CE 515. Building Information Modeling (BIM). 3 Hours.
This class provides an introduction to the virtual world of design and construction. Topics covered include uses for technology, what is BIM, and have a focus on AutoCAD and Revit Software. An emphasis is placed on the use of these tools and their practical applications to the real world environment. Students are provided with the software through the Autodesk Student community and are required to complete a Multi-Step term Project.

CE 516. Mechanical Vibrations. 3 Hours.
Free and forced single-degree-of-freedom systems. Multi-degree-of-freedom systems. Simple continuous systems. CE 215 (Dynamics) and E 220 (Mechanics of Solids) are prerequisites for this course.

CE 520. Advanced Mechanics. 3 Hours.
Variation of stress at point including determination of principal and maximum shear stresses. Basic problems involving symmetrical deformation; thickwall cylinders, spheres, and rotating disk. Torsions of noncircular sections. Curved beams. Failure Theories. Unsymmetrical bending and shear center. CE 220 (Mechanics of Solids) is a prerequisite for this course.

CE 526. Foundation Engineering. 3 Hours.
Application of principles of soil mechanics to: determine bearing capacity and settlement of spread footings, mats, single piles and pile groups; site investigation, evaluate data from field and laboratory tests; estimation of stresses in soil masses; lateral resistance of piles and pile groups; retaining walls, sheetpiles and coffer-dams.

CE 530. 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. CE 337 (Hydraulics) is a prerequisite for this course.

CE 531. Energy Resources. 3 Hours.
Overview of the various energy resources: oil, natural gas, coal, nuclear, hydro, solar, geothermal, biomass, wind, and ocean energy resources, in terms of supply, distribution, recovery and conversion, environmental impacts, economies, policy, and technology. Concepts and opportunities for energy conservation; including electric power generation, changing role of electric utilities, transportation applications, and energy use in developing countries. Field trips.

CE 533. Solid and Hazardous Wastes Management. 3 Hours.
Overview of waste characterizations, regulations, and management options.

CE 534. Air Quality Modeling and Monitoring. 3 Hours.
Atmospheric pollutants; effects, reactions, and sources. Air pollution meteorology and dispersion modeling. Ambient monitoring. ME 250 (Introduction to Thermodynamic Sciences) is a prerequisite for this course.

CE 537. Environmental Experimental Design and Field Sampling. 3 Hours.
Experimental design, sensitivity analyses, water sampling, and flow monitoring. Receiving water chemical reactions. Field investigations. CE 344 (Civil Engineering Analysis I) is a prerequisite for this course.

CE 537L. Environmental Experimental Design and Field Sampling Lab. 0 Hours.
Lab experiences in environmental experimental design and field sampling.

CE 542. Hwy Materials and Construction. 3 Hours.
Properties of materials used in highway construction. Construction methods and management. CE 332 (Soil Engineering) and CE 345 (Transportation Engineering) are suggested prerequisites for this course.

CE 543. Pavement Design & 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.

CE 544. Civil Engineering Analysis II. 3 Hours.
Sampling and experimental design. Hypotheses testing. Decision Analyses. Multiple regression analyses. Nonparametric methods. Analysis of experimental data in civil engineering research; regression, experimental design, non-parametrical analysis. CE 344 (Civil Engineering Analysis I) is suggested as a prerequisite for this course.

CE 553. Design of Wood Structures. 3 Hours.
This course will give students an understanding of structural wood materials, both sawn lumber and a number of engineered wood materials. The main objective of the course is to learn how to design wood structures using these materials, including the design of beams, columns, connections, roof diaphragms, and shear walls. The requirement of the National Design Specification for Wood Structures will be addressed.

CE 554. 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. CE 360 (Structural Analysis) is a prerequisite for this course.

CE 556. Prestressed Concrete Design. 3 Hours.
Principles and concepts of design in prestressed concrete including elastic and ultimate strength analysis for flexural, shear, bond, and deflections. Principles of concordancy and linear transformation for indeterminate prestressed structures. CE 455 (Reinforced Concrete Design) is a prerequisite for this course.

CE 557. Concrete Technology. 3 Hours.
Properties of concrete in relation to specifying, purchasing, and evaluating concrete materials. Fresh and hardened concrete properties. Concrete mix design procedures. Effects of finishing, curing, weather conditions, and various construction procedures. Ready mix concrete production and field placement techniques. Specifications writing to ensure good quality concrete and field inspection procedures. Case studies of problems in concrete construction. CE 222) (Civil Engineering Materials Laboratory) is a prerequisite for this course.

CE 560. Structural Mechanics. 3 Hours.
Elastic beam deflections, beam columns, lateral torsional buckling, column stability, plastic design, plate bending, yield line theory.

CE 561. Introduction to the Finite Element Method. 3 Hours.
Concepts and applications of the finite element method. Development and applications of basic finite elements. Software use.

CE 562. Advanced Structural Analysis. 3 Hours.
Analysis of indeterminate structures using classical and matrix methods. Use of large-scale computer programs. A grade of C or better in CE 360 (Computer Methods in Civil Engineering) or its equivalent is required.
CE 564. Structural Dynamics. 3 Hours.

CE 567. 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. CE 360 (Structural Analysis) is a prerequisite for this course.

CE 568. 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, upgrade methodologies; computer applications. CE 450 (Structural Steel Design) and CE 455 (Reinforced Concrete Design) are prerequisites for this course.

CE 570. 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 select a topic, 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 575. 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.

CE 580. Introduction to Water and Wastewater Treatment. 3 Hours.
Physical unit operations, and chemical/biological unit processes for water and wastewater treatment. Design of facilities for treatment. Treatment and disposal of sludge. CE 236 (Environmental Engineering) is a prerequisite for this course.

CE 585. Engineering Hydrology. 3 Hours.
Hydrologic principles including hydrology cycle, precipitation data, and stream-flow measurements. Applications to engineering problems; stream-flow analysis and watershed management.

CE 590. Special Topics in Civil Engineering. 1-6 Hour.
Special Topic in Civil Engineering.

CE 591. Individual Study in Civil Engineering. 1-6 Hour.
Individual Study in Civil Engineering.

CE 600. Sustainable Construction. 3 Hours.
Study of sustainable construction techniques and best practices. Provides an understanding of the interdependencies between planning, designing, building, operating, and demolishing the built environment and their impacts on the natural environment. Course topics will include: (1) issues of recourse efficiency, economics, ethics, waste, human health, environmental justice, and industrial ecology; (2) alternative practices that significantly reduce adverse environmental impacts of built infrastructure, and (3) explore past and present thinking of engineering practitioners in this newly emerging discipline.

CE 605. Project Management. 3 Hours.
Presents the theory and practice of project management as a distinct discipline with applications in time, cost, and performance management. Managerial, organizational, behavioral and cost benefit aspects of project management are covered, as well as various applied models for organizing, executing, and monitoring a project. Basic estimating techniques to determine cost and time for construction work packages are discussed followed by scheduling model techniques to include the Critical Path Method (CPM), Precedence Diagramming Method (PDM), Program Evaluation and Review Technique (PERT), and Gantt charts.

CE 607. Engineering Entrepreneurship. 3 Hours.
Course focuses on the entrepreneurial engineer—a new type of engineer who needs a broad range of business skills and knowledge above and beyond a strong science and engineering background. The course will introduce engineering students to the key aspects of engineering entrepreneurship including business planning, solving problems, risk taking, financing, marketing, and entrepreneurial leadership. The students will also be introduced to the many opportunities and challenges that accompany starting and operating an entrepreneurial venture. Entrepreneurial company leaders will present their experiences and share their leadership styles as part of the course.

CE 608. Green Building Design. 3 Hours.
Quantitative introduction to the principles of “Green Building Design”. Provides students an understanding of the interdependencies between economics, technology, design, building occupation and the subsequent impact on the natural environment. Course will emphasize green building materials, new technologies, and sustainable construction methods. Course also includes LEED Case Studies (industrial, commercial, residential, and institutional examples).

CE 610. The Engineered Environment. 3 Hours.
Fundamentals of environmental engineering as they apply to the construction of the built environment and contemporary issues faced by engineers in developing nations such as Egypt. Topics include air pollution, solid waste management, water treatment, environmental ethics, etc.

CE 612. Theory of Elasticity. 3 Hours.
Equations of linear reduction to plane stress, plane strain, and generalized plane strain. Airy and love stress functions in solution of problems.

CE 615. Theory of Elastic Stability. 3 Hours.
Static stability of bars, beams, trusses, and rigid frames. Dynamic stability of bars. Energy method applied to bucking problems. General theory of elastic stability. CE 220 (Mechanics of Solids) is a prerequisite for this course.

CE 617. Theory of Plates and Shells. 3 Hours.

CE 621. Transportation Engineering Seminar. 1 Hour.
Seminar focusing on student research and guest presentations of various topics of interest to graduate transportation engineering students.

CE 622. Traffic Flow Theory. 3 Hours.
Microscopic and macroscopic traffic flow characteristics. Traffic flow analytical techniques including car-following models, traffic stream models, shock wave analysis. Queuing analysis and gap acceptance. Simulation models for network analysis. CE 345 (Transportation Engineering) is a prerequisite for this course.
CE 623. Non-Motorized Transportation Design and Planning. 3 Hours.
Urban planning principles that support non-motorized transportation, local bicycle or pedestrian plans, non-motorized transportation safety related considerations, non-motorized transportation design including traffic calming techniques, procedures for capacity analysis of pedestrian facilities.

CE 624. Simulation Models for Transportation Applications. 3 Hours.
Basic concepts of simulation models for analysis and optimization of transportation systems. Experimentation with planning simulation models and traffic models for signal timing and capacity analysis. CE 345 (Transportation Engineering) is a prerequisite for this course.

CE 625. Intelligent Transportation Systems. 3 Hours.
Legal, institutional and planning issues. System architecture, telecommunication techniques, Advanced User Services, intermodal systems, deployment programs, cost and benefit evaluation.

CE 631. Environmental Law. 3 Hours.
Law as it applies to the practicing environmental engineer. New and emerging regulations.

CE 632. Industrial Waste and Wastewater Treatment. 3 Hours.
Solid wastes and wastewaters from various industries. Assessment of treatability, system design, and equipment selection.

CE 633. Solid and Hazardous Waste Management. 3 Hours.
Provides students a quantitative introduction to solid and hazardous waste characterizations, international regulations, and management options. Course topics to include (1) Solid waste management hierarchy (reduce, reuse, recycle, recovery, responsible disposal); (2) Dry tomb landfill design; and (3) Hazardous waste identification and treatment/disposal.

CE 636. Stormwater Pollution Management. 3 Hours.
Quality and quantity of stormwater. Receiving water problems and sources of pollutants. Runoff quality and quantity characterizations. Erosion control. Selection and design of controls; regulations.

CE 638. Water and Wastewater Chemistry. 3 Hours.

CE 639. Sediment Sources and Controls. 3 Hours.
Erosion and sediment transport areas; design of common erosion control practices.

CE 640. Wastewater Treatment Engineering. 3 Hours.
Wastewater sources and characteristics. Design and operation of wastewater treatment facilities, including grit removal, oil and grease removal, dissolved air flotation, activated sludge process, trickling filters, and rotating biological contractors, stabilization ponds and aerated lagoons, anaerobic processes for wastewater treatment and sludge digestion. Ultimate disposal of wastewater residues and considerations of discharge criteria.

CE 641. Civil Engineering Seminar. 0 Hours.
Seminar focusing on guest presentations of various civil and environmental engineering topics of interest for CE Masters students. Mandatory enrollment once prior to graduation.

CE 646. Traffic Engineering Operations. 3 Hours.
Highway and Intersection capacity analysis, traffic signal timing and phasing, coordination, freeway operations, non-signalized traffic control techniques. CE 345 (Transportation Engineering) is a prerequisite for this course.

CE 648. Urban and Transportation Planning. 3 Hours.
Land use planning for transportation systems; trip generation, trip distribution, and traffic assignment. CE 345 (Transportation Engineering) or an equivalent is a prerequisite for this course.

CE 649. Engineering Liability. 3 Hours.
Laws related to liability for engineering design in the context of productsliability and construction projects; roles and liabilities between various parties involved in construction projects.

CE 650. Advanced Structural Steel. 3 Hours.
Beams, columns, tension members, and connections; current research. CE 450 (Structural Steel Design) or its equivalent is required.

CE 655. Advanced Reinforced Concrete. 3 Hours.
Beam, column, and slab actions; current research. CE 455 (Reinforced Concrete Design) or its equivalency is required.

CE 658. Engineering Management. 3 Hours.
Management techniques for the practicing engineer.

CE 663. Finite Element Methods. 3 Hours.
Theory and applications in structural mechanics. Plane stress, plane strain, axisymmetric problems, solids, plates, shells, nonlinear systems.

CE 681. Environmental Chemistry. 3 Hours.
Chemical equilbrium, acid/base, chemical concepts in pollutant behavior. Chemical kinetics, redox system, hydrolysis, pesticides, chemical wastes.

CE 682. Water Treatment Engineering. 3 Hours.
Water sources and characteristics. Design and operations of water treatment facilities. Topics include lime softening operations, coagulation, flocculation, clarification dissolved air flotation, filtration, disinfection, absorption, ion exchange and sludge management.

CE 683. Water and Wastewater Treatment Processes Lab. 3 Hours.
Construction and evaluation of bench-scale treatment processes. Treatability of water and wastewater. Coagulation of sedimentation, settleability of biological sludge, aerobic biological treatment, chemical treatment, water softening toxicity, disinfection, and sludge treatment processes.

CE 685. Engineering Hydrology. 3 Hours.
Hydrologic principles including hydrologic cycle, precipitation data, and stream-flow measurements. Applications to engineering problems; stream-flow analysis and watershed management. A grade of C or better in CE 337 (Hydraulics) or its equivalency is required.

CE 686. Engineering Hydrogeology. 3 Hours.
Groundwater movement, natural quality, contamination, and restoration. Physical and chemical properties of groundwater. Well hydraulics and flow net analyses. Prevention and control of groundwater contamination. CE 485 (Engineering Hydraulics) and MA 252 (Differential Equations) are required.

CE 687. Stormwater Detention Pond Design. 3 Hours.
Stormwater problems and control methods. Urban hydrology prediction procedures for drainage and water quality studies. Detention pond design basics, limitations and multiple benefits.
CE 688. Strategic Management and Leadership Applications in a Global Environment. 3 Hours.
This course is designed to prepare students to face the demanding management and leadership challenges facing construction and engineering industry leaders as competition becomes ever more globalized. The necessity to personally remain trained and relevant in the changing business environment is emphasized. Strong resume writing and oral interview skills are emphasized as a necessary skill for job seekers as well as job providers. Strategic planning, management and leadership in the built environment requires savvy leaders with exceptionally developed analytical and communications skills suitable for multi-disciplinary and multi-national ventures. Every individual and organization must continually innovate and reinvent to stay competitive. In a competitive environment, a strong working knowledge of the financial markets is essential and students are exposed to multiple lessons presented by financial industry practitioners. Students participate in a group project designed to reinforce the methodology associated with preparing and presenting a dynamic business plan. This course provides the opportunity for students to discuss and research these concepts and to recognize the necessity to think independently, challenge conventional thinking, and visualize alternatives.

Prerequisites: CE 669 [Min Grade: C]

CE 689. Building Information modeling (BIM) Techniques. 3 Hours.
This course provides students with an overview of the evolution of BIM technology in the construction industry followed by hands-on training in the basic application of contemporary BIM software. Students will learn basic modeling skills and how to produce graphical presentations. Advanced applications of BIM technology are discussed and demonstrated. Students will be provided with BIM software and are required to complete a multi-step BIM model as a term project.

Prerequisites: CE 669 [Min Grade: C]

CE 690. Special Topics in (Area). 1-3 Hour.
Special Topics (Area).

CE 691. Individual Study in (Area). 1-4 Hour.
Individual Study (Area).

CE 692. CE Capstone Project. 3 Hours.
This course covers specific contemporary topics related to civil engineering practice and knowledge. Capstone project using case studies to apply skills, knowledge, techniques, and concepts developed in prior courses.

CE 693. Applied Research in CEE. 3-9 Hours.
Research tools, including elements of experimental design and proposal preparation. Effective communication, literature searches, and exploratory data analysis. Prerequisite: permission of instructor.

CE 695. International Construction Contracts/Liability. 3 Hours.
Provides an overview of the fundamental aspects of the law that affects construction and engineering companies as well as the project owners. Particular emphasis is placed on contract forms and provisions related to liability for engineering design and construction companies, the roles of the typical participation in the process, and dispute resolution.

CE 697. Master's Project. 3-9 Hours.
A UAB Master's Project must demonstrate evidence of scholarly study and writing that ultimately contributes to the scientific knowledge base. This course is designed to allow students the opportunity to develop original ideas or seek to advance knowledge through theory, conceptualization, design, testing of tools, instruments, or procedures relevant to the practice of civil engineering.

Prerequisites: GAC M

CE 712. Theory of Elasticity. 3 Hours.
Equations of linear reduction to plane stress, plane strain, and generalized plane strain. Airy and love stress functions in solution of problems.

CE 715. Theory of Elastic Stability. 3 Hours.

CE 717. Theory of Plates and Shells. 3 Hours.

CE 721. Transportation Engineering Seminar. 1 Hour.
Seminar focusing on student research and guest presentation of various topics of interest to graduate transportation engineering students.

CE 722. Traffic Flow Theory. 3 Hours.
Microscopic and macroscopic traffic flow characteristics. Traffic flow analytical techniques including car-following models, traffic stream models, shock wave analysis. Queuing analysis and gap acceptance. Simulation models for network analysis.

CE 723. Non-Motorized Transportation Design and Planning. 3 Hours.
Urban planning principles that support non-motorized transportation, local bicycle or pedestrian plans, non-motorized transportation safety related considerations, non-motorized transportation design including traffic calming techniques, procedures for capacity analysis of pedestrian facilities.

CE 724. Simulation Models for Transportation Applications. 3 Hours.
Basic concepts of simulation models for analysis and optimization of transportation systems. Experimentation with planning simulation models and traffic models for signal timing and capacity analysis.

CE 725. Intelligent Transportation Systems. 3 Hours.
Legal, institutional and planning issues related to Intelligent Transportation Systems. System architecture, telecommunication technologies. Advanced User Services, intermodal systems, deployment, cost benefit evaluation.

CE 731. Environmental Law. 3 Hours.
Law as it applies to the practicing environmental engineer. New and emerging regulations.

CE 732. Industrial Waste and Wastewater Treatment. 3 Hours.
Solid wastes and waste waters from various industries; assessment of treatability, system design, and equipment selection.

CE 736. Stormwater Pollution Management. 3 Hours.
Quality and quantity of stormwater. Receiving water problems and sources of pollutants. Runoff quality and quantity characterizations. Erosion control. Selection and design of controls; regulations.

CE 738. Water and Wastewater Chemistry. 3 Hours.
CE 739. Sediment Sources and Controls. 3 Hours.
Erosion and sediment transport in urban areas, design of common erosion control practices.

CE 740. Wastewater Treatment Engineering. 3 Hours.
Wastewater sources and characteristics. Design and operation of wastewater treatment facilities, including grit removal, oil and grease removal, dissolved air flotation, activated sludge process, trickling filters, and rotating biological contactors, stabilization ponds and aerated lagoons, anaerobic processes for wastewater treatment and sludge digestion. Ultimate disposal of wastewater residues and considerations of discharge criteria.

CE 741. Civil Engineering Seminar. 0 Hours.
Seminar focusing on guest presentations on various civil and environmental engineering topics of interest for CE Ph.D. students. Mandatory enrollment at least once prior to graduation.

CE 749. Engineering Liability. 3 Hours.
Laws related to liability for engineering design in the context of product liability and construction projects; roles and liabilities between various parties involved in construction projects.

CE 750. Advanced Structural Steel. 3 Hours.
Beams, columns, tension members, and connections; current research.

CE 755. Advanced Reinforced Concrete. 3 Hours.
Beam, column, and slab actions; current research.

CE 758. Engineering Management. 3 Hours.
Management techniques for practicing engineers.

CE 763. Finite Element Methods. 3 Hours.
Theory and applications in structural mechanics. Plane stress, plane strain, axisymmetric problems, solids, plates, shells, nonlinear systems.

CE 781. Environmental Chemistry. 3 Hours.
Chemical equilibrium, acid/base, chemical concepts in pollutant behavior. Chemical kinetics, redox system, hydrolysis, pesticides, chemical wastes.

CE 782. Water Treatment Engineering. 3 Hours.
Water sources and characteristics. Design and operation of water treatment facilities including lime softening operations, coagulation, flocculation, clarification, dissolved air flotation, filtration, disinfection, absorption, ion exchange, and sludge disposal.

CE 783. Water and Wastewater Treatment Processes Lab. 3 Hours.
Construction and evaluation of bench-scale treatment processes. Treatability of water and wastewater. Coagulation of sedimentation, settleability of biological sludge, aerobic biological treatment, chemical treatment, water softening toxicity, disinfection, and sludge treatment processes.

CE 786. Engineering Hydrogeology. 3 Hours.

CE 787. Stormwater Detention Pond Design. 3 Hours.
Stormwater problems and control methods. Urban hydrology prediction procedures for drainage and water quality studies. Detention pond design basics, limitations and multiple benefits.

CE 790. Special Topics in (Area). 1-3 Hour.
Special Topics (In Area).

CE 791. Individual Studies (In Area). 1-4 Hour.
Individual Studies (In Area).