MAJOR: ENGINEERING at Department of Civil & Architectural Engineering, College of Engineering, Tennessee State University
DEGREE: MASTER OF ENGINEERING (M.E.)

CONCENTRATIONS:
CIVIL ENGINEERING
ENVIRONMENTAL ENGINEERING

The College of Engineering offers work leading to the Master of Engineering (M.E.) degree with six concentrations: Civil Engineering, Environmental Engineering.

The Master of Engineering degree requires

1. admission of all degree seeking students to candidacy for the degree after the completion of nine (9) graduate credit hours in residence at the University;
2. a minimum of thirty-three (33) graduate semester hours of course work, including at least six (6) credit hours of mathematics, three (3) credit hours of laboratory based courses, three (3) credit hours of special problems in engineering applications (design project), and six (6) credit hours of electives with the consent of the advisor.

Substitution within the core courses may be permitted with the consent of the advisor and the department head.

Admission Requirements

For unconditional admission to the Master of Engineering degree program, the student must have a bachelor's degree in engineering or science from an accredited program and must have the necessary prerequisite courses. If the evaluation of a student's undergraduate degree program reveals prerequisite deficiencies, the student must eliminate them by satisfactorily completing each of the prerequisite courses prescribed before unconditional status is achieved. None of the courses used to eliminate undergraduate deficiencies may be used in the student's program of study for the Master of Engineering degree.

For admission with unconditional classification, in addition to the above, the student must possess a grade point average (GPA) of 3.00 on a 4.00 scale. For admission with conditional classification, in addition to the above, the student must have a GPA between 2.75 and 2.99 or a GPA between 2.50 and 2.74 and a passing score of 70 on the Fundamental of Engineering (FE) examination. All students applying for admission must submit to the Graduate School a completed Graduate Application form and two copies of transcripts from all colleges and universities previously attended.

PROGRAM OF STUDY

Courses Required, All Options - 9 hours
ENGR 5100	Methods of Applied Mathematics for Engineers I	3
ENGR 5500	Special Problems	3

Either of the following three-hour courses
ENGR 5150	Numerical Methods for Engineers	3
ENGR 5020	Optimization Methods for Engineers	3

<div align="center">

CONCENTRATION: CIVIL ENGINEERING

Lin Li, Ph.D., P.E., F. ASCE, Professor and Chair

</div>

Civil Engineering

Core Courses - 12 hours listed below:

CVEN 5050	Transportation Modeling	3
CVEN 5400	Theoretical Soil Mechanics	3
CVEN 5410	Ground Water and Seepage	3
CVEN 5780	Finite Element Analysis	3

Electives with the consent of the advisor - 12 hours

Transportation Engineering Courses with the consent of the advisor

CVEN 5090	Traffic Engineering	3
CVEN 5100	Pavement Design	3
CVEN 5200	Advanced Geometric Design of Highways	3
CVEN 5660	Highway Safety Engineering	3

Structural Engineering Courses with the consent of the advisor

CVEN 5730	Matrix Analysis of Structures	3
CVEN 5710	Advanced Reinforced Concrete Design	3
CVEN 5750	Stability and Vibrations of Structures	3
CVEN 5800	Advanced Steel Design	3

Geotechnical Engineering Courses with the consent of the advisor

CVEN 5420	Advanced Foundation Engineering	3
CVEN 5430	Applied Soil Mechanics	3
CVEN 5450	Applied Rock Mechanics	3
CVEN 5470	Soil Dynamics	3
CVEN 5480	Unsaturated Soil Mechanics	3

CONCENTRATION: ENVIRONMENTAL ENGINEERING

Lin Li, Ph.D., P.E., F. ASCE, Professor and Chair

Core Courses - 12 hours listed below:

CVEN 5280	Solid Waste Management	3	
CVEN 5300	Environmental Engineering Processes I	3	
CVEN 5390	Principles of Sustainable and Geoenvironmental Engineering		3
CVEN 5290	Air Pollution	3	

Electives with the consent of the advisor - 12 hours

CVEN 5270	Ground Water Contamination	3	
CVEN 5320	Environmental Engineering Design	3	
CVEN 5330	Water Quality Management	3	
CVEN 5350	Hazardous Waste Management	3	
CVEN 5370	Environmental Chemistry	3	
CVEN 5380	Environmental Impact Analysis	3	
CVEN 5390	Principles of Sustainable and Geoenvironmental Engineering		3

COURSE DESCRIPTIONS

ENGINEERING

ENGR 5100. METHODS OF APPLIED MATHEMATICS FOR ENGINEERING 1. (3) Review of differential equations, Laplace and Fourier transforms, linear algebra, complex variables, integration in complex plane, residue theorem, partial differential equations, boundary value problems, and Integral equations. Prerequisite MATH 3120 or equivalent.

ENGR 5150. NUMERICAL METHODS IN ENGINEERING. (3) Numerical solutions of linear and non-linear equations, interpolation formulas, numerical integration and differentiation, and initial-value and boundary-value problems for ordinary and partial differential equations, eigenvalues and eigenvectors. Use of the computer in the numerical methods. Prerequisite ENGR 3400 or equivalent.

ENGR 5500. SPECIAL PROBLEMS. (3) Industry-oriented design project coupled with oral presentation and a written report. Prerequisite: consent of advisor.

CVEN 5020. OPTIMIZATION METHODS FOR ENGINEERING DESIGN. (3) Computerized design methods for optimization techniques. Formulation of optimization. Problems using design variables and design constraints. Constrained and unconstrained minimization techniques using gradient and direct methods, special redesign directions for simplified analysis.

CVEN 5050. TRANSPORTATION MODELING. (3) Analytical evaluation of trip generation, gravity models, probabilistic models used in trip distribution trip assignment; shortest path algorithm, Modal split calibration and testing of existing models. Application of generalized linear models and categorical outcome models in civil engineering data analysis.

CVEN 5090. TRAFFIC ENGINEERING. (3) A study of traffic congestion, capacity, signs and signalization, accident analysis and pedestrian controls using MUTCAD guidelines.

CVEN 5100. PAVEMENT DESIGN. (3) Analysis and design of sub-base and roadway surface; the mechanics of layered pavements (flexible and rigid), stresses and design criteria involved.

CVEN 5200. GEOMETRIC DESIGN OF HIGHWAYS. (3) Concepts of design and the mechanics of motion applicable to the construction, operation, and maintenance of highways systems and facilities using AASHTO guidelines. Field exercises in horizontal and vertical curve layout required.

CVEN 5270. GROUNDWATER CONTAMINATION. (3) Analysis of subsurface contaminant transport and remediation; activation, adsorption, dispersion, chemical reaction and biodegradation of contaminants in groundwater flow, application of mathematical models to predict contaminant transport; case studies.

CVEN 5280. SOLID WASTE MANAGEMENT. (3) Quantities and characteristics of solid wastes; collection methods and equipment; recycling of wastes; disposal methods including composting, incineration and sanitary landfills; economics and planning of solid waste management systems.

CVEN 5290. AIR POLLUTION CONTROL. (3) Sources of primary and secondary air pollution; production of air pollutants from combustion processes. Air pollution control devices; air quality modeling. Prerequisite: Graduate Standing or permission of instructor.

CVEN 5300. ENVIRONMENTAL ENGINEERING PROCESSES I. (3) Theory and application of physical and chemical processes applied to water and wastewater treatment systems including coagulation, flocculation, sedimentation and filtration. Prerequisite: Permission of instructor.

CVEN 5320. ENVIRONMENTAL ENGINEERING DESIGN. (3) Theory and design of structures for collection, purification, distribution, and disposal of water and wastewater.

CVEN 5330. WATER QUALITY MANAGEMENT. (3) Analytical evaluation of chemical, physical, and biological processes in natural water systems such as streams, lakes and estuaries; estimation of waste assimilation capacity; water quality criteria and management.

CVEN 5340. INDUSTRIAL WASTE TREATMENT AND DISPOSAL. (3) Evaluation of industrial waste problems; characteristics of wastes produced from industries; applications of engineering principles to treatment, recovery, and disposal of industrial wastes.

CVEN 5350. HAZARDOUS WASTE MANAGEMENT. (3) Generation of hazardous wastes by industries; nature and quantities of hazardous wastes; Transportation, treatment and Disposal; Environmental Impacts; Risk Analysis of Spills; management of Radioactive Wastes.

CVEN 5360. ENVIRONMENTAL ENGINEERING LABORATORY. (3) Basics of wet chemical analysis of water samples; titrametric and spectrometric analysis; evaluation of processes such as coagulations, thickening, adsorption, gas transfer, etc. Prerequisite: Permission of instructor.

CVEN 5370. ENVIRONMENTAL CHEMISTRY. (3) The kinetics and equilibrium relationships controlling the chemical behavior of aquatic environments; distribution and behavior of chemical species in dilute aqueous systems.

CVEN 5380. ENVIRONMENTAL IMPACT ANALYSIS. (3) An introduction to techniques for monitoring and assessing the impacts of engineering systems on environmental quality; study of air, water, land and urban environments.

CVEN 5390. PRINCIPLES OF SUSTAINABLE AND GEOENVIRONMENTAL ENGINEERING. (3) Definition, methodology, and current applications of the principles of sustainability and resiliency in engineering practice. Engineering properties of solid wastes, flow of water and contaminants through soils, overview of waste containment systems, design of compacted clay liners and geosynthetic liners, leachate collection systems, landfill covers design, containment geotechnics, design constraints, legal and ethical considerations, environmental, economic, and social impacts. Prerequisites: CVEN 3130.

CVEN 5400. THEORETICAL SOIL MECHANICS. (3) Flow of water in soil, stresses in soil mass, 1-D and 3-D consolidated including standard and constant strain-rate tests, shear strengths of soils, Triaxial and Simple Shear Tests. Prerequisite: CVEN 3130 or equivalent.

CVEN 5410. GROUND WATER AND SEEPAGE. (3) Hydro mechanics of confined and unconfined flow of water through soil; potential theory, application to design of earth dams and retaining walls. Prerequisites: CVEN 3130 or equivalent.

CVEN 5420. ADVANCED FOUNDATION ENGINEERING. (3) Subsoil investigation, shallow foundations. Analysis and design of retaining walls, piles and pile foundations. Prerequisite: CVEN 4440 or equivalent.

CVEN 5430. APPLIED SOIL MECHANICS. (3) Slope stability analysis soil dynamics, earthquake-resistant design of retaining walls and dams. Advanced seepage analysis including Transformation methods and Geotextiles. Prerequisites: CVEN 3130 or equivalent.

CVEN 5450. APPLIED ROCK MECHANICS. (3) Dynamic response to rock media, core-drilling problems, rapid excavation in rock. Case history studies, evaluation of currant theories used in design of tunnels. Prerequisite: CVEN 3130 or equivalent.

CVEN 5470. SOIL DYNAMICS. (3) Study of soil behavior under various dynamic loadings including earthquakes. Laboratory & field techniques for determining dynamic soil properties and liquefaction potential. Factors affecting liquefaction; dynamic soil-structure interaction. Design examples. Prerequisites: CVEN 3130.

CVEN 5480. UNSATRUATED SOIL MECHANICS. (3). Introduction of unsaturated soil, stress-state variables, soil water suction and soil water characteristic curves, hydraulic function curves, flow in unsaturated soil, shear strength and slope stability analysis, lateral earth pressure and retaining structures design, and compressibility and volume change analysis for unsaturated soils. Prerequisites: CVEN 3130.

CVEN 5460. NUCLEAR CHEMISTRY. (3) This course will involve the characteristics of nuclides (Isotopes). Radioactive nuclides are those elements having different masses, the same atomic number but unstable nuclei. These are two different occurrences of radioactive nuclei. Prerequisite: Graduate standing.

CVEN 5500. ADVANCED GEOMETRIC DESIGN OF HIGHWAYS. (3) Parameters governing the geometric design of highways, mechanics of curvilinear motion curve super elevation, widening on highway curves, elements of intersection design and design of interchange, use of AASHTO design guidelines. A design project is required. Prerequisite: CVEN 3320 or equivalent.

CVEN 5600. PAVEMENT DESIGN. (3) Analysis and design of sub-base, base and pavement of a roadway, mechanics of layered pavement, discussion of flexible pavement and rigid pavement, and rigid pavements as structural units. Beams of elastic foundations. Prerequisites: CVEN 3130, 3320 or their equivalent.

CVEN 5620. ADVANCED TRAFFIC ENGINEERING. (3) Characteristics of traffic elements; the road user, the vehicle and the road; volume, speed and delay studies; accident cause and prevention; highway capacity: concepts and applications; analysis of signal systems; parking control and design; pedestrian protection; roadway illumination systems and other operational problems. Prerequisite: CVEN 4640 or equivalent, or consent of instructor.

CVEN 5640. TRANSPORTATION SYSTEMS EVALUATION PROCEDURES. (3) Examination of transportation problems, goals and objectives; evaluation and decision-making techniques in transportation planning; economic analysis of transportation systems; cost allocation and benefit transfer; uncertainty and risk analysis; differential impact of transportation improvements. Prerequisites: CVEN 3320, ENGR 5300.

CVEN 5650. TRANSPORTATION MODELING. (3) Analytical evaluation of trip generation, gravity models, probabilistic models used in trip distribution, trip assignment and model split models, use of computer package, shortest path algorithm, critical review of the art in model formulations. Calibration and testing of some existing models for this geographical area. Prerequisite: CVEN 3320 or equivalent.

CVEN 5660. HIGHWAY SAFETY ENGINEERING. (3) Study of accident statistics, reporting systems, and characteristics; accident reconstruction; principles and techniques used in identification and evaluation of hazardous locations; and corrective measures to enhance highway safety. Prerequisite: CVEN 4640 or equivalent, or consent of instructor.

CVEN 5680. URBAN MASS TRANSIT PLANNING. (3) The mass transportation problem, demand analysis and statistical projections methods, mass transit planning model, introduction to UMTA planning package program network simulation. Prerequisite: CVEN 3320 or equivalent.

CVEN 5700. PLASTIC DESIGN IN STEEL. (3) Plastic analysis and design of steel beams, frames and connections, using the methods of mechanisms, energy and the moment rotation characteristics. Designed by the specifications. Analysis and design in steel using the Load and Resistance Factor Design method. Prerequisite: CVEN 3440 or equivalent.

CVEN 5710. ADVANCED REINFORCED CONCRETE DESIGN. (3) Design of footings, retaining walls, and two-way slabs. Design of beams for torsion. Analysis and design of continuous structures. Analysis and design of prestressed concrete beams. Prerequisite: CVEN 3420 or equivalent.

CVEN 5720. COMPOSITE STRUCTURE DESIGN. (3) Design of wood beams, columns, shear walls, diaphragms, and connections based on the latest specification. Materials include sawn lumber, glued-laminated timber, and plywood. Prerequisite: CVEN 3120 or equivalent.

CVEN 5730. MATRIX ANALYSIS OF STRUCTURES. Development of stiffness matrix for linear structural elements. Matrix operations with particular emphasis on the solution of banded matrices. Development of computer programs for structural analysis using the stiffness method. Prerequisite: CVEN 3410 or equivalent.

CVEN 5740. ELASTICITY. (3) Equations of equilibrium, compatibility and boundary conditions, and their application to pane stress and plane strain problems. Stress functions, strain energy methods, stress distribution in axially symmetrical bodies, special problems, and structures involving torsion and bending or prismatic bars. Prerequisites: CVEN 3120 or equivalent.

CVEN 5750. STABILITY AND VIBRATIONS OF STRUCTURES. (3) Bending of prismatic bars under simultaneous action of axial and lateral loads, harmonic motion, free and force vibrations of one-degree of freedom systems with and without damping. Systems with two or more degrees of freedom, vibration of rods and beams. Prerequisite: CVEN 3410 or equivalent.

CVEN 5760. ADVANCED INDETERMINATE STRUCTURES. (3) Analysis of indeterminate structures, including multi-story frames, bearing wall and shear wall buildings. Analysis of entire structure. Prerequisite: CVEN 3410 or equivalent.

CVEN 5770. THEORY OF PLATES AND SHELLS. (3) Elements of plate-bending. Analysis of circular and rectangular plates by classical, finite difference, and finite element methods. An introduction to membrane theory of shells. Prerequisite: CVEN 3120 or equivalent.

CVEN 5780. FINITE ELEMENT ANALYSIS. (3) Theoretical basis of finite element method. Elements for use in the solution of two and three dimensional stress problems, plate bending and shell problems. Development of computer programs utilizing plane stress conditions. Prerequisite: CVEN 3120 or equivalent.

CVEN 5790. REINFORCED MASONRY DESIGN. (3) Design of masonry elements with emphasis on reinforced masonry, including the design of beams, columns, walls, and footings. Structural analysis and design of masonry building. Prerequisite: CVEN 3440 or equivalent.

CVEN 5800. ADVANCED STEEL DESIGN. (3) Advanced topics in structural steel design, including composite design, build-up beams, plate girders, and moment resisting column base plates. Introduction to design of roof trusses, rigid frames, bridges, and multistory buildings. Structural analysis and design of steel structure. Prerequisite: CVEN 3440 or equivalent.

CVEN 5820. PRINCIPLES OF DESIGN. (3) Development of design theories; design for manufacturability; evaluation of design; redesign principles; case studies.