COURSES FOR CIVIL, CONSTRUCTION AND ENVIRONMENTAL ENGINEERING

CE501 Masters Capstone Project-Plan II
Hours 3

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.

Prerequisite(s): MS Plan II students only

CE514 Information Systems Design
Hours 3

An overview of management information systems (MIS). The course will focus on the practical aspects, applications, and methodology or MIS, particularly from the construction engineer's perspective. Information design methodology and building information modeling (BIM) will be covered in detail.

CE515 Transportation Data Science
Hours 3

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.

Prerequisite(s): CE 350

Prerequisite(s) with concurrency: MATH 227

CE516 Advanced Info Systems Design
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.

CE517 Advanced Project Management
Hours 3

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.

CE518 Engineering Mangement
Hours 3

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.

CE521 Environmental Engineering Microbiology
Hours 3

Fundamentals of microbiology for environmental engineers and application of these principles to natural and engineered systems.

Prerequisite(s): CE 320 or equivalent

CE522 Solid Hazardous Waste Managmnt
Hours 3

Engineering design and regulatory requirements for the collection, storage, recycling, treatment, and disposal of solid wastes.

Prerequisite(s): CE 320

CE524 Water & Wastewater Treatment
Hours 3

No description available

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Prerequisite(s): AEM 311 or CHE 304; and CE 320

CE525 Air Pollution
Hours 3

Introduction to the source, characteristics, and effects of air pollution and to air pollution control technology and design.

Prerequisite(s): AEM 311 or CE 320

CE526 Groundwater Mechanics
Hours 3

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.

Prerequisite(s): MATH 227 and AEM 311

CE528 Environmental Data Analysis
Hours 3

An introduction to the area of data science with applications in environmental research. The course helps students develop skills and knowledge about useful data analysis methods and tools. The lectures cover the theory, and assignments will be mainly on applications (Python programming required). The lectures and assignments prepare students for interdisciplinary research projects and train them to develop data-driven approaches to answer environmental problems.

Prerequisite(s): ST 260; or GES 255; or CE 573 (or similar coursework)

CE529 Research Proposal Writing in EWR
Hours 3

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).

CE530 Non-Destructive Evaluation and Testing of Civil Engineering Structures
Hours 3

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.

Prerequisite(s): CE 331 AND CE 340

CE531 Structural Dynamics
Hours 3

Response of civil engineering structures to typical dynamic loads including theory, development of basic equations, and measurement of structure response in the laboratory.

Prerequisite(s): AEM 264 and CE 331

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

Portland cement and supplementary cementitious materials, aggregates, properties of fresh and hardened concrete, concrete durability issues, mixture proportioning, concrete construction methods, special concrete materials, test methods.

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.

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

CE571 Hydrologic Forecasting Praxis Lab
Hours 3

Floods, droughts, and other water related events regularly dominate today's headlines. Increases in frequency and magnitude of extreme hydrologic events combined with changes in land use, land cover, climate, policies, and societal behaviors are increasing the complexity and difficulty of hydrologic forecasting. Opportunities for the use of new observation platforms, data-driven techniques, modeling frameworks, prediction systems, and decision support are revolutionizing the state of the practice in hydrologic forecasting. The goal of the Hydrologic Forecasting Praxis Lab is to engage students in table-top experiential learning exercises to develop their knowledge, skills, and competencies to enter and advance the practice of hydrologic forecasting. Students will learn through preliminary training and the table-top forecasting exercises how to analyze hydrometeorological observations, use water prediction models and tools, apply new techniques such as artificial intelligence, and communicate forecast information to diverse stakeholders and decision makers.

Prerequisite(s): CE 475 or CE 476 or instructor approval with equivalent hydrology course

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, 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)

CE582 Hydrologic Forecast Seminar 1
Hours 2

A beneficial aspect of the Water-R2O NRT for the students will be the continuous integration of co-curricular activities to add value to the learning outcomes. Students will have the opportunity to attend AWI WaterWorks to cross-pollinate with other disciplines, CIROH@UA distinguished speaker seminars, and have the chance to participate in other happenings based off the mentoring needs identified by the students with the Water-R2O Project Coordinator, Dr. Hannah Holcomb, helping the students to identify appropriate mentors. In addition, Water R2O project team members will provide group-based professional development opportunities (e.g., team science and science communication training). In addition, project mentors will guide multidiscipline teams of trainees in their NRT capstone project that begins in this seminar course and continues into the Spring semester. The NRT capstone project will be completed at the conclusion of the Praxis Lab in the spring semester following. Engagement and other learning opportunities from home departments, AWI, NOAA National Water Center, USGS Hydrologic Instrumentation Facility, and others will be available and made known to the students during the weekly class meetings.

Prerequisite(s): Must be accepted into the Water-R2O program at The University of Alabama and be in accepted graduate student standing in a relevant Water-R2O academic department.

CE583 Hydrologic Forecasting Seminar II
Hours 2

Students will have the opportunity to attend workshops, other related events, and hear speakers pertaining to NRT themes. In addition, Water-R2O project team members and others will provide group-based professional development opportunities (e.g., various programming workshops). Engagement and other learning opportunities from home departments, AWI, NOAA National Water Center, USGS Hydrologic Instrumentation Facility, selected project stakeholders, and others will be available and made known to the students during the weekly class meetings.

Prerequisite(s): CE 582

CE585 Constructn Site Erosion Contrl
Hours 3

Nature and magnitude of erosion problems, and erosion plan development. Rainfall energy and erosion predictions. Sediment transport in urban areas. Channel and slope stability, and sedimentation and other controls.

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
SP

Hours 1-3

Independent study. Credit is based on the amount of work undertaken.

Special Topics Course

CE592 Graduate Independent Study in Civil Engineering Sub-Discipline
SP

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.

Special Topics Course

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

CE655 Sustainable Transportation
Hours 3

No description available

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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
SP

Hours 1-6

Advanced work in some area of specialization. Credit awarded is based on the amount of work completed.

Special Topics Course

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.

CE698 Non-Dissertation Research
Hours 1-6

Independent study; general research activities; pass/fail; no credit toward Ph.D. course requirements; no substitution for CE 699. This course serves as an introduction to Ph.D.-level research prior to Ph.D. candidacy. It involves early-stage research activities to prepare students for more focused dissertation research taken as CE 699 once admitted to candidacy.

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