. Emphasis is placed on a fundamental understanding of asphalt cements and aggregates, and how these materials affect mixture design and pavement performance. Modern asphalt pavement design and construction practices are also introduced.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7350. Highway Bridge Design.
This course covers the design of highway bridge structures, including both the super- and sub-structure. Design is in accordance with current Federal Highway Administration (FHWA) specifications.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7351. Advanced Reinforced Concrete Members.
This course covers advanced topics related to reinforced concrete materials and specifications, and the behavior and design of reinforced concrete members. The topics include the following: flexural behavior and design of reinforced concrete, behavior and design of slender columns, design of structural components, frame joints, and walls, serviceability and durability issues, and anchorage design using splices, hooks, and mechanical devices.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7352. Advanced Prestressed Concrete.
This course covers the theories, principles, and concepts of prestressed concrete, including analysis and design of prestressed components for axial, flexure, shear, and torsion. This course will also introduce the applications of prestressed elements in various types of infrastructure.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7353. Earthquake Engineering.
This course covers the theories, principles, and concepts of earthquake waves and wave equations, structural dynamics, and the effect of earthquakes on structures, including modal analysis and linear and nonlinear analyses of single- and multi-degree of freedom systems. Additionally, different earthquake-resistant design principles (e.g., force-based, displacement-based, and energy-based) will be discussed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7360. Pavement Design.
This course covers the design of concrete, asphalt, and pervious pavements. Included are highway pavements, urban streets, airport pavements, industrial pavements, and roller compacted concrete. Design is in accordance with current FHWA specifications. Common construction methods are also addressed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7361. Pavement Asset Management.
This course discusses applications of pavement condition evaluation technologies, pavement distress data analysis and modeling, and pavement maintenance and rehabilitation decision making in the management of pavement systems. Topics include methods of evaluating field performance of rigid and flexible pavements by measuring surface distresses, profiles, friction resistance, and structural integrity. In addition, the course discusses pavement performance evaluation models, and ranking and optimization methods for decision-making of pavement maintenance and rehabilitation strategies.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7362. Advanced Traffic Engineering.
This course evaluates components of transportation systems by applying principles of transportation engineering, geometric design of highways, and study of warrants for traffic control devices. Additional topics include analysis of traffic flow theory and characteristics, levels of service, and capacity of urban and rural highways, design and analysis of traffic signals and timing plans, and analysis of urban and highway traffic characteristics using simulation software.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7363. Road Infrastructure Safety.
This course provides an introduction to road infrastructure safety. Topics include fundamentals of road safety analysis, highway safety management systems, count data modeling, crash severity modeling, highway safety design, basics of artificial intelligence and machine learning, human factors, and design based on safe system approach (SSA).
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7364. Non Destructive Testing and Forensic Studies.
This course focuses on applications of non-destructive testing (NDT) technologies in pavement infrastructure forensic studies. The course covers typical modern NDT devices employed in transportation testing and evaluation including ground penetrating radar, 3-D laser scanning, falling weight deflectometer, traffic-speed deflectometer, high-speed inertial profiler, and impact echo. The course will provide in-depth content on the principles of these NDT technologies. Based on these technologies, a series of real-world projects will be comprehensively discussed as forensic study cases. The objective is to develop engineering decision making skills in effectively identifying the root-course of distresses or failures based on the NDT test results.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7366. Advanced Statistical and Econometric Modeling.
This course focuses on a comprehensive understanding of statistical and econometric analysis techniques, emphasizing their application in civil engineering and scientific data analysis. It covers model-estimation methods that extend beyond traditional statistics courses, providing students with a broad range of data-analysis applications while discussing underlying theories and limitations for proper comprehension and application. Prerequisite: CE 7363 with a grade of "B" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Graduate Assistantship
Grade Mode: Standard Letter

CE 7370. Urban Stormwater Management.
This course examines the planning, design, operation, and maintenance of urban stormwater management systems. Political, social, economic, and environmental influences on such systems are examined. The impact of extreme events on stormwater systems and the urban landscape are also considered.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7371. Remote Sensing in Hydrology.
This course focuses on the basics of remote sensing, data collection, processing, and analysis for a wide range of applications for hydrology and water resources at different scales. Topics include the hydrologic cycle, relevant sensor types, the electromagnetic spectrum, active/passive microwave remote sensing (precipitation, soil moisture, snow, vegetation water content, etc.), thermal sensing of evapotranspiration, and the gravity method of groundwater. This course also covers an introduction to data assimilation and practical approaches with remote sensing data for water resources management including floods and drought monitoring.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7372. Water, Climate, and Disasters.
This course introduces the interactions between water and climate systems and their relationship with occurrences, magnitude, and frequencies of natural disasters with a focus on climate impacts on hydrology, water resources, and extreme events (e.g., floods, drought, heat waves, landslides, and wildfires). This course covers disaster risk management and adaptation strategies for a sustainable and resilient natural environment and human society against weather and climate extreme disasters.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7390. Infrastructure Systems Analysis.
This course is an advanced study of the planning, operation, and maintenance of municipal and commercial infrastructure assets. Political, social, economic, environmental, and engineering influences on infrastructure systems are addressed. Use of technology to enhance the safety and economic value of the infrastructure is also investigated.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7391. Advanced Mechanics of Materials.
This course is an advanced study of stress, strain, and deformation in elastic bodies. Topics covered include torsion, unsymmetrical bending, nonlinear beams, stress concentrations, beams on elastic foundations, Mohr's circle, and an introduction to the theory of elasticity.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7393. Artificial Intelligence Applications in Civil Engineering.
This course explores the interface between artificial intelligence (AI) and civil engineering. The course covers foundational topics including civil engineering basics, AI fundamentals, matrix algebra, and data preprocessing. The curriculum also includes specific AI methodologies, like supervised, unsupervised, deep learning, and explainable AI, in addition to natural language processing. It highlights emerging technologies in civil engineering and the ethical and social implications of AI in the sector.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7394. Climate Change Impact and Adaptation in Civil Engineering.
This course provides an introduction to global and regional climate change processes, drivers, and impacts. Case studies are presented for the regional impacts of climate change on extreme weather, water availability, and energy and transportation systems. Students are introduced to a variety of natural hazards and possible mitigation approaches as well as principles of design, including adaptable design and design for failure. Students select the problems they want to solve and develop their projects. Students carry out exercises with relevant data sets, write critiques of key issues, and complete a focused term project.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7395. Finite Element Modeling in Civil Engineering.
This course is an introduction to finite element methods (FEM) as applicable to a range of problems in physics and engineering. A survey of finite element analyses with a review of differential equations, boundary conditions, integral forms and numerical integration will be covered. This course particularly focuses on the steady-state and transient problems encountered in geotechnical, geomechanical, and hydrological engineering.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7396. Life Cycle Assessment of Infrastructure.
This course provides analytical tools and methods for implementing principles of life cycle analysis for civil engineering infrastructure. Civil infrastructure systems are critical assets that are subjected to damage, service-life deterioration, and increasing maintenance and rehabilitation cost. Effective infrastructure management and principles of sustainable development can help to find an optimal compromise between economic growth and environmental protection for all stakeholders. Life cycle assessment (LCA) is an important decision support framework for estimating and assessing the environmental impacts attributable to the life cycle of civil infrastructure systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7399. Dissertation.
This course includes original research and writing in civil engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CE 7599. Dissertation.
This course includes original research and writing in civil engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CE 7699. Dissertation.
This course includes original research and writing in civil engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CE 7999. Dissertation.
This course includes original research and writing in civil engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit