Civil Engineering (M.S.C.E., Ph.D.*)

View PDF of Civil Engineering Admissions Checklist
Prospective students should use this checklist to obtain specific admissions requirements on how to apply to Graduate School.

View PDF version of the Civil Engineering catalog description

*The Ph.D. is offered through a joint program with the University of Alabama in Huntsville.

Degree Offered: M.S.C.E., Ph.D.

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| Fax:          | (205) 934-9855       |
| E-mail:       | rwpeters@uab.edu     |
| Web site:     | http://www.uab.edu/engineering/departments-research/civil |

Primary Faculty

Fouad H. Fouad, Chair and Professor (Civil, Construction, and Environmental Engineering); Structural Engineering, Reinforced Concrete, Precast Concrete, Concrete Materials, Sustainability in Engineering Design

Wilbur A. Hitchcock, Professor (Civil, Construction, and Environmental Engineering); Construction Engineering Management, Structural Engineering

Ian E. Hosch, Assistant Professor (Civil, Construction, and Environmental Engineering); Structural Engineering, Structural Mechanics, Structural Dynamics

Jason T. Kirby, Associate Professor (Civil, Construction, and Environmental Engineering); Environmental Engineering, Hydraulics, Hydrology; Sustainability in Engineering Design

Melinda M. Lalor, Professor (Civil, Construction, and Environmental Engineering); Environmental Engineering, Surface Water Quality, Watershed Management, Pollution Prevention, Sustainable Development

Robert W. Peters, Professor (Civil, Construction, and Environmental Engineering); Environmental Engineering, Water and Wastewater Treatment, Physical/Chemical Treatment, Soil and Ground Water Remediation, Sonication/Acoustic Cavitations, Advanced Oxidation Processes, Water Chemistry, Energy Conservation

Talat F. Salama, Assistant Professor (Civil, Construction, and Environmental Engineering); Construction Engineering Management, Structural Engineering, Finite Element Modeling; Sustainability in Engineering Design

Virginia P. Sisiopiku, Associate Professor (Civil, Construction, and Environmental Engineering); Traffic Engineering, Intelligent Transportation Systems, Traffic Operations, Traffic Safety

Nasim Uddin, Professor (Civil, Construction, and Environmental Engineering); Structural Engineering, Structural Dynamics, Infrastructure Rehabilitation, Hazard Mitigation

Christopher Waldron, Assistant Professor (Civil, Construction, and Environmental Engineering) Structural Engineering, Bridge Design, Engineering Mechanics
Secondary Appointment Faculty

**Heshmat Aglan**, Professor & Associate Dean (Tuskegee University); Mechanical Engineering, Structural Mechanics, Polymer Modified Pavement

**Ashraf Z. Al-Hamdan**, Lecturer (University of Alabama in Huntsville); Subsurface Remediation, Contaminant Transport Modeling & Waste Resources Planning & Management

**Michael D. Anderson**, PhD, Associate Professor (University of Alabama in Huntsville); Transportation and Traffic Engineering, Geographic Information Systems, Simulation and Public Transit, Urban Planning

**Mohamed Ashour**, PhD, PE., Associate Professor (University of Alabama in Huntsville); Laterally & Axially Loaded Pile/Shafts Under Static & Seismic Scenarios, Soil-Structure Interaction, Soil Modeling & Soil Liquefaction, Slope Stabilization

**James F. Cruise**, PhD., Professor (University of Alabama in Huntsville); Hydrologic and Stochastic Modeling, Wetlands and Estuarine Hydrology, Steady and Unsteady Free Surface Flow

**Bo Dowswell**, PhD., P.E.; Structural Steel Design, Steel Connections

**Alan Eberhardt**, Associate Professor (Biomedical Engineering); Solid Mechanics, Biomechanics, Analytical and Numerical Methods

**Wood Herren**, Attorney at Law (Bradley Arant Law Firm); Corporate and International Law

**Michael Knapp**, Attorney at Law (Bradley Arant Law Firm); Corporate and International Law

**Kathleen M. Leonard**, PhD, PE, Professor (University of Alabama in Huntsville); Wastewater Treatment and Reuse, Sustainable Design, Ozonation for Water and Hazardous Waste Treatment

**Lee Moradi**, PhD., PE, Director of Engineering (Center for Biophysical Sciences and Engineering); Structural Engineering and Analyst, Constitutive Properties of Concrete Masonry Units Subjected to Blast, System Performance and Design.

**Edmund P. Segner**, Jr., Professor Emeritus, (Civil, Construction, and Environmental Engineering); Structural Engineering, Structural Mechanics

**Houssam A. Toutanji**, PhD, Professor (University of Alabama in Huntsville); Smart Materials & Structures, Structural Retrofitting & Repair, Durability & Long-Term Performance of Advanced Composites, High Strength Concrete, Fiber-Reinforced Cementitious Composites

Admission Requirements

In addition to the UAB Graduate School admission requirements, requirements for admission to the program leading to the Master of Science in Civil Engineering degree include the following five criteria:

1. An undergraduate engineering degree from an accredited program by the ABET. Applicants who do not meet this criterion but who have an outstanding academic record in an engineering degree program not accredited by ABET, or in a baccalaureate degree program in a related field, may be admitted on probation. Students admitted in this category will be required to complete a sequence of undergraduate courses in addition to the normal requirements of the M.S.C.E. degree. This set of extra requirements will
be specified in writing at the time of admission to the program.

2. GPA of 3.0 or better (A = 4.0) in all undergraduate degree major courses attempted;

3. Three letters of evaluation concerning the applicant's previous academic and professional work; and

4. Submission of scores achieved on the GRE General Test. Admission to the program is competitive and is based on all available evidence; for admission in good academic standing, scores above 160 on each component of GRE General Test are preferred. Minimum scores of 550 on the Test of English as a Foreign Language (TOEFL) and a 3.5 on the Test of Written English (TWE) are also required for those applicants whose native language is not English. These test scores will be used primarily if an applicant fails to meet minimum standards for admission in good standing and is being considered for admission on probation.

5. Verification of registration by examination as a Professional Engineer (P.E.) will satisfy criteria 4 above.

**M.S.C.E. Program Requirements**

The following minimum requirements apply to the plan of study for a student who has earned a baccalaureate degree in civil engineering. A student with an undergraduate degree in another field may also be accepted into the civil engineering program but will normally have to take additional preparatory coursework as part of an expanded plan of study. Continuous enrollment for at least 3 credit hours per term is required. Students receiving a research or teaching assistantship are required to be enrolled as full-time students every semester. A full-time student is one who is enrolled in at least 9 credit hours per term. *Enrollment in the Civil Engineering Graduate Seminar (CE 641) is required at least once prior to graduation.*

**Plan I (Thesis Option)**

1. In addition to the general Graduate School requirements, the student must successfully complete at least 33 semester hours of graduate credit, including:

   (a) A minimum of 18 semester hours in civil engineering;

   (b) Up to 6 semester hours in disciplines outside civil engineering, such as other engineering disciplines, mathematics, biology, earth science, physics, urban affairs, or public health.

   (c) A minimum of 9 hours of CE 699 - Masters Thesis Research.

2. The student must pass a comprehensive examination on the content of the program. This examination may be written, oral, or both and shall include an oral defense of a thesis.

**Plan II (Nonthesis Option): Research/Design Emphasis**

1. The student must successfully complete at least 33 semester hours of graduate credit including:

   a) A minimum of 24 semester hours in civil engineering;

   b) Up to 6 semester hours in disciplines outside civil engineering, such as; other engineering disciplines, mathematics, biology, earth sciences, physics, chemistry, or public health; and
c) A minimum of 3 hours of CE 698 – Nonthesis Research under the direction of the graduate study committee chair, resulting in a committee approved written report.

2. The student must pass a comprehensive examination on the content of the program. This examination may be written, oral, or both and shall include an oral defense of the nonthesis research project.

Plan II (Nonthesis Option): Sustainable Engineering Design Emphasis

1. The student must successfully complete at least 33 semester hours of graduate credit, including the following:

   a) A minimum of 24 semester hours of Sustainable Engineering Design courses from the CCEE Department, which may be satisfied from among the following courses: CE 600, CE 601, CE 602, CE 603, CE 604, CE 605, CE 606, CE 692 , or course; and

   b) A minimum of 6 semester hours from the MBA program, which may be satisfied from among the following courses; MBA 609, MBA 610, MBA 611, MBA 650, or an approved course from the MBA program; and

   d) a minimum of 3 hours of CE 698 – Nonthesis Research under the direction of the graduate study committee chair, resulting in a committee approved written report.

2. The student must pass a comprehensive examination on the content of the program. This examination may be written, oral, or both and shall include an oral defense of the nonthesis design project.

Areas of Specialization

Specialization programs are available in the fields of environmental engineering, structural engineering/structural mechanics, construction engineering management; and transportation engineering. Supporting courses are offered in geotechnical engineering, optimization, engineering law and other areas. **Enrollment in the Civil Engineering Graduate Seminar series (CE 641/741) is required of all graduate students at least once prior to graduation.**

Required Courses for Specialization in Environmental Engineering

In addition to the M.S.C.E. program requirements, the following undergraduate classes (plus all associated prerequisites) are generally required of all M.S.C.E. students specializing in environmental engineering:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>CE 236</td>
<td>Environmental Engineering</td>
</tr>
<tr>
<td>CE 337</td>
<td>Hydraulics</td>
</tr>
<tr>
<td>CE 344</td>
<td>Civil Engineering Analysis</td>
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<tr>
<td>CE 430</td>
<td>Water Supply and Drainage Design</td>
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<tr>
<td>Or</td>
<td></td>
</tr>
<tr>
<td>CE 480</td>
<td>Water and Wastewater Treatment</td>
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</tbody>
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Required Courses for Specialization in Structural Engineering/Structural Mechanics

In addition to the M.S.C.E. program requirements, the following undergraduate classes (plus all associated
prerequisites) are generally required of all M.S.C.E. students specializing in structural engineering/structural mechanics:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>CE 332</td>
<td>Soil Engineering</td>
</tr>
<tr>
<td>CE 344</td>
<td>Civil Engineering Analysis</td>
</tr>
<tr>
<td>CE 360</td>
<td>Structural Analysis</td>
</tr>
<tr>
<td>CE 450</td>
<td>Structural Steel Design</td>
</tr>
<tr>
<td>CE 455</td>
<td>Reinforced Concrete Design</td>
</tr>
</tbody>
</table>

Required Courses for Specialization in Construction Engineering Management

In addition to the M.S.C.E. program requirements, the following undergraduate classes (plus all associated prerequisites) are generally required of all M.S.C.E. students specializing in construction management.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>CE 395</td>
<td>Engineering Economics</td>
</tr>
<tr>
<td>CE 497</td>
<td>Construction Engineering</td>
</tr>
</tbody>
</table>

Required Courses for Specialization in Transportation Engineering

In addition to the M.S.C.E. program requirements, the following undergraduate classes (plus all associated prerequisites) are generally required of all M.S.C.E. students specializing in transportation engineering.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>CE 344</td>
<td>Civil Engineering Analysis</td>
</tr>
<tr>
<td>CE 345</td>
<td>Transportation Engineering</td>
</tr>
</tbody>
</table>

Ph.D. Program

This is a joint program with the University of Alabama in Huntsville (UAH). A typical student entering the program would already have an undergraduate degree in Civil Engineering from an ABET accredited program. Students with outstanding records in related fields or from a non-accredited engineering program will be considered for admission on conditional standing, and must remedy deficiencies in their preparation after the start of their academic program. They may then be granted unconditional standing in the doctoral program.

The program requires 48 credit hours of coursework beyond the baccalaureate level or 24 credit hours of coursework beyond the master's degree, plus a minimum of 24 credit hours of dissertation research. **Enrollment in the Civil Engineering Graduate Seminar (CE 741) at least once prior to graduation is required.** A minimum of 6 credit hours must be taken from the UAH campus, and may be taken through the Intercampus Interactive Telecommunications (IITS) System here at UAB, Distance Learning courses from UAH (DL) or Web-based Instruction from UAH.

A comprehensive examination is required of all doctoral candidates. This examination is given after (a) all coursework is completed, and (b) the student’s Graduate Committee, which consists of faculty representatives from both campuses, deems the student to have adequate preparation in the major and minor fields of study. The examination is conducted by the student’s Graduate Committee and administered on the resident campus. The examination consists of a written part and an oral part. During the oral portion of the examination, the student also presents his/her dissertation proposal. The Comprehensive Examination may only be taken twice.

For additional details, please refer to the CCEE website: [http://www.uab.edu/engineering/departments-research/civil](http://www.uab.edu/engineering/departments-research/civil)
Additional Information

For detailed information, contact Jennifer A. Vinson, Administrative Associate (jav@uab.edu), UAB Department of Civil, Construction, and Environmental Engineering, HOEN 140, 1530 3rd Ave., S., Birmingham, AL 35294-4440. Physical location: 140 Hoehn Building, 1075 13th Street South, Birmingham, AL, Telephone # (205) 934-8430.

CE Specialty Certificate Programs

Category A certificates are offered by the Civil, Construction, and Environmental Engineering Department. Any undergraduate or graduate student in good standing who is pursuing a Civil Engineering degree (B.S.C.E., M.S.C.E., Ph.D.) may elect to simultaneously complete the requirements of his or her degree program and the Certificate Program. These certificates are listed on student transcripts and in the university graduation bulletin. Certificates can be earned in:

1. Construction Engineering Management
2. Sustainable Engineering Management
3. Structural Engineering
4. Environmental Engineering
5. Transportation Engineering
6. Geotechnical Engineering

Civil Engineering (B.S.C.E.) graduates who complete the Certificate Program will have greater depth in specific technical area. The certificates also allow a means for practicing engineers to acquire expertise beyond a Bachelor degree, and have it formally recognized, without completing a program leading to a master’s degree. This technical expertise will enhance their proficiency and marketability. Up to 12 graduate level credit hours taken for a certificate may be applied toward the M.S.C.E. degree.

Students who wish to pursue a CE Certificate must be admitted to the Department as either undergraduate or graduate students (B.S.C.E. or M.S.C.E. program). Students who are not currently enrolled in the civil engineering program may be admitted as a non-degree seeking student to earn a Certificate.

Certificates require a minimum of 15 semester hours. They consist of one required course (which may also count toward the B.S.C.E. degree at UAB) and four graduate level elective courses in the area of specialization. Courses that can be applied towards the Certificate can be found at http://www.uab.edu/engineering/departments-research/civil

For more information, please contact Jennifer A. Vinson, Administrative Associate, 140 Hoehn Engineering Building, 1075 13th Street South, telephone (205) 934-8430, e-mail jav@uab.edu

Course Descriptions

Unless otherwise noted, all courses are for 3 semester hours of credit.

Civil Engineering (CE)

Environmental Engineering

530. Water Supply and Drainage Design. Water requirements; wastewater characteristics. Hydraulics and design of sewers; distribution, and reuse of water. Development of water supplies; design considerations. Prerequisite: CE 337.
531. **Energy Resources**. 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, recover and conservation, environmental impacts, economics, 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.

533. **Solid and Hazardous Waste Management**. Overview of waste characterizations, regulations, and management options.


537. **Environmental Experimental Design and Field Sampling**. Experimental design, sensitivity analyses, water sampling, and flow monitoring. Receiving water chemical reactions. Field investigations. Lecture and laboratory. Prerequisite: CE 344.

580. **Intro to Water and Wastewater Treatment**. Physical unit operations, and chemical / biological unit processes for water and wastewater treatment. Design of facilities for treatment. Treatment and disposal of sludge. Prerequisite: CE 236.

585. **Engineering Hydrology**. Hydrologic principles including hydrology cycle, precipitation data, and stream-flow measurements. Applications to engineering problems; stream-flow analysis and watershed management. Prerequisite: CE 236

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

632. **Industrial Water and Wastewater Treatment**. Solid wastes and wastewaters from various industries. Assessment of treatability, system design, and equipment selection. Prerequisite: CE 480.

636. **Stormwater Pollution Management**. 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. Prerequisite: CE 430.


639. **Sediment Sources and Controls**. Erosion and sediment transport in urban areas; design of common erosion control practices. Prerequisite: CE 430.

640. **Wastewater Treatment Engineering**. Wastewater sources and characteristics. Design and operation of wastewater treatment facilities, including grit removal, oil and grease removal, dissolved air floatation, 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. Prerequisite: CE 480.

641. **Civil Engineering Graduate Seminar**. Seminar focusing on guest presentations of various civil, construction, and environmental engineering topics of interest for CE Masters students. Mandatory enrollment at least once prior to graduation. 1 hour.

682. *Water Treatment Engineering*. 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. Prerequisite: CE 480.

683. *Water and Wastewater Treatment Processes Laboratory*. Construction and evaluation of bench-scale treatment processes. Treatability of water and wastewater. Coagulation of sedimentation, settleability of biological sludges, aerobic biological treatment, chemical treatment, water softening toxicity, disinfection; and sludge treatment processes. Prerequisite: CE 682.


687. *Stormwater Detention Pond Design*. Stormwater problems and control methods, urban hydrology prediction procedures for drainage and water quality studies. Detention pond design basics, limitations and multiple benefits. Prerequisite: CE 430.


732. *Industrial Water and Wastewater Treatment*. Solid wastes and waste waters from various industries; assessment of treatability, system design and equipment selection. Prerequisite: CE 480.


739. *Sediment Sources and Controls*. Erosion and sediment transport in urban areas; design of common erosion control practices. Prerequisite: CE 430.

740. *Wastewater Treatment Engineering*. 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. Prerequisite: CE 480.

741. *Civil Engineering Graduate Seminar*. Seminar focusing on guest presentations on various civil, construction, and environmental engineering topics of interest for CE Ph.D. students. Mandatory enrollment at least once prior to graduation. 1 hour.
781. **Environmental Chemistry.** Chemical equilibrium, acid/base, chemical concepts in pollutant behavior. Chemical kinetics, redox system, hydrolysis, pesticides, chemical wastes. Prerequisite: CE 638 or CE 738.

782. **Water Treatment Engineering.** Water sources and characteristics. Designs and operation of water treatment facilities including lime softening operations, coagulation, flocculation, clarification, dissolved air flotation, filtration, disinfection, adsorption, ion exchange, and sludge disposal. Prerequisite: CE 480.

783. **Water and Wastewater Treatment Processes Laboratory.** Construction and evaluation of bench-scale treatment processes. Treatability of water and wastewater. Coagulation of sedimentation, settleability of biological sludges, aerobic biological treatment, chemical treatment, water softening toxicity, disinfection, sludge treatment processes. Prerequisite: CE 682 or CE 782.


787. **Stormwater Detention Pond Design.** Stormwater problems and control methods, urban hydrology prediction procedures for drainage and water quality studies. Detention pond design basics, limitations and multiple benefits. Prerequisite CE 430.

**Structural Engineering and Structural Mechanics**


520. **Advanced Mechanics.** Variation of stress at a point, including determination of principal and maximum shear stress. Basic problems involving symmetrical deformation; thick-wall cylinders, sphere, and rotating disk. Torsions of noncircular sections. Curved beams. Failure theories. Unsymmetrical bending, shear center. Prerequisites: CE 220.

526. **Foundation Engineering.** 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; estimate stresses in soil masses; lateral resistance of piles and pile group; retaining walls, sheetpiles and coffer-dams. Prerequisite: CE 332 and CE 455.

553. **Design of Wood Structures.** Design and detailing of timber structures. Properties and specifications for dimension and glulam timbers. Design of beams, columns, beam-columns, connections (nails and bolts), roof diaphragms, and shear walls. Design of timber structures to meet the requirements of the National Design Specification standards. Prerequisite: CE 360.


556. **Prestressed Concrete Design.** Principles and concepts of design in prestressed concrete including elastic and ultimate strength analyses for flexural, shear, bond, and deflection. Principles of concordancy and linear transformation for indeterminate prestressed structures. Prerequisite: CE 455.

557. **Concrete Technology.** 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. Specification writing to ensure good quality concrete and field inspection procedures. Case studies of problems in concrete construction. Prerequisite: CE 222.

561. **Introduction to the Finite Element Method.** Concepts and applications of the finite element method. Development and applications of basic finite elements. Software use. Prerequisite: CE 220.

562. **Advanced Structural Analysis.** Analysis of indeterminate structures using classical and matrix methods. Use of large-scale computer programs. Prerequisite: CE 360.


567. **Wind and Seismic Loads.** Methods of calculating loads on structures caused by extreme winds and earthquakes. Calculation of wind loads on various types of structures according to theory and code. Determination of earthquakes loads on structures using structural dynamics and codes. Prerequisite: CE 360.

568. **Bridge Engineering.** 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. Prerequisites: CE 450 and CE 455.


641. **Civil Engineering Graduate Seminar.** Seminar focusing on guest presentations of various civil, construction, and environmental engineering topics of interest for CE Masters students. Mandatory enrollment at least once prior to graduation. 1 hour.

650. **Advanced Structural Steel Design.** Beams, columns, tension members, and connections; current research. Prerequisite: CE 450.

655. **Advanced Reinforced Concrete.** Beam, column, and slab actions; current research. Prerequisite: CE 455.

663. **Finite Element Methods.** Theory and applications in structural mechanics. Plane stress, plane strain, axisymmetric problems, solids, plates, shells, nonlinear systems. Prerequisite: CE 561.


741. **Civil Engineering Graduate Seminar.** Seminar focusing on guest presentations on various civil, construction, and environmental engineering topics of interest for CE Ph.D. students. Mandatory enrollment at least once prior to graduation. 1 hour.

750. **Advanced Structural Steel Design.** Beams, columns, tension members, and connections; current research. Prerequisite: CE 450.

755. **Advanced Reinforced Concrete.** Beam, column, and slab actions; current research. Prerequisite: CE 455.

763. **Finite Element Methods.** Theory and applications in structural mechanics. Plane stress, plane strain, axisymmetric problems, solids, plates, shells, nonlinear systems. Prerequisite: CE 561.

**Transportation Engineering Courses**


543. **Pavement Design and Construction.** Analysis of stresses and strains in pavement systems. Design and construction of flexible and rigid pavement, base courses and subgrades. Effects of loading on pavement life. Prerequisites: CE 345.

544. **Civil Engineering Analysis.** Sampling and experimental design. Hypotheses testing. Decision analyses. Multiple regression analyses. Nonparametric methods. Analysis of experimental data in civil engineering research; hypothesis testing, regression, experimental design, non-parametrical analysis. Prerequisite: CE 344.

547. **Engineering Optimization and Modeling.** Mathematical techniques for analysis of systems. Project scheduling, optimization, and simulation applied to civil engineering system analysis. Prerequisite: CE 344, EE 130 or EE 134.

621. **Transportation Engineering Seminar.** Seminar focusing on student research and guest presentations of various topics of interest to Masters Transportation Engineering students. 1 hour.

622. **Traffic Flow Theory.** 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. Prerequisite: CE 345.

623. **Non-Motorized Transportation Design and Planning.** 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.

624. **Simulations Models for Transportation Applications.** 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. Prerequisite: CE 345.

625. **Intelligent Transportation Systems*, Graduate.** Legal, institutional and planning issues. System architecture, telecommunication technologies. Advanced user services, intermodal systems. Deployment programs,
cost and benefit evaluation.

641. Civil Engineering Graduate Seminar. Seminar focusing on student research and guest presentations of various civil, construction, and environmental engineering topics of interest for CE Masters students. Mandatory enrollment at least once prior to graduation. 1 hour.

646. Traffic Engineering Operations. Highway and intersection capacity analysis, traffic signal timing and phasing, coordination, signal networks, freeway operations, nonsignalized traffic control techniques. Prerequisite: CE 345.

648. Urban and Transportation Planning. Land use planning for transportation systems; trip generation, trip distribution, and traffic assignment. Prerequisite: CE 345.

721. Transportation Engineering Seminar. Seminar focusing on student research and guest presentations of various topics of interest to PhD. Transportation Engineering students. 1 hour.


723. Non-Motorized Transportation Design and Planning. 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.

724. Simulation Models for Transportation Applications. 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. Prerequisite: CE 345.


741. Civil Engineering Graduate Seminar. Seminar focusing on guest presentations on various civil, construction, and environmental engineering topics of interest for CE PhD. students. Mandatory enrollment at least once prior to graduation. 1 hour.

Construction Engineering Management Courses

600. Sustainable Construction. 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 infrastructures, and (3) Explore past and present thinking of engineering practitioners in this newly emerging discipline.

601. Construction Methods. This course provides an overview of construction methods, building systems, material and equipment used in the construction of buildings, earthwork, bridges and roads. Excavation, formwork, concrete, masonry, and steel erection methods. Types of foundations that can be used for a project are presented.

602. Construction Contracting, Bidding, and Estimating. Estimation of construction project costs: direct and
indirect, labor, material, and equipment costs. Overhead and profit, bidding computer-based estimating.

Introduction to the U.S. legal system as it applies to civil engineering and construction. Fundamental concepts of contract and tort law, claims, risk management, business formation and licensing, agency, insurance and bonding, and real property.

603. **Construction Accounting and Financial Management.** This course covers financial accounting and cost control concepts dealing with the integration and management of both company and project-level revenue and expense. It shows how effective cost control methodology and data is essential to monitoring and controlling current project budgets as well as developing accurate future bids. The course covers accounting systems unique to construction companies and financial analysis methods typically employed; progress payment disbursement; forecasting and trends; cash flow life cycle theory; computer applications; project funding; and the use of cost information and associated reports.

604. **International Construction Contracts and Law.** 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. Required bonding and other risk allocation vehicles are discussed.

605. **Project Management.** This course 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.

606. **Advanced Project Management.** Directed study of selected topics in construction management. The schedule of classes will list topics selected. Topics will include: business policy and problems relating to construction companies, contractors’ organization, financial management, project management, supervision, costs analysis and equipment economics, team building, professional ethics, leadership and topics in construction law.

608. **Green Building Design.** 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 will also include LEED Case Studies (industrial, commercial, residential, and institutional examples).

609. **Advanced Topics in Engineering Law.** Course will cover advanced topics in engineering law as it relates to sustainable design and construction practices. Examples include BIM, crane regulations, safety, international contracts and joint venture, term sheets, etc.

610. **The Engineered Environment.** 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 included air pollution, solid waste management, water treatment, environmental ethics, etc.

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

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

658. **Engineering Management.** Management techniques for practicing engineers. Students will learn management and leadership skills, how to work in teams, as well as professional issues on ethics.

692. **Civil Engineering Capstone.** The 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.

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

749. **Engineering Liability.** Laws related to liability for engineering design in the context of products liability and construction projects, roles and liabilities between various parties involved in construction projects.

758. **Engineering Management.** Management techniques for practicing engineers. Students will learn management and leadership skills, how to work in teams, as well as professional issues on ethics.

**Sustainable Engineering Management Courses**

600. **Sustainable Construction.** 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 infrastructures, and (3) Explore past and present thinking of engineering practitioners in this newly emerging discipline.

601. **Construction Methods.** This course provides an overview of construction methods, building systems, material and equipment used in the construction of buildings, earthwork, bridges and roads. Excavation, formwork, concrete, masonry, and steel erection methods. Types of foundations that can be used for a project are presented.

602. **Construction Contracting, Bidding, and Estimating.** Estimation of construction project costs: direct and indirect, labor, material, and equipment costs. Overhead and profit, bidding computer-based estimating. Introduction to the U.S. legal system as it applies to civil engineering and construction. Fundamental concepts of contract and tort law, claims, risk management, business formation and licensing, agency, insurance and bonding, and real property.

603. **Construction Accounting and Financial Management.** This course covers financial accounting and cost control concepts dealing with the integration and management of both company and project-level revenue and expense. It shows how effective cost control methodology and data is essential to monitoring and controlling current project budgets as well as developing accurate future bids. The course covers accounting systems unique to construction companies and financial analysis methods typically employed; progress payment disbursement; forecasting and trends; cash flow life cycle theory; computer applications; project funding; and the use of cost information and associated reports.

604. **International Construction Contracts and Law.** 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. Required bonding and other risk allocation vehicles are discussed.
605. **Project Management.** This course 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.

606. **Advanced Project Management.** Directed study of selected topics in construction management. The schedule of classes will list topics selected. Topics will include: business policy and problems relating to construction companies, contractors’ organization, financial management, project management, supervision, costs analysis and equipment economics, team building, professional ethics, leadership and topics in construction law.

608. **Green Building Design.** 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 also include LEED Case Studies (industrial, commercial, residential, and institutional examples).

609. **Advanced Topics in Engineering Law.** Course will cover advanced topics in engineering law as it relates to sustainable design and construction practices. Examples include BIM, crane regulations, safety, international contracts and joint venture, term sheets, etc.

610. **The Engineered Environment.** 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 included air pollution, solid waste management, water treatment, environmental ethics, etc.

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

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

658. **Engineering Management.** Management techniques for practicing engineers. Students will learn management and leadership skills, how to work in teams, as well as professional issues on ethics.

692. **Civil Engineering Capstone.** The 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.

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

749. **Engineering Liability.** Laws related to liability for engineering design in the context of products liability and construction projects, roles and liabilities between various parties involved in construction projects.

758. **Engineering Management.** Management techniques for practicing engineers. Students will learn management and leadership skills, how to work in teams, as well as professional issues on ethics.

**Other Courses**

690. **Special Topics in (Area).** 3 hours.
691. **Individual Study in (Area)**. 3 hours.

698. **Nonthesis Research**. 3, 6, 9 hours.

699. **Thesis Research**. Prerequisite: Admission to candidacy. 3, 6, 9 hours.

700. **Special Topics in (Area)**. 3 hours.

701. **Individual Study in (Area)**. 3 hours.

708. **Nondissertation Research**. 3, 6, 9, 12 hours.

709. **Doctoral Dissertation**. Prerequisite: Admission to candidacy. 3, 6, 9, 12 hours.

**Master in Engineering – Construction Management Program Requirements**

The Department of Civil, Construction, and Environmental Engineering is pleased to announce its newest program, a Master in Engineering – Construction Management. This program is designed to enhance the engineering and business qualifications of working professionals interested in project and company management.

In addition to the Graduate School admission requirements, requirements for admission to the program leading to the Master in Engineering – Construction Management degree include the following:

1. Must have a Bachelors degree from an accredited U.S. College or University;
2. Must have an Undergraduate GPA of 3.0 or higher (individuals not meeting this requirement may start on a probationary status with strong interview and recommendations);
3. No GRE required for U.S. Citizens;
4. Must submit at least two letters of recommendation
5. Must schedule an interview with the Program director or coordinator.
6. Student must successfully complete at least 33 semester hours of graduate credit;

**Master in Engineering - Construction Management Courses**

628. **Construction Management Case Study, Part 1**. Students review case studies involving project planning and risk assessment (1 hour).

629. **Construction Management Case Study, Part 2**. Students review case studies emphasizing project control and coordination (1 hour).

630. **Construction Management Case Study, Part 3**. Students review case studies emphasizing technology advancements in construction methods and project management, (1 hour).

669. **Advanced Project Management**. Skills generally required for sound project management in a variety of management settings are studied in addition to specific management issues typically associated with engineering and construction companies. A discussion of corporate organizational structures and the evolving use of project management processes helps establish an appreciation for the role of a Project Manager. The elements of a project and the role and responsibilities of the Project Manager are studied in depth. Students are also acquainted with risk management concepts, financial, labor, safety, equipment, contracting issues facing managers in the engineering and construction environment. Particular emphasis is placed on individual management strengths and weakness, team building, and characteristics of successful companies. One of the primary vehicles for discussion
will be small case studies from real companies and the outside reading of one or two relevant topical books.

670. Construction Estimating and Bidding. Provides an overview of typical construction delivery systems, and the planning and contracting associated with each. A broad study of estimating methodology ranging from rough “ball park” estimates to detailed unit pricing is presented focusing on labor, equipment, materials, subcontractors, job conditions, location, overhead and profit. This course is intended to establish a basic understanding of the estimating process; and, therefore, substantial course focus will be placed on the term group project which consists of the development of a bid estimate for a small construction project.

671. Construction Liability and Contracts. Provides an overview of the fundamental aspects of the laws that affect 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. (Prerequisites CE 669 and CE 670 or approval by the Project Director)

672. Construction Methods and Equipment. Provides students a big-picture understanding of the construction methods employed to bring the concepts and designs of architects and engineers to physical reality. The focus areas include earthmoving, heavy construction, building construction, and process plants. Students will understand the planning and deployment of equipment, materials, labor, and subcontractors required in the construction process. The course is strengthened with guest lectures from industry practitioners and student interaction with construction industry participants as parts of the group semester project. (Prerequisites: CE 669 or approval by the Program Director).

673. Techniques of Project Planning and Control. Provides a thorough understanding of the project scheduling process in construction planning and control. Students learn the relationship between the work breakdown structure, organization breakdown structure, and the activities used in developing project schedules. The Critical Path Method (PM) and the Precedence Diagram Method (PDM) are discussed in detail to include hand calculations and powerful computer software products. The use of scheduling techniques for project control, resources constraint management, cash flow management, and project completion date management are investigated and the importance of communications in the planning and controlling process emphasized. (Prerequisites: CE 669, and CE 670).

674. Green Building Design and Construction (LEED). This course provides an introduction to the emerging trends in green building sustainable design and construction. The course will include instruction suitable to prepare students for the Leadership in Energy and Environmental (LEED©) Green Building Rating System TM certification exam. (Prerequisite: CE 672).

675. Financial & Managerial Accounting for Non-Financial Managers. Provides an extensive overview of accounting concepts for non-financial managers. Students will learn the basic elements of accounting (Generally Accepted Accounting Practices). They will understand typical financial records and financial statements are established for companies. Once the basics are understood, students will study how financial data is used for internal cost controlling, planning, and budgeting. (Prerequisite: CE 669, CE 670, CE 673, and CE 677).

676. Construction Project Risk Management. This course addresses the methodologies employed in the engineering and construction industries to assist in rational decision making in the face of uncertainty. The course reviews the fundamentals of common probabilistic theories and models, data sampling, hypothesis testing and the basics of Bayesian Decision Theory. In addition, basic financial analysis tools will be reviewed. Theoretical models will then be applied to specific examples encountered in engineering and construction decision making with
emphasis on engineering economics applications. (Prerequisites: CE 669, CE 670, and CE 673).

677. Construction Accounting and Finance. Introduces students to some of the particular accounting needs, practices and methods unique to construction companies. Students will understand the details of budget preparation, cost tracking and reporting systems. Emphasis is placed on understanding the importance of linking detailed project planning, scheduling with cost accounting and reporting in the management of individual construction projects and the company as a whole. A broad overview of financial management of construction companies and the specific tools used to operate the enterprise are discussed. Business planning, financing and contracting strategies suitable for a cyclical demand industry are discussed. (Prerequisites: CE 669, CE 670, and CE 672).

678. Construction Business Systems and Information Technology. The use of information management systems design and construction operations is studied in detail. Emerging technology and state-of-the-art equipment and software will be discussed. The importance of information technology and equipment, and benefit cost tradeoffs for different company and project sizes will be discussed and investigated by students. A large portion of the course effort is the student group investigative topical research project and oral presentation. (Prerequisites: CE 669, CE 670, and CE 672).

679. Construction Methods – Detailing and Finishing. This course is an extension of the concepts and technical terminology introduced in Construction Methods and Equipment. Topics explored in this course include green design/sustainable construction, finishing systems, windows and cladding, HVAC/plumbing, and roofing. The International Building Code will be examined, as well as, fundamental engineering, design, and construction methods. Upon completion students will be better equipped to read and understand drawings and specifications, necessary skills for detailed estimating of cost and time. (Prerequisite: CE 671).

680. Construction Management Capstone Studies. Students review case studies involving project planning and risk assessment, or individual topical study, case studies emphasizing project control and coordination or individual topical study, case studies emphasizing technology advancements in construction methods and project management, or individual topical study. (3 hour)

684. Construction Project Administration. This course is designed to provide a comprehensive overview of the important business, legal, and management aspects of construction management with emphasis on administrative procedures. The course is an extension of Advanced Project Management concepts with specific focus on the construction management issues facing owners, engineers, constructors, architects, and students to include the International business environment. (Prerequisite: CE 669)

688. Management & Leadership Applications in a Global Environment. This course is designed to prepare students to face the demanding management and leadership challenges as competition becomes ever more globalized. Organization design and management, selection and use of technology, and methodologies for measuring and monitoring performance are all fundamental working concepts necessary to think strategically in a changing world business environment. This course will provide the opportunity for students to discuss and research these concepts and to recognize the necessity to think independently, challenge conventional thinking, and visualize alternatives.

689. Building Information Modeling (BIM) Techniques. 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 will be discussed and demonstrated.
694. **Sustainable Construction.** Provides students 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.

695. **International Construction Contracts & Liability.** 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.

**Master in Engineering – Engineering Management Program Requirements**

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3. No GRE required for U.S. Citizens;
4. Must submit at least two letters of recommendation
5. Student must successfully complete at least 33 semester hours of graduate credit;