# COURSES FOR CIVIL, CONSTRUCTION AND ENVIRONMENTAL ENGINEERING

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Hours</th>
<th>Description</th>
<th>Prerequisite(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE501</td>
<td>Masters Capstone Project-Plan II</td>
<td>3</td>
<td>Development of a research paper, professional practice or policy paper, or other equivalent report. Topic to be approved in advance by the student's graduate advisor.</td>
<td>MS Plan II students only</td>
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<tr>
<td>CE514</td>
<td>Information Systems Design</td>
<td>3</td>
<td>An overview of management information systems (MIS). The course will focus on the practical aspects, applications, and methodology of MIS, particularly from the construction engineer's perspective. Information design methodology and building information modeling (BIM) will be covered in detail.</td>
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<tr>
<td>CE515</td>
<td>Transportation Data Science</td>
<td>3</td>
<td>The course will provide basic introduction to processing and analyses of large-scale transportation-related data. The course will prepare the students with programming skills in Python, the understanding of important algorithms and machine learning methods in transportation research and projects, and applying these algorithms and models using transportation data.</td>
<td>CE 350, MATH 227 with concurrency</td>
</tr>
<tr>
<td>CE516</td>
<td>Advanced Info Systems Design</td>
<td>3</td>
<td>Current concepts in information systems architecture and applications, including decision support systems and expert systems. Emphasis placed on expanded use of systems design methodology.</td>
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<tr>
<td>CE517</td>
<td>Advanced Project Management</td>
<td>3</td>
<td>Not open to students who have credit for CE 417. This is an engineering management course designed to introduce students to the functions of project engineers and managers. It details the processes of planning and controlling project scope, time, and cost.</td>
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<tr>
<td>CE518</td>
<td>Engineering Management</td>
<td>3</td>
<td>Not open to students who have credit for CE 418. An introduction to management principles, and the management functions of planning, organizing, motivating, and controlling. Management of engineers in research, design, manufacturing/construction, and quality will be studied.</td>
<td>CE 331 AND CE 340</td>
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<tr>
<td>CE521</td>
<td>Environmental Engineering Microbiology</td>
<td>3</td>
<td>Fundamentals of microbiology for environmental engineers and application of these principles to natural and engineered systems.</td>
<td>CE 320 or equivalent</td>
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<tr>
<td>CE522</td>
<td>Solid Hazardous Waste Management</td>
<td>3</td>
<td>Engineering design and regulatory requirements for the collection, storage, recycling, treatment, and disposal of solid wastes.</td>
<td>CE 320</td>
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<tr>
<td>CE524</td>
<td>Water &amp; Wastewater Treatment</td>
<td>3</td>
<td>No description available</td>
<td></td>
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<tr>
<td>CE525</td>
<td>Air Pollution</td>
<td>3</td>
<td>Introduction to the source, characteristics, and effects of air pollution and to air pollution control technology and design.</td>
<td>AEM 311 or CE 320</td>
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<tr>
<td>CE526</td>
<td>Groundwater Mechanics</td>
<td>3</td>
<td>A mechanics course focusing on developing the physical and mathematical principles of groundwater models used for predicting water and contaminant transport processes in subsurface aquifers.</td>
<td>MATH 227 and AEM 311</td>
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<tr>
<td>CE529</td>
<td>Research Proposal Writing in EWR</td>
<td>3</td>
<td>Research funding is essential to a successful academic career. However, few PhD students receive adequate mentoring in how to craft competitive proposals. In this course, graduate students review literature, identify research questions, then draft and submit competitive funding proposals (for example to the EPA P3 program).</td>
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<tr>
<td>CE530</td>
<td>Non-Destructive Evaluation and Testing of Civil Engineering</td>
<td>3</td>
<td>This course covers the state-of-the-art and state-of-the-practice methods of non-destructively evaluating and testing various civil engineering structures and materials such as concrete, asphalt, and steel. Students will use the techniques to solve real-world problems by evaluating and testing various structures across campus.</td>
<td>CE 331 AND CE 340</td>
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<tr>
<td>CE531</td>
<td>Structural Dynamics</td>
<td>3</td>
<td>Response of civil engineering structures to typical dynamic loads including theory, development of basic equations, and measurement of structure response in the laboratory.</td>
<td>AEM 264 and CE 331</td>
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CE532 Matrix Analysis of Structures  
Hours 3  
Introduction to the matrix-displacement method of analysis for framed structures, including computer implementation of analysis. An introduction to finite-element analysis is also included. 
Prerequisite(s): CE 331

CE534 Advanced Structural Mechanics  
Hours 3  
Introduction to advances structural mechanics topics, including elementary elasticity, elementary beam theories, beams on elastic foundations, energy methods, buckling and free vibration of beams, and elementary thin-plate theory.

CE535 Concrete Materials  
Hours 3  
Prerequisite(s): CE 331 or CE 340; MTE 271 for non-CCEE students

CE536 Wood Structural Design  
Hours 3  
Modern timber engineering: design of beams, columns, trusses, and floor systems. 
Prerequisite(s): CE 331

CE537 Reinforced Concrete Struct II  
Hours 3  
Design of reinforced concrete building components including two-way slabs, slender columns, prestressed beams, slap-on-grade, and retaining walls. 
Prerequisite(s): CE 433

CE538 Struct Steel Design II  
Hours 3  
Basic and elementary design procedures for steel structures such as plate girders, mill buildings, multistory buildings, highway bridges, and light-gauge steel structures. 
Prerequisite(s): CE 434

CE541 Wind and Earthquake Engineering  
Hours 3  
Wind and Earthquake engineering theories and their applications in load estimation and structural design. 
Prerequisite(s): CE 531, Structural Dynamics or instructor permission.

CE542 Waste Containmnt Facility  
Hours 3  
Introduction to the fundamentals of soil behavior as they relate to environmental engineering. Topics include soil behavior, soil compaction, conduction phenomena, geosynthetics, and aspects of landfill design. 
Prerequisite(s): CE 320

CE543 Prestressed Concrete Design  
Hours 3  
Analysis and design of prestressed concrete members, review of hardware, stress calculations, prestress losses, section proportioning, flexural design, shear design, deflections, and statically indeterminate structures. 
Prerequisite(s): CE 433 or equivalent course on reinforced concrete structures

CE544 Foundation Engineering  
Hours 3  
Analysis and design of soil foundation systems. 
Prerequisite(s): CE 340

CE551 Roadway and Intersection Design  
Hours 3  
Application of the principles of geometric design and traffic signal layout: vertical and horizontal alignment, intersections, traffic control, and traffic signal layout. Design projects will be prepared to illustrate standard techniques. 
Prerequisite(s): CE 350

CE552 Transportation Safety and Security  
Hours 3  
This course focuses on major transportation safety and security issues. The course examines how death, injury and property damage and the public perception of risk detract communities from achieving their goals. The specific issues relate to transportation safety and security goals, relevant frameworks, and the selection of safety countermeasures and their evaluation in terms of specific criteria. 
Prerequisite(s): CE 350

CE553 Intelligent Transportation Systems  
Hours 3  
This course covers the fundamentals of Intelligent Transportation Systems (ITS). The topics to be covered in the course will include systems engineering approach applied to ITS, ITS deployment and transportation operations, transportation system management, traveler response to technologies and information, ITS planning, evaluation, and institutional issues. 
Prerequisite(s): CE 350

CE554 Urban Transportation Planning  
Hours 3  
An introduction to the planning process, software associated with transportation modeling, and conducting transportation planning and traffic impact studies. 

CE555 Traffic Flow Theory  
Hours 3  
This course covers the fundamentals of traffic flow theory. Topics shall include microscopic flow characteristics, macroscopic flow characteristics, microscopic speed characteristics, macroscopic speed characteristics, microscopic density characteristics, macroscopic density characteristics, demand-supply analysis, capacity analysis, traffic stream models, shockwave analysis, queueing analysis, and simulation models. 
Prerequisite(s): CE 350
CE558 Traffic Engineering  
Hours 3  
This course covers the fundamentals of traffic engineering, including vehicle operating characteristics, traffic flow, traffic data, traffic hardware, traffic software, geometric design of road and intersections, and methods of traffic control.  
Prerequisite(s): CE 350

CE559 Pavement Design and Rehabilitation  
Hours 3  
This course covers two areas concerning care of existing highway asphalt and concrete pavements. Major maintenance includes overlay design, additional drainage, recycling, and slab repair. Routine maintenance includes distress surveys, pothole repair, and crack and joint sealing.  
Prerequisite(s): CE 350 or CE 366

CE561 Horizontal Construction Method  
Hours 3  
Introduction to horizontal construction engineering equipment and methods. Design of horizontal construction systems, and construction operation analyses and simulation.

CE562 Vertical Construction Methods  
Hours 3  
Construction of buildings, including mechanical, electrical, plumbing and controls systems, design of temporary structures, and planning and design of lifts.  
Prerequisite(s): CE 366

CE563 Construction Cost Estimating  
Hours 3  
Addresses the estimating and cost control function from conceptual planning through project execution. Topics include productivity analysis, organization of estimates, cost forecasting, estimating tolls and techniques, contingency planning and relationship to contract types and project execution strategies.  
Prerequisite(s): CE 366

CE564 Safety Engineering and Management  
Hours 3  
Not open to students with credit for CE 464. An exposure to safety engineering and accident prevention including state and federal laws related to general and construction projects. Topics include accident theories, safety regulations, Construction Safety Act, hazards and their control, human behavior and safety, and safety management.  
Prerequisite(s): GES 255, CE 366

CE566 Sustainable and Lean Construction  
Hours 3  
An introduction to sustainable and lean construction, including application of engineering economics principles to sustainable construction problems. Green design, construction, and operations from a project management standpoint. Theoretical concepts and industry practices used to model, evaluate, and enhance construction performance through the design and implementation of effective project schedules, construction operations, and contracting relationships.  
Prerequisite(s): CE 366

CE567 Constr. Accounting & Finance  
Hours 3  
Applications of accounting and financial practice to management of construction projects.  
Prerequisite(s): CE366

CE568 Construction Scheduling  
Hours 3  
The management structure of construction companies and the laws, regulations, practices, tools, and processes used in planning, scheduling, and monitoring construction projects. Writing proficiency is required for a passing grade in this course.

CE570 Open Channel Flow  
Hours 3  
Basic concepts of fluid flow, energy and momentum principles, flow resistance in nonuniform sections, channel controls and transitions, and nonuniform flow computations.  
Prerequisite(s): CE 378

CE573 Statistical Applications  
Hours 3  
Applications of statistical and probabilistic methodologies for analysis and solution of practical civil engineering problems, including hypothesis testing, simple and multiple regression analysis, analysis of variance for single and multi-factor experiments, forecasting models, simulation, and statistical quality control.  
Prerequisite(s): GES 255

CE574 Paleohydrology  
Hours 3  
Students will examine hydrologic data (precipitation, snowpack, streamflow) and tree-ring data (proxies) and, when combining these datasets (Dendrohydrology), students will examine the past (paleo) variability of water. Students will participate in the collection (coring) of trees and an in-class lab on tree-ring cross dating. Students will gain knowledge in various statistical techniques including Stepwise Linear Regression and data filtering.  
Prerequisite(s): GES 255, ST 260, PY 211, BER 245, or permission of instructor

CE575 Hydrology  
Hours 3  
Hydrologic cycle, rainfall-runoff relations, unit hydrograph, statistical hydrology, and hydrologic simulation; includes a class project with application to flood control, water supply, and multipurpose projects.  
Prerequisite(s): CE 378

CE576 Process Hydrology  
Hours 3  
This course develops a quantitative approach to understanding and prediction of hydrologic processes. The processes covered include interception, snowmelt, evapotranspiration, infiltration, groundwater flow, overland flow, and streamflow. Relative (dis-)advantages of different model representations will be highlighted. Process couplings and their impact on the integrated hydrologic response will be also discussed. Evaluation in the course will consist of out-of-class assignments and a term project.  
Prerequisite(s): CE 378
CE578 Analytical Methods in Environmental Engineering  
Hours 3  
The field of environmental engineering relies heavily on a number of analytical techniques, which have become the basis for a large amount of the work being conducted. The main objective of this course is to introduce students to the theory and application of many of the analytical instruments that are commonly used by environmental engineers.  
Prerequisite(s): CH 101 or CH 117; CE 320 or CHE 255

CE581 Legal Aspects of Engineering and Construction  
Hours 3  
Legal aspects of engineering and construction contracts and specifications; contract formation, interpretation, rights and duties, and changes; legal liabilities and professional ethics of architects, engineers and contractors. This is a three-hour survey course covering, primarily, the organization of the federal and state courts, construction contracting, potential tort liability and professionalism for engineers in Alabama.  
Prerequisite(s): CE 320, CE 331, CE 340, CE 350, CE 366 or CE 378, and one HU elective (3 credits)

CE585 Constructn Site Erosion Ctrl  
Hours 3  

CE586 GIS for Civil Engineers  
Hours 3  
Introduction to geographic information system design and use for civil engineering problem solving.  
Prerequisite(s): CE 260 and any CE 300 Level course

CE591 Special Problems  
Hours 1-3  
Independent study. Credit is based on the amount of work undertaken.

CE592 Graduate Independent Study in Civil Engineering Sub-Discipline  
Hours 1-4  
Independent study, either as individual students or a group of five students or less working under the guidance and mentorship of an instructor. The independent study will typically focus on: (1) a specific issue, problem, application, design or process in a traditional field of civil engineering OR (2) a specific development, advancement, issue, problem, or challenge in a new or developing specialty area in the fields of civil engineering.

CE593 Practicum  
Hours 1-3  
This course allows graduate students to gain classroom and laboratory experience under supervised conditions. Tasks may include grading for selected courses, structured lecturing, laboratory monitoring, and other related pedagogical exercises.

CE598 Non-Thesis Research  
Hours 1-6  
Research Not Related to Thesis. Variable credit.

CE599 Thesis Research  
Hours 1-12  
This independent research course partially fulfills required master's-level research thesis hours toward the master's degree in Civil Engineering/Environmental Engineering. The course is conducted under the guidance of the thesis advisor. Material covered will be of an advanced nature aimed at providing master's students with an understanding of the latest research and current developments within the field. Discussion and advisor guidance will be directed towards readings of research articles and development of research methodology, with the aim of producing an original research contribution that represents a novel development in the field, or a novel perspective on a pre-existing topic in the field.

CE616 Advanced Information Systems  
Hours 3  
Current concepts in information systems architecture and applications, including decision support systems and expert systems. Emphasis placed on expanded use of systems design methodology.  
Prerequisite(s): CE 414 or CE 514

CE631 Experimental Methods in Structural Dynamics  
Hours 3  
Introduction to experimental methods in the behavior of structures subjected to dynamic loading. Principles of vibration testing and digital signal processing. Current techniques in modal analysis, system identification, actuator and structural control, structural health monitoring.  
Prerequisite(s): CE 531

CE632 Structural Reliability  
Hours 3  
The knowledge taught in this course is to provide the background needed to understand how reliability-based design criteria were developed and to provide a basic tool for structural engineers interested in applying this reliability-based design criteria to other situations.  
Prerequisite(s): CE 573 Statistical Applications in Civil Engineering or instructor permission

CE636 Advanced Infrastructure Materials  
Hours 3  
Introduction to advanced and innovative materials used in civil infrastructure systems. An introduction to research methodology in materials is also included.  
Prerequisite(s): CE 331

CE641 Wind Engineering  
Hours 3  
This research-oriented class is intended to provide a rational description of the phenomena involved and to develop appropriate analytical and design tools for structural engineering. The course attempts to present a synthesis of the main trends of specialized literature in Wind Engineering.  
Prerequisite(s): CE 531

CE655 Sustainable Transportation  
Hours 3  
No description available
CE673 Statistical and Econometrics Practices for Engineers  
Hours 3  
This course covers basic and advanced statistical and econometric methods as applied to engineering-related problems. Topics include introduction to ordinary least squares regression, count-data models including Poisson and negative binomial regressions and their extensions, simultaneous equations models, multinomial logit models, ordered probability models, joint discrete/continuous models, and hazard-based duration models.  
Prerequisite(s): CE 573

CE691 Special Problems  
Hours 1-6  
Advanced work in some area of specialization. Credit awarded is based on the amount of work completed.

CE693 Practicum  
Hours 1-3  
This course allows graduate students to gain classroom and laboratory experience under supervised conditions. Tasks may include grading for selected courses, structured lecturing, laboratory monitoring, and other related pedagogical exercises.

CE699 Dissertation Research  
Hours 1-12  
This independent research course partially fulfills required doctoral level research dissertation hours toward the Ph.D. in civil engineering. A minimum of 24 dissertation hours are required, at 1-12 hours per semester. The course is conducted under the guidance of the Ph.D. advisor. After completing requirements for admission to candidacy, the student registers for a minimum of 3 hours per semester in this course, each semester, until all dissertation requirements have been approved. Material covered will be of an advanced nature aimed at providing doctoral students with an understanding of the latest research and current developments within the field. Discussion and advisor guidance will be focused on readings of research articles and development of research methodology, with the aim of producing an original research contribution that represents a novel development in the field, or a novel perspective on a pre-existing topic in the field.

Civil, Construction and Environmental Engineering