DOCTOR OF PHILOSOPHY (PH.D.) MAJOR IN CIVIL ENGINEERING (STRUCTURAL AND MATERIALS ENGINEERING ENTERING WITH MASTER'S DEGREE)

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

Application Requirements

Application requirements consist of institutional and program requirements for applicable semesters of entry during the current academic year. Additional information 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/).

Unless otherwise noted on The Graduate College program page, AI tools can only be used to correct spelling and grammar errors in application materials.

Institutional Requirements

Institutional requirements are the minimum standards for admission to any graduate program at Texas State. These include:

- Completed online application
- Nonrefundable application fee
  - Degree Programs (Doctoral and Master's)
    - $55 fee, or
    - $90 for applications with international credentials
  - Post-Baccalaureate Programs (Certificate, Certification, Non-Degree, and Visiting)
    - $20 fee, or
    - $60 for applications with international credentials
- Official transcripts from each institution where course credit was granted. Final transcripts showing degree completion are required before the student may register for their second term of enrollment.
- GPA requirements (a higher GPA may be listed in the Program Requirements)
  - Doctoral programs require a 3.00 overall GPA or a 3.00 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
  - Master's and Specialist programs require a 2.75 overall GPA or a 2.75 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
  - Post-Baccalaureate programs require a 2.50 overall GPA or a 2.50 GPA in your last 60 hours (https://www.gradcollege.txst.edu/admissions/policy.html#gpa) of undergraduate course work (plus any completed graduate courses).
- Baccalaureate degree from a regionally accredited university. (Non-U.S. degrees must be equivalent to a four-year U.S. Bachelor's degree. In most cases, three-year degrees are not considered. Visit our International FAQs (https://www.gradcollege.txst.edu/international/faqs.html) for more information.)

Approved English Proficiency Exam Scores

Applicants are required to submit an approved English proficiency exam score that meets the minimum requirements below unless they have earned a bachelor's degree or higher from a regionally accredited U.S. institution or the equivalent from a country on our exempt countries list (http://www.gradcollege.txstate.edu/international/language.html#waiver). Some programs may restrict acceptable tests or require higher scores than the institutional scores; this will be noted in the Program Requirements.

- official TOEFL iBT scores required with a 78 overall if taken on or before January 21, 2026
- official TOEFL iBT scores required with a 4 overall if taken after January 21, 2026
- 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
- official Texas State Intensive English Program score of 90% or higher in the highest-level course (level 5)

The institution does **not** offer admission if the scores above are not met.

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

  or

- $90 non-refundable application fee for applicants with international credentials
- completed master's degree in Civil Engineering or a closely related discipline, from an accredited college or university
- 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 Structural and Materials Engineering requires 54 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
Concentration		
CE 7340	Advanced Infrastructure Materials	3
CE 7351	Advanced Reinforced Concrete Members	3
Choose 3 hours from the following:		3
CE 7322	Low Impact Development and Green Infrastructure	
CE 7330	Advanced Soil Mechanics	
CE 7361	Pavement Asset Management	
CE 7363	Road Infrastructure Safety	
CE 7394	Climate Change Impact and Adaptation in Civil Engineering	
CE 7395	Computational Methods 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 7322	Low Impact Development and Green Infrastructure	
CE 7323	Soil and Groundwater Remediation	
CE 7330	Advanced Soil Mechanics	
CE 7332	Earth Retaining Structures and Slopes	
CE 7333	Ground Improvement Techniques	
CE 7334	Advanced Foundation Engineering	
CE 7336		
CE 7341	Advanced Bituminous Materials	
CE 7350	Highway Bridge Design	
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 7395	Computational Methods 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		
MATH 7375C		
MATH 7375D		
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		**54**

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 (http://mycatalog.txstate.edu/graduate/science-engineering/ingram-school/civil-engineering-structural-materials-phd/#CE)

Courses Offered

Civil Engineering (CE)

CE 7199. Dissertation.

This course provides Ph.D. students with the opportunity to conduct original research in civil engineering under the guidance of a dissertation advisor. The scope includes identification of research problems, formulation of hypotheses, experimental or computational investigation, data analysis, and preparation of the dissertation document. Students are expected to apply advanced engineering knowledge, research methodologies, and scholarly practices throughout the research process. The course is delivered through independent research, regular advisor meetings, and progress presentations. By the end of the course, students are expected to complete and defend a dissertation that contributes new knowledge to the field.

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 provides Ph.D. students with the opportunity to conduct original research in civil engineering under the guidance of a dissertation advisor. The scope includes identification of research problems, formulation of hypotheses, experimental or computational investigation, data analysis, and preparation of the dissertation document. Students are expected to apply advanced engineering knowledge, research methodologies, and scholarly practices throughout the research process. The course is delivered through independent research, regular advisor meetings, and progress presentations. By the end of the course, students are expected to complete and defend a dissertation that contributes new knowledge to the field.
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 7301. Research in Civil Engineering.
This course examines independent research in civil engineering leading to doctoral candidacy. Emphasis is placed on problem formulation, literature synthesis, and development of research methodologies. Topics include identification of research gaps, hypothesis development, data collection and analysis, and interpretation of results. Students refine research questions and methodological approaches to support advancement to candidacy and preparation for dissertation research. The course supports the transition to independent research within the doctoral program and aligns with expectations for scholarly inquiry and contribution.
3 Credit Hours. 0 Lecture Contact Hours. 12 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7310. Experimental Design for Civil Engineering.
This course examines the design and analysis of experiments in engineering and scientific applications. Topics include completely randomized designs, factorial treatment structures, random and mixed effects models, complete and incomplete block designs, Latin squares, confounding, split-plot designs, fractional factorial designs, and response surface methods. Emphasis is placed on selecting appropriate experimental designs, analyzing data, and interpreting results to identify significant factors and interactions. Examples from diverse application areas illustrate how experimental design supports efficient data collection, model development, and evidence-based decision-making in complex systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7320. Water Quality Management.
This course examines principles and practices for drinking water quality management in engineered water supply systems. Topics include physicochemical and microbiological characteristics of drinking water, regulatory frameworks (e.g., primary and secondary standards, health advisories, and emerging contaminant programs), and public health implications. Emphasis is placed on contaminant sources, occurrence, and treatability in relation to water treatment processes. Students engage in evaluation of water quality requirements and treatment approaches for compliance and protection of public health. By the end of the course, students are expected to assess drinking water quality and select appropriate treatment and management strategies.
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 and water sustainability. Students study approaches such as rainwater harvesting, small-scale systems, and resource recovery. The course emphasizes innovative, technology-enhanced solutions that reduce environmental impacts and improve water management. Students evaluate design strategies that support resilience, efficiency, and sustainability. Emphasis focuses on practical applications and modern techniques that promote environmentally responsible development while addressing current and future challenges in water resources and urban infrastructure systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7323. Soil and Groundwater Remediation.
This course covers remediation technologies for cleaning contaminated soil and groundwater. Students study subsurface hydrology, contaminant fate and transport, and both physicochemical and biological remediation methods. The course emphasizes monitoring techniques and strategies for brownfield redevelopment. Students evaluate the significance of subsurface contamination and its impacts on environmental health. Emphasis focuses on practical applications, regulatory considerations, and sustainable approaches to site cleanup. The course prepares students to design and implement effective remediation solutions that protect ecosystems, public health, and community safety.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7324. Water Reuse.
This course explores the role of water reuse in water resources management, addressing engineering principles and interdisciplinary challenges. Topics include advanced treatment technologies, regulatory frameworks, and environmental and economic impacts across agricultural, industrial, and urban applications, with attention to emerging approaches. Students engage in case studies, quantitative analysis, and system-level evaluation of water reuse applications. Emphasis is placed on the design and assessment of water reuse systems within regulatory and engineering contexts.
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 that serves as the foundation for all geotechnical engineering courses. Topics include soil composition, index properties, classification, compaction, total and effective stress, consolidation and secondary compression, drained and undrained shear strength (friction, cohesion, dilatancy and critical states), effects of stress history and rate of loading. The mandatory laboratory component provides hands-on experience with characterizing soils for engineering purposes (stress-deformation and strength characteristics) and helps to familiarize students with ASTM geotechnical laboratory testing procedures and standards.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

CE 7332. Earth Retaining Structures and Slopes.
This course covers the analysis and design of a range of earth retaining structures and the evaluation of slope stability. Students learn fundamental lateral earth pressure theories and apply them to the design of gravity walls, cantilever walls, mechanically stabilized earth walls, soil nails, and tiebacks. Slope stability analysis includes infinite slopes, methods of slices, chart-based solutions, and finite element methods using commercial software. Additional topics address slope remediation techniques and the use of geosynthetics for stabilization in geotechnical engineering practice.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7333. Ground Improvement Techniques.
This course presents advanced topics in ground improvement for challenging sites to remediate seepage and strength issues. It covers techniques such as deep soil mixing, jet grouting, dynamic compaction, vibro-compaction, stone columns, rigid inclusions, and permeation grouting. Emphasis is placed on mitigating liquefaction, settlement, hydraulic conductivity, and stability concerns. The course integrates practical field investigation methods, design principles, performance evaluation, and long-term monitoring considerations in both natural and reclaimed land environments, including coastal, offshore, and urban redevelopment sites.
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 foundation design including design, analysis and construction of shallow and deep foundations. Shallow foundation topics emphasize mat foundations in preparation for pile-raft foundations. Deep foundation topics include driven piles, drilled shafts, micropiles, and auger cast in place piles. The course covers axial capacity of friction and end bearing piles, 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 7340. Advanced Infrastructure Materials.
This course examines advanced theories and research developments in cement-based infrastructure materials, with emphasis on physicochemical processes, microstructure evolution, and performance modeling. Topics include cement hydration mechanisms, transport phenomena, durability, and multi-scale characterization of cementitious systems. The course analyzes relationships among composition, processing, structure, and long-term material behavior under mechanical and environmental loading. Advanced analytical and numerical approaches used to predict material performance are considered. Current literature is evaluated to assess emerging materials, design methodologies, and research trends in cement-based infrastructure systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7341. Advanced Bituminous Materials.
This course examines advanced theories and research developments in bituminous materials, including asphalt binders, aggregates, and mixture systems used in pavement engineering. Emphasis is placed on rheology, chemo-mechanical behavior, and microstructure–performance relationships of asphalt materials. The course analyzes mixture design frameworks, damage mechanisms, and long-term performance under coupled traffic and environmental loading. Advanced experimental, analytical, and modeling approaches are considered for characterizing and predicting material behavior. Current research literature is evaluated to assess emerging materials, performance-based specifications, and innovations in asphalt pavement engineering.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7350. Highway Bridge Design.
This course presents the principles and practices involved in the design of highway bridge structures, including both superstructure and substructure components. Emphasis focuses on structural analysis, load evaluation, material selection, and design detailing in accordance with current Federal Highway Administration (FHWA) specifications. The course covers bridge elements, structural performance assessment, and application of relevant codes and standards. It integrates practical design considerations with engineering analysis related to safety, serviceability, and durability in bridge engineering projects.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7351. Advanced Reinforced Concrete Members.
This course examines advanced topics in reinforced concrete materials, specifications, behavior, and structural design. Topics include flexural behavior and design of reinforced concrete members, behavior and design of slender columns, and design of structural components such as frame joints and walls. Additional emphasis is placed on serviceability, durability, and anchorage design using splices, hooks, and mechanical devices. The course covers relevant design provisions and engineering principles used in the evaluation and design of reinforced concrete systems in accordance with applicable standards and specifications.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7352. Advanced Prestressed Concrete.
This course examines the fundamental theories, principles, and behavior of prestressed concrete systems. Topics include the analysis and design of prestressed components subjected to axial, flexural, and shear loads. Emphasis is placed on prestress effects, load transfer mechanisms, and structural responses under service and ultimate limit states. Applications of prestressed elements in infrastructure systems, including bridges and structural components, are addressed, with attention to practical design considerations, material behavior, and relevant design codes and specifications for engineering practice.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7353. Earthquake Engineering.
This course examines earthquake ground motion, wave propagation, and structural dynamics, including modal analysis and linear and nonlinear response of single- and multi-degree-of-freedom systems. The effects of earthquakes on structures are analyzed, and earthquake-resistant design principles, including force-based, displacement-based, and energy-based approaches, are evaluated with emphasis on advanced applications. Emphasis is placed on interpreting analytical results, assessing structural performance, and applying seismic design concepts to complex structural systems subjected to earthquake loading in engineering practice.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7354. Time-Dependent Behavior of Concrete Structures.
This course examines the fundamental mechanisms and engineering implications of time-dependent behavior in concrete structures subjected to environmental loadings. Topics include creep, shrinkage, temperature and moisture effects, and durability-related phenomena influencing long-term serviceability. Emphasis is placed on understanding, modeling, and predicting structural response under realistic environmental conditions, with a focus on evaluating long-term performance and applying engineering principles and design approaches to address durability and serviceability challenges in concrete infrastructure systems. Practical case scenarios and analytical methods are incorporated to support assessment of long-term behavior.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7360. Pavement Design.
This course develops students' ability to analyze, evaluate, and design modern pavement systems using state-of-practice and advanced methodologies. Students examine ASTM, AASHTO, and FHWA standard and specifications in pavement materials. Students explore key design approaches, identify critical input variables, and apply AASHTO methods for flexible and rigid pavements. Students also design flexible and rigid pavements using advanced mechanistic-empirical design framework, interpretation of design outcomes, and recommendation of optimal solutions. Through real-world case studies and collaborative projects, students synthesize knowledge, develop rehabilitation strategies, and demonstrate effective teamwork, leadership, and communication skills.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7361. Pavement Asset Management.
This course enables students to analyze, evaluate, and design data-driven strategies for managing pavement systems at both network and project levels. Students examine condition evaluation technologies for flexible and rigid pavements, including distress, roughness, friction, and structural assessment based on national and state standards and specifications. Students apply advanced statistical models for performance prediction and interpret results to inform optimal maintenance and rehabilitation decisions. Students design and implement optimization and ranking techniques for resource allocation. Through collaborative projects, students synthesize concepts and demonstrate effective teamwork, leadership, and communication in solving complex pavement management problems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7362. Advanced Traffic Engineering.
This course is an advanced introduction of the components of a highway traffic system and fundamentals of traffic engineering; analysis of traffic stream characteristics, levels of service, and capacity of urban and rural highways; traffic data collection using fixed and mobile sources; macroscopic and microscopic level traffic modeling; study of warrants for traffic control devices; design and analysis of traffic signals and timing plans; analysis of urban and highway traffic characteristics using empirical data and 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 a comprehensive introduction to road infrastructure safety. Topics include fundamentals of road safety analysis, highway safety management systems, count data modeling, crash severity modeling, short-term crash prediction models, road safety audits, network screening, and choice modeling. The course also introduces basics of artificial intelligence and machine learning, human factors in transportation, and safety-focused design principles based on the Safe System Approach (SSA). Emphasis is placed on analyzing methods and frameworks used in roadway safety evaluation and data-driven engineering decision-making.
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 develops students' ability to analyze, evaluate, and diagnose pavement infrastructure conditions using advanced Non-Destructive Testing (NDT) technologies. Students examine the principles and applications of modern tools and sensor systems, including ground penetrating radar, falling weight deflectometer, high-speed inertial profilers, and 3-D laser scanning. The course emphasizes interpretation of NDT data, integration of multiple data sources, and evaluation of distress evidence through real-world forensic case studies. Students synthesize analytical findings to identify root causes of pavement distress and to formulate data-driven engineering decisions for maintenance, rehabilitation, and failure prevention.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7366. Advanced Statistical and Econometric Modeling.
This course provides a comprehensive understanding of statistical and econometric analysis techniques, emphasizing their application in civil engineering and scientific data analysis. It introduces advanced model estimation methods beyond traditional statistics courses, with focused instruction in NLOGIT and R for econometric modeling. Students will learn to implement, interpret, and critically evaluate count data models, classification models, and choice models using real-world datasets while developing a strong understanding of underlying theories, assumptions, and limitations relevant to applied engineering and research contexts. 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. It explores political, social, economic, and environmental factors that influence system development and performance. Students analyze how these factors shape decision making and infrastructure outcomes. The course also evaluates the impacts of extreme events on stormwater systems and the urban landscape. Emphasis is placed on sustainable design strategies, resilience, and practical approaches to managing runoff, reducing flood risks, and protecting communities and ecosystems in rapidly changing urban environments.
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 fundamentals of remote sensing, including data collection, processing, and analysis for hydrology and water resources applications across multiple spatial and temporal scales. Topics include the hydrologic cycle, relevant sensor types, the electromagnetic spectrum, and active and passive microwave remote sensing for precipitation, soil moisture, snow, and vegetation water content. Additional coverage includes thermal remote sensing for evapotranspiration estimation and gravity-based methods for groundwater assessment. The course also introduces data assimilation concepts and practical applications of remote sensing data in water resources management, including flood and drought monitoring. Emphasis is placed on interpreting remote sensing products and integrating observations into applied hydrologic analysis and decision-making.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7372. Water, Climate, and Disasters.
This course examines the interactions between water and climate systems and their relationships with the occurrence, magnitude, and frequency of natural disasters. Emphasis is placed on climate impacts on hydrology, water resources, and extreme events such as floods, droughts, heat waves, landslides, and wildfires. The course covers disaster risk management and climate adaptation strategies aimed at supporting sustainable and resilient natural environments and human systems. Students analyze hydroclimatic processes, climate-driven hazards, and engineering responses to weather- and climate-related extremes using computational tools and scientific literature. The course integrates theory, modeling, and applied analysis to support informed decision-making for disaster risk reduction and infrastructure resilience under changing climate conditions.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7390. Infrastructure Systems Analysis.
This course examines the planning, operation, and maintenance of infrastructure systems in municipal and commercial contexts. Political, social, economic, environmental, and engineering factors influencing infrastructure decision-making are analyzed. Methods for evaluating system performance, lifecycle considerations, system interactions, and service demands are investigated. Strategies for enhancing infrastructure safety, reliability, resilience, and economic value are evaluated within the context of modern infrastructure management practices, including asset management, risk assessment, long-term system performance evaluation, decision-making under uncertainty, and integration of advanced analytical approaches for infrastructure system analysis and management.
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 with emphasis on rigorous formulation and solution of structural mechanics problems. Topics covered include torsion of noncircular members, unsymmetrical bending of prismatic and thin-walled sections, nonlinear beam behavior, and stress concentrations in structural details and connections. Additional topics address beams on elastic foundations, energy methods, stability-related effects, and advanced use of Mohr's circle for multi-axial stress and strain. The course also includes an introduction to the theory of elasticity, emphasizing the formulation of governing equations and classical two- and three-dimensional solution techniques.
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, providing a comprehensive foundation in both domains. Topics include civil engineering fundamentals, AI principles, matrix algebra, and data preprocessing techniques. The course introduces key methodologies such as supervised and unsupervised learning, deep learning, explainable AI, and large language models (LLMs). It also covers emerging paradigms including world models and vision–language models for multimodal infrastructure analysis. Applications across transportation, infrastructure monitoring, and smart systems are emphasized, along with the broader social, ethical, and workforce implications of AI integration in civil engineering practice.
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 examines the interactions between water and climate systems and their relationships to the occurrence, magnitude, and frequency of natural disasters. Emphasis is placed on climate impacts on hydrology, water resources, and extreme events such as floods, droughts, heat waves, landslides, and wildfires. The course addresses disaster risk management and climate adaptation strategies that support sustainable and resilient natural and human systems. Students analyze hydroclimatic processes, climate-driven hazards, and engineering responses to extreme events using computational tools and peer-reviewed literature. The course integrates theory, modeling, and applied analysis to inform infrastructure planning and disaster risk reduction under changing climate conditions.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7395. Computational Methods in Civil Engineering.
This course introduces numerical analysis and computational methods applicable to civil engineering problems. Topics include a survey of finite element analysis, differential equations, boundary conditions, integral formulations, and numerical integration techniques. Emphasis is placed on applying computational methods to simulate and solve steady-state and transient problems in solid and fluid systems relevant to civil engineering practice. Students develop skills in computational modeling, numerical analysis, and interpretation of simulation results. The course supports effective problem-solving in complex engineering scenarios and builds proficiency in the use of modern computational tools for engineering analysis and decision-making.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7396. Life Cycle Assessment of Infrastructure.
This course examines analytical tools and methods for applying life cycle assessment (LCA) to civil infrastructure systems. Emphasis is placed on evaluating environmental impacts across the full life cycle of infrastructure, including material production, construction, operation, maintenance, and end-of-life stages. Civil infrastructure systems are analyzed as critical assets subject to deterioration, maintenance, and rehabilitation. The course also addresses the role of LCA in supporting sustainable infrastructure management by integrating environmental, economic, and societal considerations. Applications highlight how LCA informs data-driven decision-making and long-term planning for infrastructure systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CE 7399. Dissertation.
This course provides Ph.D. students with the opportunity to conduct original research in civil engineering under the guidance of a dissertation advisor. The scope includes identification of research problems, formulation of hypotheses, experimental or computational investigation, data analysis, and preparation of the dissertation document. Students are expected to apply advanced engineering knowledge, research methodologies, and scholarly practices throughout the research process. The course is delivered through independent research, regular advisor meetings, and progress presentations. By the end of the course, students are expected to complete and defend a dissertation that contributes new knowledge to the field.
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 provides Ph.D. students with the opportunity to conduct original research in civil engineering under the guidance of a dissertation advisor. The scope includes identification of research problems, formulation of hypotheses, experimental or computational investigation, data analysis, and preparation of the dissertation document. Students are expected to apply advanced engineering knowledge, research methodologies, and scholarly practices throughout the research process. The course is delivered through independent research, regular advisor meetings, and progress presentations. By the end of the course, students are expected to complete and defend a dissertation that contributes new knowledge to the field.
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 provides Ph.D. students with the opportunity to conduct original research in civil engineering under the guidance of a dissertation advisor. The scope includes identification of research problems, formulation of hypotheses, experimental or computational investigation, data analysis, and preparation of the dissertation document. Students are expected to apply advanced engineering knowledge, research methodologies, and scholarly practices throughout the research process. The course is delivered through independent research, regular advisor meetings, and progress presentations. By the end of the course, students are expected to complete and defend a dissertation that contributes new knowledge to the field.
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 provides Ph.D. students with the opportunity to conduct original research in civil engineering under the guidance of a dissertation advisor. The scope includes identification of research problems, formulation of hypotheses, experimental or computational investigation, data analysis, and preparation of the dissertation document. Students are expected to apply advanced engineering knowledge, research methodologies, and scholarly practices throughout the research process. The course is delivered through independent research, regular advisor meetings, and progress presentations. By the end of the course, students are expected to complete and defend a dissertation that contributes new knowledge to the field.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit