# CE-Civil Engineering Courses

## Courses

**CE 011. Undergraduate Internship in CE. 0 Hours.**
Engineering internship experience in preparation for the student's intended career. Students in a university recognized cooperative education experience should register for COP 011 or COP 012.

**CE 200. Engineering Geology. 2 Hours.**
Fundamentals and advanced topics of geology including plate tectonics, mineral formation, sedimentary / igneous / metamorphic rocks, structural deformations, weathering and erosion, groundwater migration, and slope stability.

**CE 210. Statics. 3 Hours.**
Newton's laws of motion. Scalar and vector quantities, vector algebra, and the concepts of position and moment vectors. Two-dimensional systems: forces, moments, couples, and resultants. Three-dimensional systems and equivalent force systems, free body diagrams, and equations of equilibrium. Construction of shear force and bending moment diagrams. Analysis of pin-connected beams, plane trusses, and frames: method of joints and method of sections. Friction and properties of surfaces. Center of mass, center of gravity, and area moment of inertia. Quantitative Literacy is a significant component of this course.
**Prerequisites:** (MA 126 [Min Grade: C] or MA 126 [Min Grade: P] or MA 226 [Min Grade: C]) and (PH 221 [Min Grade: C] or PH 221 [Min Grade: P])

**CE 220. Mechanics of Solids. 3 Hours.**
Variation of stress at a point. Equilibrium requirements and body force concepts. Variation of strain at a point. Stress-strain relationships. Stress transformation and Mohr’s Circle for plane stress. Analysis of axially loaded bars, circular shafts in torsion, shear and bending of beams, and buckling of columns. Analysis of simple, statically determinate and indeterminate structures.
**Prerequisites:** CE 210 [Min Grade: D]

**CE 221. Mechanics of Solids Laboratory. 1 Hour.**
Standard tensile, torsion, bending, and column tests. Installation and applications of strain gages and rosettes. Measurement of forces, displacements, strains, and other variables. Writing is a significant component of this course.
**Prerequisites:** CE 220 [Min Grade: D](Can be taken Concurrently)

**CE 222. Civil Engineering Materials Laboratory. 1 Hour.**
Testing properties of construction materials such as cement, aggregate, concrete, and asphalt. Design of Portland cement concrete mixes. Writing is a significant component of this course.
**Prerequisites:** CE 220 [Min Grade: D](Can be taken Concurrently)

**CE 230. Plane Surveying. 3 Hours.**
Fundamental topics of surveying including care and use of surveying instruments, surveying methods, error theory, traversing, stadia, mapping techniques, circular and parabolic curves, areas, and volumes. CE 230L must be taken concurrently.
**Prerequisites:** MA 125 [Min Grade: C] or MA 225 [Min Grade: C]

**CE 230L. Plane Surveying Laboratory. 0 Hours.**
Principles of land measurement, the instruments and techniques used in surveying, theory of errors and mathematical precision in engineering analysis and design. Introduction to route surveying and the principles of horizontal and vertical curves. Companion to CE 230 and must be taken concurrently.

**CE 236. Environmental Engineering. 3 Hours.**
Introduction to environmental engineering principles. Air and water pollution, solid waste, quality of environment, environmental health, regulations and legal considerations, and ethics and civic responsibility. Design of testing protocols.
**Prerequisites:** MA 125 [Min Grade: C](Can be taken Concurrently) or MA 225 [Min Grade: C](Can be taken Concurrently) and CH 115 [Min Grade: C]

**CE 236L. Environmental Engineering Laboratory. 0 Hours.**
Laboratory equipment and methods. Chemical and physical tests to determine characteristics of water and wastewater. Companion lab to CE 236 and must be taken concurrently.

**CE 280. Sustainable Cities. 3 Hours.**
Students learn how the built environment affects a variety of quality-of-life factors, including the natural environment, personal health, and broader measures of community health and well-being. Classroom lectures are reinforced through field activities, data collection, and direct interaction with the Birmingham government and community organizations. Classes focus on built environment elements such as urban design, building materials, green building design, green spaces, transportation infrastructure, and advanced technologies. Each course offered under this proposal will requires a final project that combines course topics with data collection/activities conducted in Birmingham communities. This course meets Blazer Core City as Classroom requirement with a flag in Sustainability and Service Learning.

**CE 332. Soil Engineering. 4 Hours.**
Soil identification and properties, stress concepts, permeability settlement analysis, soil compaction, bearing capacity, shear strength of soil, and slope stability. CE 332L must be taken concurrently.
**Prerequisites:** CE 200 [Min Grade: D] and CE 220 [Min Grade: D]

**CE 332L. Soil Engineering Laboratory. 0 Hours.**
Soil classification, strength and shear tests, and permeability and consolidation tests. Companion to CE 332 and must be taken concurrently.

**CE 337. Hydraulics. 3 Hours.**
Fundamentals of hydraulics, fluids, and flow in pipe systems. Topics covered in fluid flow include hydrostatics, laws of fluid motion, kinematics, dynamics, energy balance, and dimensionless groups. Topics covered in pipe flow include incompressible flow, compressibility, pumps, viscosity, boundary layers, turbulence, and losses. The course includes appropriate laboratory experiments and computer applications.
**Prerequisites:** MA 126 [Min Grade: C] or MA 226 [Min Grade: C]

**CE 337L. Hydraulics Laboratory. 0 Hours.**
The laboratory exercises are designed to assist the student in the investigation of fluid properties, fluid statics, and application of flow measurement techniques, application of conservation laws of mass, momentum and energy, major and minor losses, and pipe networks. Companion lab to CE 337 and must be taken concurrently.

**CE 344. Civil Engineering Analysis I. 3 Hours.**
Inspection and treatment of data using exploratory data analysis. Descriptive statistics. Introduction to probability and commonly used distributions. Basic data analysis using regression analysis, hypothesis testing, and analysis of variance. Quantitative literacy is a significant component of this course.
**Prerequisites:** MA 126 [Min Grade: C] or MA 226 [Min Grade: C]

**CE 345. Transportation Engineering. 3 Hours.**
Principles of transportation engineering and urban transportation planning. Traffic flow characteristics, traffic control, capacity analysis of basic highway sections and intersections, geometric design, and travel demand forecasting.
**Prerequisites:** PH 221 [Min Grade: C]

**CE 360. Structural Analysis. 3 Hours.**
Reactions, shears, moments, and axial forces in determinate and indeterminate structures. Influence lines; moment area and energy methods of computing deflections; methods of truss and frame analysis. Computer applications.
**Prerequisites:** CE 210 [Min Grade: D]

**CE 371. Engineering Communication. 2 Hours.**
Introduces communication skills necessary for professional development. Topics include forms of technical writing and oral communication, report writing and organization, plan reading, professional practice, and ethics.
**Prerequisites:** EH 102 [Min Grade: D]

**CE 395. Engineering Economics. 3 Hours.**
Fundamental concepts of engineering economy. Introduction to cost and revenue estimating and cash flow analysis for engineering projects. Choosing between alternatives taking into account the time value of money, depreciation, inflation, income taxes and risk factors.
**Prerequisites:** MA 125 [Min Grade: C] or MA 225 [Min Grade: C]

**CE 410. FE Review for Civil Engineers. 0 Hours.**
Review concepts of the engineering core and civil engineering in preparation for the Fundamentals of Engineering (FE) exam.

**CE 415. Building Information Modeling (BIM). 3 Hours.**
Introduction to virtual design and construction using AutoCAD and Revit software. An emphasis is placed on the use of these tools and their practical applications to real world engineering and design projects. Students are provided with the software required to complete a multi-step project.
**Prerequisites:** EGR 103 [Min Grade: D] or ME 102 [Min Grade: D]

**CE 420. Advanced Mechanics. 3 Hours.**
Variation of stress at point including determination of principal and maximum shear stresses. Strain gages and rosettes. Failure theories. Inelastic stress-strain behavior of axially loaded bars. Torsion of noncircular sections and plastic torque. Curved beams. Elastic and plastic analysis for unsymmetrical bending. Shear center. Beams on elastic foundations.
**Prerequisites:** CE 220 [Min Grade: D]

**CE 426. Foundation Engineering. 3 Hours.**
Design of foundations including bearing capacity and settlement of spread footings, mats, single piles, and pile groups. Site investigation and evaluation of data from field and tests. Estimation of stresses in soil masses, lateral resistance of piles and pile groups. Design of retaining walls, sheet piles, and cofferdams.
**Prerequisites:** CE 332 [Min Grade: D] and CE 455 [Min Grade: D]

**CE 430. Water Supply/Drainage Design. 3 Hours.**
Water requirements; wastewater characteristics. Hydraulics and design of sewers; distribution and reuse of water. Development of water supplies; design considerations.
**Prerequisites:** CE 337 [Min Grade: D]

**CE 430L. Water Supply/Drainage Design Laboratory. 0 Hours.**
The laboratory exercises are designed to assist the student in the investigation of water supply and drainage design including the analysis of water networks, pipe network design, storm-water and sewer collection network design, flow path visualization, hydraulic jump, flow over weirs, channel design, and basin modeling. Companion lab to CE 430 and must be taken concurrently.

**CE 434. Air Quality Modeling and Monitoring. 3 Hours.**
Overview of atmospheric pollutant effects, reactions, and sources. Introduction to air dispersion modeling and ambient air quality monitoring.

**Prerequisites:** ME 251 [Min Grade: D]

**CE 440. Civil Engineering Honors Research. 3 Hours.**
Departmental honors students work closely with faculty researchers and graduate students in departmental concentration specialties to develop research skills. Enrollment is limited to undergraduate students enrolled in CCEE Departmental Honors Program.

**CE 441. Civil Engineering Honors Seminar. 1 Hour.**
Seminar focusing on student research and guest presentations of various topics of interest to civil and environmental engineering students.

**CE 443. Pavement Design and Construction. 3 Hours.**
Analysis of stresses and strains in pavement systems. Design and construction of flexible and rigid pavements, base courses, and subgrades. Effects of loading on pavement life.
**Prerequisites:** CE 345 [Min Grade: D]

**CE 445. Engineering the Built Environment. 3 Hours.**
This service learning course explores the effects the built environment has on urban function, connectivity, community health, and the well-being of its residents. Students work directly in local neighborhoods learning how to assess components of the built environment, including transportation, green spaces, lighting, and blight, and to estimate their impacts on community health and well-being. Students propose engineering solutions, develop cost estimates, assess potential benefits, and develop implementation plans. Registration restricted to Junior or Senior standing.

**CE 446. Green Infrastructure and Transportation. 3 Hours.**
Policy and technical issues related to sustainable transportation. Examines the concepts, viewpoints, and fundamentals essential for understanding sustainable transportation planning and the tools used to assess sustainability of transportation facilities and neighborhoods. Design options in support of green infrastructure and transportation, including livable street design and traffic calming applications. Registration restricted to Junior or Senior standing.

**CE 447. Principles of Sustainable Development. 3 Hours.**
Concepts, viewpoints, and fundamentals essential for understanding the urban sustainable development agenda. Review of basic earth sciences to better evaluate the impact of anthropogenic activities on the natural environment and how to minimize adverse future outcomes. Case studies of sustainable developments are used to illustrate the value, challenges, and limitations of this concept.
**Prerequisites:** CE 236 [Min Grade: D]

**CE 450. Structural Steel Design. 3 Hours.**
Tension members, columns, beams, and beam columns. Simple connections. Load Resistance Factor Design (LRFD) approaches.
**Prerequisites:** CE 220 [Min Grade: D] and CE 221 [Min Grade: D](Can be taken Concurrently) and CE 360 [Min Grade: D]

**CE 453. Design of Wood Structures. 3 Hours.**
Properties of structural wood materials, both sawn lumber and engineered wood materials. Design of wood structures including beams, columns, connections, roof diaphragms, and shear walls. The requirements of the National Design Specification for Wood Structures will be addressed.
**Prerequisites:** CE 220 [Min Grade: D] and CE 360 [Min Grade: D]

**CE 454. Design of Masonry Structures. 3 Hours.**
Design and detailing of masonry structures. Nomenclature, properties, and specifications for components. Design of assemblages, simple masonry structures, unreinforced and reinforced elements, and complex masonry structures.
**Prerequisites:** CE 220 [Min Grade: D] and CE 360 [Min Grade: D]

**CE 455. Reinforced Concrete Design. 3 Hours.**
Behavior, strength, and design of reinforced concrete structural members (beams, columns, one-way slabs, and continuous beams) subjected to moment, shear, and axial forces according to the American Concrete Institute Building Code Requirements for Structural Concrete (ACI 318). Crack control and serviceability considerations. Introduction to the design of reinforced concrete structures.
**Prerequisites:** CE 220 [Min Grade: D] and CE 222 [Min Grade: D](Can be taken Concurrently) and CE 360 [Min Grade: C]

**CE 456. Prestressed Concrete Design. 3 Hours.**
Principles and concepts of design in prestressed concrete including elastic and ultimate strength analyses for flexural, shear, bond, and deflection. Principles of concordance and linear transformation for indeterminate prestressed structures.
**Prerequisites:** CE 455 [Min Grade: D]

**CE 460. Structural Mechanics. 3 Hours.**
Elastic beam deflections, beam columns, lateral torsional buckling, column stability, plastic design, plate bending, and yield line theory.
**Prerequisites:** CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

**CE 461. Introduction to the Finite Element Method. 3 Hours.**
Concepts and applications of finite element method (FEM). Review of statics, equilibrium, compatibility, and constitutive relations. Direct stiffness method, principle of virtual work, concept of stiffness, and matrix methods: planar trusses, beams, and planar frames. Support settlements, three-dimensional systems; development and application of basic finite elements. Software use.
**Prerequisites:** CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

**CE 462. Advanced Structural Analysis. 3 Hours.**
Analysis of indeterminate structures utilizing both classical and matrix methods. Use of computer structural analysis programs.
**Prerequisites:** CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

**CE 464. Structural Dynamics. 3 Hours.**
Closed form and numerical solutions to single-degree-of-freedom structural models. Analysis of multistory frames. Response of single and multiple degree of freedom models to harmonic, periodic, impulse and arbitrary time-dependent loads. Computer applications and seismic analysis. Techniques of modal analysis.
**Prerequisites:** CE 220 [Min Grade: D] and CE 360 [Min Grade: C] and ME 215 [Min Grade: D]

**CE 465. CE Construction Documents. 3 Hours.**
Introduction to Civil Engineering design and construction documents including drawings, specifications, contracts, and testing reports. Overview of civil infrastructure and project types, including the civil engineer's role in the preparation, certification, and use of construction documents. Construction topics include measurement, quantity estimating, and engineering budgets.

**CE 467. Wind and Seismic Loads. 3 Hours.**
Methods for calculating loads on structures caused by extreme winds and earthquakes. Calculation of wind loads on various types of structures according to theory and codes. Determination of earthquake loads on structures using structural dynamics and codes.
**Prerequisites:** CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

**CE 468. Bridge Engineering. 3 Hours.**
Bridge loads, steel beam bridges, composite beam bridges, bridge bearings, reinforced and prestressed concrete slab and T-beam bridges, bridge evaluations and ratings, and upgrade methodologies. Computer applications.
**Prerequisites:** CE 220 [Min Grade: D] and CE 360 [Min Grade: C]

**CE 470. International Research Experience. 3 Hours.**
The International Research Experience for Students (IRES) program provides the opportunity for undergraduate and graduate students to participate in hands-on engineering research in an international setting. Students perform research on an approved topic related to civil engineering design in an international environment. Students perform a detailed literature review and work with mentors from UAB and the international host institution to develop research objectives and a detailed research plan. The course will culminate in a 6-8 week visit to the international host institution, during which time students will conduct hands-on research with their mentors and prepare final reports.

**CE 475. Construction Safety and Health Management. 3 Hours.**
This course covers various causes of construction accidents and the adopted strategies to prevent worksite injuries and illnesses. Other topics covered include workers' compensation, OSHA standards for the construction industry, economics of construction safety management, temporary structures, system safety, ergonomic applications, health hazards, and the development of a safety program.
**Prerequisites:** CE 344 [Min Grade: D]

**CE 480. Introduction to Water and Wastewater Treatment. 3 Hours.**
Examination of chemical/biological unit processes for water and wastewater treatment. Design of wastewater treatment facilities and unit processes. Treatment and disposal of sludge.
**Prerequisites:** CE 236 [Min Grade: C]

**CE 485. Engineering Hydrology. 3 Hours.**
Hydrologic principles including the hydrologic cycle, precipitation data and stream-flow measurements. Applications to engineering problems: stream-flow analysis, and watershed management.
**Prerequisites:** CE 337 [Min Grade: C]

**CE 489. Undergraduate Engineering Research. 0 Hours.**
Undergraduate research experiences in civil, construction and/or environmental engineering.
**Prerequisites:** (EGR 194 [Min Grade: D] or EGR 111 [Min Grade: D]) or EGR 200 [Min Grade: D] or HC 111 [Min Grade: D] and MA 125 [Min Grade: C] or MA 225 [Min Grade: C] and PH 221 [Min Grade: C](Can be taken Concurrently)

**CE 490. Special Topics in Civil Engineering. 1-3 Hour.**
Special Topics in Civil Engineering.

**CE 491. Individual Study in Civil Engineering. 1-6 Hour.**
Individual Study in Civil Engineering.

**CE 497. Construction Engineering Management. 3 Hours.**
Study of construction management services including project planning, scheduling, estimating, budgeting, contract administration, agreements, and ethics. Emphasis is on the management of manpower, materials, money, and machinery.
**Prerequisites:** CE 395 [Min Grade: D]

**CE 499. Capstone Design Project. 3 Hours.**
Students work in teams to solve a complex engineering problem that incorporates real-world aspects of civil engineering design including structural, geotechnical, environmental, transportation, and construction management components. The course also includes lectures and assignments related to professionalism including engineering ethics, leadership, and management. Students must sit for the FE exam as part of course requirements. Normally taken during last term before graduation.
**Prerequisites:** CE 332 [Min Grade: D] and CE 337 [Min Grade: C] and CE 345 [Min Grade: D] and (CE 450 [Min Grade: D] or CE 455 [Min Grade: D]) and CE 430 [Min Grade: D](Can be taken Concurrently) and CE 497 [Min Grade: D](Can be taken Concurrently)