# COURSES FOR CIVIL, CONSTRUCTION AND ENVIRONMENTAL ENGINEERING

## Civil, Construction and Environmental Engineering

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE121</td>
<td>Intro Civil Constrctn Envir Eg</td>
<td>1</td>
<td>Introduce the student to the areas of professional, civil and environmental engineering practices with exposure to faculty members specializing in each area, solving typical problems in each professional area, learning of the activities of service organizations, and the responsibilities of professional practice.</td>
</tr>
<tr>
<td>CE220</td>
<td>Society Infrastruct &amp; Environm</td>
<td>3</td>
<td>Permitting, environmental impact statements and other environmental issues associated with human activities and engineering projects.</td>
</tr>
<tr>
<td>CE260</td>
<td>Civil &amp; Construction Surveying</td>
<td>2</td>
<td>Precise measurement of lengths, angles, areas, and elevations in geodetic systems; computation of construction control, including highway alignment and land areas.</td>
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<tr>
<td></td>
<td>Prerequisite(s): (ENGR 161 or ENGR 171 or ART 131) and MATH 115 or (MATH 112 and MATH 113) or ACT 30 or SAT 680 or PLMA 440 or PLAC 565</td>
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<tr>
<td>CE262</td>
<td>Civil &amp; Constructn Engr Mats</td>
<td>3</td>
<td>Introduction to the engineering properties of structural materials, including steel, wood, aggregate, concrete and asphalt, including experimental testing procedures and interpretation of results.</td>
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<td></td>
<td>Prerequisite(s): AEM 201 or ESM 201; and</td>
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<td></td>
<td>Prerequisite(s) with concurrency: AEM 250</td>
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<tr>
<td>CE270</td>
<td>Field Studies in Water and Climate</td>
<td>4</td>
<td>Water is one of the most abundant, yet most precious, natural resources on Earth. Processes occurring within and across many geosystems determine water's movement and properties. This course explores how components of Earth's water and climate systems operate and are linked through a combination of lecture and experiential field/lab activities. Fieldtrips and lab activities are designed to expose students to standard and innovative techniques used by engineers and geoscientists to understand water and climate systems, including map interpretation, glacial mass balance analysis, and dendrochronologic (tree ring measurement) analysis to obtain river flow and flood information. Fieldtrips will also help students better understand how humans modify water systems, through processes such as river regulation. Students will reside in Innsbruck (Austria) [with daytrips to King Ludwig II's castles in Bavaria, Stubaier Glacier in Austria, and Bolzano, Italy] and Munich (Germany).</td>
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<tr>
<td>CE320</td>
<td>Intro Environmental Engineerg</td>
<td>3</td>
<td>Introduction to the scientific and engineering principles needed to analyze and solve environmental engineering problems, and lab experience in the practice of environmental engineering related to air, water and waste water management. Writing proficiency within this discipline is required for a passing grade in this course.</td>
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<tr>
<td></td>
<td>Prerequisite(s): CH 101 OR CH 117 min grade of C-</td>
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<td></td>
<td>Prerequisite(s) with concurrency: AEM 311 and CHE 304</td>
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<tr>
<td>CE331</td>
<td>Intro to Structural Eng.</td>
<td>3</td>
<td>Introduction and principles of structural analysis of determinate and indeterminate structures. Computing proficiency is required for a passing grade in this course.</td>
</tr>
<tr>
<td>CE340</td>
<td>Geotechnical Engineering</td>
<td>C, W</td>
<td>Static and dynamic interaction of soil and water; theories of stress distribution, consolidation, strength and failures; stability of soil structures. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course.</td>
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<tr>
<td>CE350</td>
<td>Intro. to Transportation Eng</td>
<td>3</td>
<td>An introduction to different modes of transportation with emphasis on roadway and traffic engineering. Topics include transportation economics and planning, highway geometric and pavement design, drainage, construction, traffic control devices, traffic operations, and management and highway capacity analysis.</td>
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<td>Prerequisite(s): CE 260 GES 255</td>
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<tr>
<td>CE366</td>
<td>Introduction to Construction Engineering</td>
<td>3</td>
<td>Applying engineering economic principles to construction and engineering problems; construction management processes and methods in planning, scheduling, and monitoring engineering projects.</td>
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<td>Prerequisite(s): CE 262</td>
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<tr>
<td>CE378</td>
<td>Water Resources Engineering</td>
<td>3</td>
<td>Mechanics of steady and unsteady flow in closed and open conduits, hydrology; water supply and wastewater disposal.</td>
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<tr>
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<td>Prerequisite(s): Dynamics (AEM 264) and Fluid Mechanics (AEM 311); or Fluid Flow Operations (CHE 304)</td>
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CE401 Capstone Design Site Development: Civil Engineering  
C, W  
Hours 4  
Students use of software to design site projects in teams, prepare construction drawings and deliver engineering reports. This class is normally taken during the last term on campus. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course. Computer proficiency is required for a passing grade in the course. A student who does not display computer upper-division student skills with Civil 3D and HEC-HMS will not earn a passing grade, no matter how well the student performs in the other areas of the course.  
Prerequisite(s): CE 340 plus 4 of the following (CE 320, CE 331, CE 350, CE 366, CE 378)  
Prerequisite(s) with concurrency: 1 of ((CE 461 or CE 561) OR (CE 458 or CE 558) OR (CE 424 or CE 524) OR (CE 475 or CE 575) OR (CE 451 or CE 551)) and and AND and and 1 of ((CE 424 or CE 524) OR (CE 425 or CE 525) OR CE 433 OR CE 434 OR (CE 451 or CE 551) OR (CE 458 or CE 558) OR (CE 459 or CE 559) OR (CE 461 or CE 561) OR (CE 462 or CE 562) OR (CE 475 or CE 575))  
Computer Science, Writing

CE402 Capstone Design Site Development: Construction Engineering  
C, W  
Hours 4  
Students use software to design projects in teams, prepare construction drawings and deliver engineering reports. Writing proficiency within this discipline and computing proficiency are required for a passing grade in this course. Computer proficiency is required for a passing grade in the course. A student who does not display computer upper-division student skills with Civil 3D and HEC-HMS will not earn a passing grade, no matter how well the student performs in the other areas of the course.  
Prerequisite(s): CE 340 AND CE 366 AND CE 331  
Prerequisite(s) with concurrency: CE 461 OR CE 561 and AND and CE 468 OR CE 568 and AND and CE 433 OR CE 434  
Computer Science, Writing

CE403 Capstone Design Building Systems: Civil Engineering  
C, W  
Hours 4  
Students use software to design building projects in teams, prepare construction drawings and deliver engineering reports. This class is normally taken during the last term on campus. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course. Computer proficiency is required for a passing grade in the course. All students will use the software program Revit to model their design project.  
Prerequisite(s): CE 331 and CE 340 and 3 of (CE 320, CE 350, CE 366, CE 378) and (CE 433 OR CE 434)  
Prerequisite(s) with concurrency: ONE of the following: (CE 424 OR CE 524) or (CE 425 OR CE 525) or and CE 433 or CE 434 or (CE 451 OR CE 551) or (CE 458 OR CE 558) or (CE 459 OR CE 559) or (CE 461 OR CE 561) or (CE 462 OR CE 562) or (CE 475 OR CE 575)  
Computer Science, Writing

CE404 Capstone Design Building Systems: Construction Engineering  
C, W  
Hours 4  
Students use software to design building projects in teams, prepare construction drawings and deliver engineering reports. The course is normally taken during the last term on campus. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course. Computing proficiency is required for a passing grade in this course. All students will use the software program Revit to model their design project. A Revit assignment and test will be given during the semester.  
Prerequisite(s): CE 340 AND CE 366 AND CE 331 AND (CE 433 OR CE 434)  
Prerequisite(s) with concurrency: CE 462 OR CE 562 and AND and CE 468 OR CE 568  
Computer Science, Writing

CE405 Capstone Design Site Development: Environmental Engineering  
C, W  
Hours 4  
Students use of software to design site projects in teams, prepare construction drawings and deliver engineering reports. This class is normally taken during the last term on campus. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course. Computer proficiency is required for a passing grade in the course. A student who does not display computer upper-division student skills with Civil 3D and HEC-HMS will not earn a passing grade, no matter how well the student performs in the other areas of the course.  
Prerequisite(s): CE 320 AND CE 340 AND CE 378  
Prerequisite(s) with concurrency: CE 425 OR CE 525 and AND and CE 424 OR CE 524 OR CE 524 and AND and CE 475 OR CE 575  
Computer Science, Writing
CE406 Capstone Design Building Systems: Architectural Engineering  
C, W  
Hours 4  
Students use software to design building projects in teams, prepare  
construction drawings and deliver engineering reports. The course is  
normally taken during the last term on campus. Writing proficiency is  
required for a passing grade in this course. A student who does not write  
with the skill normally required of an upper-division student will not earn a  
passing grade, no matter how well the student performs in other areas of  
the course. Computing proficiency is required for a passing grade in this  
course. All students will use the software program Revit to model their  
design project.  
Prerequisite(s): CE 340 AND CE 366 AND CE 331  
Prerequisite(s) with concurrency: CE 462 OR CE 562 and AND and CE 433  
and AND and CE 434  
Computer Science, Writing  
CE414 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.  
Prerequisite(s): CE 366  
CE417 Advanced Project Management  
Hours 3  
This is an engineering management course designed to introduce  
students to the functions of project engineering and managers. It details  
the processes of planning and controlling project scope time and cost.  
Prerequisite(s): CE 366 or IE 203  
Prerequisite(s) with concurrency: GES 255  
CE418 Engineering Management  
Hours 3  
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.  
Prerequisite(s): CE 366  
CE420 Environmental Measurements  
Hours 3  
Environmental Engineering phenomena are explored through conducting  
laboratory experiments, selecting analytical protocols to achieve an  
objective, evaluating collected data sets, and discussing the results in  
well written reports. The course is composed of classroom lectures/  
discussions and weekly laboratory activities.  
Prerequisite(s): CE320 and CE378 and GES 255  
Prerequisite(s) with concurrency: CE 424  
CE422 Solid And Hazardous Waste Mgt  
Hours 3  
Engineering and regulatory requirements for the collection, storage,  
recycling, treatment and disposal of solid wastes.  
Prerequisite(s): CE 320  
CE424 Water And Wastewater Treatment  
Hours 3  
Physical, chemical and biological principles and design of municipal  
water and wastewater treatment units.  
Prerequisite(s): CE 320  
CE425 Air Quality Engineering  
Hours 3  
This is an introductory course in Air Quality Engineering. We have to  
major foci. The first is to understand and evaluate our air resources and  
air quality (as related to human and environmental health) in terms of  
fundamental principles and design processes. The second is to introduce  
the student to a variety of air pollution issues and engineered treatment  
processes.  
Prerequisite(s): AEM 311 or CHE 304; and CE 320  
CE426 Groundwater Mechanics  
Hours 3  
To understand the physics and theoretical principles of groundwater flow  
and transport processes, and apply this knowledge for solving practical  
groundwater flow and transport problems.  
Prerequisite(s): MATH 227 and AEM 311  
CE430 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 340  
CE432 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  
CE433 Reinf Concrete Struct I  
Hours 3  
Concrete materials, placement of concrete and theory and design of  
reinforced beams, girders, slabs, columns and footings.  
Prerequisite(s): CE 331  
CE434 Structural Steel Design I  
Hours 3  
Theory and design of structural steel members and their connections.  
Prerequisite(s): CE 331
CE435 Concrete Materials
Hours 3
Prerequisite(s): CE 331 or CE 340

CE436 Wood Structural Design
Hours 3
Modern timber engineering: design of beams, columns, trusses and floor systems.
Prerequisite(s): CE 331

CE437 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

CE438 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

CE439 Design of Wood and Masonry Structures
Hours 3
Design of wood and masonry components and subassemblies for low-rise residential and commercial buildings according to current design specifications.
Prerequisite(s): CE 331

CE442 Waste Containment 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 340 and CE 320

CE444 Foundation Engineering
Hours 3
Analysis and design of soil foundation systems.
Prerequisite(s): CE 340

CE451 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

CE454 Urban Transportation Planning
Hours 3
The course will provide a foundation in urban transportation planning, including an introduction to the planning process, software associated with transportation modeling and conducting transportation planning and traffic impact studies.
Prerequisite(s): CE 350

CE458 Traffic Engineering
Hours 3
Vehicle operating characteristics, traffic flow, geometric design of road and intersections, and methods of traffic control.
Prerequisite(s): CE 350

CE459 Pavement Design and Rehabilitation
Hours 3
This course covers two major areas of asphalt and concrete pavements: pavement thickness design and pavement maintenance. Topics include pavement design by the Asphalt Institute and AASHTO methods. Major maintenance will cover overlay design and slab repair, while routine maintenance will cover distress surveys, pothole repair, and crack and joint sealing.
Prerequisite(s): CE 350 or CE 366
Prerequisite(s) with concurrency: CE 340

CE461 Horizontal Construction Methods
Hours 3
Introduction to horizontal construction equipment and methods, design of horizontal construction systems and construction operation analysis and simulation.
Prerequisite(s): CE 366
Prerequisite(s) with concurrency: CE 340

CE462 Vertical Construction Methods
Hours 3
Introduction to vertical construction equipment and methods, design of vertical construction systems and construction operation analysis and management processes.
Prerequisite(s): CE 366
Prerequisite(s) with concurrency: CE 331

CE463 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 tools and techniques, contingency planning, and relationship to contract types and project execution strategies.
Prerequisite(s): CE 366
CE464 Safety Engineering and Management  
Hours 3  
An introduction to safety management 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 and CE 366

CE466 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

CE467 Constr. Accounting & Finance  
Hours 3  
Financial management of construction projects. Topics include alternative selection, life-cycle analysis, applied financial management techniques, insurance/indemnification, risk management and tax implications.  
Prerequisite(s): CE 366

CE468 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 within this discipline is required for a passing grade in this course.  
Prerequisite(s): CE 366

CE470 Water Resources in the European Alps  
Hours 4  
The course focuses on statistical hydrology, climate, dendrohydrology (tree rings) and glaciers. The classroom lectures and in-class labs include the use of statistical software to analyze hydrologic datasets, the use of remote imagery to evaluate glacier recession, application of empirical equations to estimate glacier mass loss, evaluation of hydrologic (streamflow, snowpack) and climatic datasets, developing skeleton plots and cross dating tree-ring data, and seminars. The field labs consist of hand coring and analyzing tree ring data.  
Prerequisite(s): Sophomore status, 2.5 GPA, CE 378

CE471 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

CE475 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

CE476 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.  
Prerequisite(s): CE 378

CE480 Forensic Engineering  
Hours 3  
When failures in the built environment occur, whether during design, construction or in-service, a thorough examination of the causes is essential to both the evolution sound engineering practices and to dispute resolution through the legal system. The role of the engineer in this process is examined.

CE481 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. Writing proficiency within this discipline is required for a passing grade in this course.  
Prerequisite(s): CE 320, CE 331, CE 340, CE 350, CE 366 or CE 378, and one HU elective (3 credits)

CE485 Const. Site Erosion Control  
Hours 3  
Prerequisite(s): CE 378

CE486 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
CE491 Special Topics in Civil Engineering
Hours 1-4
Credit is based on the amount of work undertaken. This course is presents developing topics in the Civil Engineering disciplines including: transportation systems, processes and model; site development; architectural & building systems; advances in civil engineering materials and structural design; environmental analysis, modeling, or processes; hydrologist processes, models and water resources advances; next generation construction engineering; sustainability and resilient infrastructure systems.
Prerequisite(s): CE 262 AND One of the following: CE 320, CE 340, CE 350, CE 366, CE 378

CE492 Independent Study in Civil Engineering Sub-Disciplines
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.

CE498 Undergraduate Research Experience
Hours 1-6
Conduct research under the guidance of a faculty member. Analyze data. Produce and present, submit or publish related scholarly work.
Prerequisite(s): CE 320 or CE 331 or CE 340 or CE 350 or CE 366 or CE 378, and Permission of a department faculty member (research advisor)

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.

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 Management
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 Management
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
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

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 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

CE533 Structural Loads
Hours 3
Calculation of typical gravity and lateral loads on Civil Engineering structures, identification of load paths for different building systems, and preliminary evaluation of structural adequacy.
Prerequisite(s): CE 331

CE534 Advanced Structural Mechanics
Hours 3
Introduction to advanced 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

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

**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 Contrl  
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.

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.