Master of Science Degree in Civil Engineering
Graduate work leading to the Master of Science degree in civil engineering is offered by the College of Engineering. The program provides advanced study in the areas of structural engineering, environmental engineering, geotechnical engineering, hydraulic and water resources engineering, and structural engineering.

Admission
The Department of Civil and Environmental Engineering requires that applicants to the master's program hold a bachelor's degree in civil or environmental engineering (or
A graduate student in the Department of Civil and Environmental Engineering is required to develop a program of study with a graduate adviser and establish a graduate committee of at least three members before the end of his/her first semester in the graduate program. Each student majoring in civil and environmental engineering may, with the approval of the graduate committee, also take graduate level courses in other branches of engineering or in areas of science and business, such as physics, geology, chemistry, mathematics, life science, administrative sciences, or computer science.

A minimum of thirty semester hours of acceptable graduate credit is required, including a minimum of three semester hours of CE 599 Thesis. Of this total, eighteen semester hours must be earned in the Department of Civil and Environmental Engineering. Furthermore, at least fifteen semester hours must be 500-level and completed at Southern Illinois University Carbondale. Each candidate is also required to pass a comprehensive oral examination covering all of the student's graduate work, including a thesis.

Each student will select a minimum of three engineering graduate faculty members to serve as a graduate committee, subject to the approval of the Chair of the Civil and Environmental Engineering Department. The committee will:

1. approve the student’s program of study;
2. approve the student’s thesis topic;
3. approve the completed thesis;
4. administer and approve the comprehensive oral examination.

Teaching or research assistantships and fellowships are available for qualified applicants. Additional information about the program, courses, assistantships, and fellowships may be obtained from the College of Engineering or the Department of Civil and Environmental Engineering.

Master of Engineering Degree in Civil and Environmental Engineering
The Master of Engineering degree (ME) in Civil and Environmental Engineering is a non-thesis, course only professional degree designed to provide advanced technical knowledge for professional practice. The program provides advanced study in the areas of structural engineering, environmental engineering, geotechnical engineering, and water resources engineering.

Admission
The Department of Civil and Environmental Engineering requires that applicants to the master’s program hold a bachelor’s degree in civil or environmental engineering (or equivalent), or have completed all undergraduate degree requirements prior to registration, with minimum grade point average (GPA) of 3.0 (A=4.0) for the last 60 hours of undergraduate work. Students having a GPA less than a 3.0 will be considered on a case-by-case basis. The GRE is not required for students applying to the ME degree program.

Prospective students are strongly encouraged to apply on-line at http://www.gradschool.siuc.edu/applygrad.html. You will be prompted to submit a non-refundable application fee of $50.00 via credit card. In the absence of reliable internet connection, please contact the department for hardcopy application documents. The application fee may also be submitted in the form of a money order and/or cashier’s check, payable to Southern Illinois University at a United States bank. Do not send cash. Please send the money order and/or cashier’s check directly to the department.

Requirements
A graduate student in the Department of Civil and Environmental Engineering is required to develop a program of study with a graduate adviser and establish a graduate committee of at least three members before the end of his/her first semester in the graduate program. Each student majoring in civil and environmental engineering may, with the approval of the graduate committee, also take graduate level courses in other branches of engineering or in areas of science and business, such as physics, geology, chemistry, mathematics, life science, administrative sciences, or computer science.

A minimum of thirty semester hours of acceptable graduate credit is required, including a minimum of three semester hours of CE 599 Thesis. Of this total, eighteen semester hours must be earned in the Department of Civil and Environmental Engineering. Furthermore, at least fifteen semester hours must be 500-level and completed at Southern Illinois University Carbondale. Each candidate is also required to pass a comprehensive oral examination covering all of the student’s graduate work, including a thesis.

Each student will select a minimum of three engineering graduate faculty members to serve as a graduate committee, subject to the approval of the Chair of the Civil and Environmental Engineering Department. The committee will:
Each student will select a minimum of three engineering graduate faculty members to serve as a graduate committee, subject to the approval of the Chair of the Civil and Environmental Engineering Department. The committee will:
1. approve the student’s program of study;
2. approve the student's engineering project topic;
3. approve the completed engineering project and report.

For graduation, the ME student is required to complete thirty semester hours including CE 593 Civil Engineering Project. Of this, eighteen semester hours must be earned in the Department. Furthermore, at least fifteen semester hours must be 500-level and completed at Southern Illinois University Carbondale.

The ME program permits students to complete an advanced degree in three semesters (12 credit hours Fall, 12 credit hours Spring, 6 credit hours Summer). This is a non-research degree, teaching or research assistantships are not available for students pursuing this degree, nor would this be a suitable track to pursue a Ph.D.

Courses (CE)


413-3 Collection Systems Design. Design of wastewater and storm water collection systems including installation of buried pipes. Determination of design loads and flows, system layout and pipe size. Prerequisite: 310 and 370a.

418-3 Water and Wastewater Treatment. A study of the theory and design of water and wastewater treatment systems, including physical, chemical, and biological processes. Topics include sedimentation, biological treatment, hardness removal, filtration, clarification and residuals management. Prerequisite: 310, 370 and Engineering 351.

419-3 Advanced Water and Wastewater Treatment. Advanced concepts in the analysis and design of water and wastewater treatment plants. Topics include advanced physical, chemical and biological processes. Emphasis is on the treatment and disposal of sludges, design of facilities, advanced treatment principles, and toxics removal. Prerequisite: 418.

421-3 Foundation Design. Application of soil mechanics to the design of the foundations of structures; subsurface exploration; bearing capacity and settlement analysis of shallow foundations; lateral earth pressures and design of retaining walls; capacity and settlement of pile foundations for vertical axial loads. Prerequisite: CE 320.

422-3 Environmental Geotechnology. Geotechnical aspects of land disposal of solid waste and remediation, solute transport in saturated soils, waste characterization and soil-waste interaction, engineering properties of municipal wastes, construction quality control of liners, slope stability and settlement considerations, use of geosynthetics and geotextiles, cap design, gas generation, migration and management. Prerequisite: 310.

431-3 Pavement Design. Design of highway and airport systems: subgrades, subbases, and bases; soil stabilization; stresses in pavements; design of flexible and rigid pavements; cost analysis and pavement selection; and pavement evaluation and rehabilitation. Prerequisite: CE 320 and 330.


441-3 Matrix Methods of Structural Analysis. Flexibility method and stiffness method applied to framed structures. Introduction to finite elements. Prerequisite: 340.

442-3 Structural Steel Design. An introduction to structural steel design with emphasis on buildings. Design of structural members and typical welded and bolted connections in accordance with the specifications of the Steel Construction Manual of Steel Construction (AISC). Design project and report required. Prerequisite: 340.

444-3 Reinforced Concrete Design. Behavior and strength design of reinforced concrete beams, slabs, compression members and footings. Prerequisite: 340.


447-3 Seismic Design of Structures. Basic seismology, earthquake characteristics and effects of earthquakes on structures, vibration and diaphragm theories, seismic provisions of the International Building Code, general structural design and seismic resistant concrete and steel structures. Prerequisite: 442 or 444, concurrent enrollment or consent of instructor.

448-3 Structural Design of Highway Bridges. Structural design of highway bridges in accordance with the specifications of the American Association of State Highway and Transportation Officials (AASHTO); superstructure includes concrete decks, steel grinders, prestressed and post-tensioned concrete grinders; substructure includes abutments, wingwalls, piers, and footings. Prerequisite: 442 or 444, concurrent enrollment or consent of instructor.

471-3 Groundwater Hydrology. Analysis of groundwater flow and the transport of pollution by subsurface flow; applications to the design of production wells and remediation of polluted areas; finite difference methods for subsurface analyses. Prerequisite: 370 or consent of instructor.

472-3 Open Channel Hydraulics. Open channel flow, energy and momentum, design of channels, gradually varied flow computations, practical problems, spatially varied flow, rapidly varied flow, unsteady flow, flood routing, method of characteristics. Prerequisite: 474 or consent of instructor.

473-3 Hydrologic Analysis and Design. Hydrological cycle, stream-flow analysis, hydrographs generations, frequency analysis, flood routing, watershed analysis, urban hydrology, flood plain analysis. Application of hydrology to the design of small dams, spillways, drainage systems. Prerequisite: 370.

474-3 Hydraulic Engineering Design. Study of pipe flow, network systems, pump selection, open channel flow, uniform flow, critical flow, gradually varied flow, rapidly varied flow, design of transitions, water surface profiles. Prerequisite: CE 370 and ENGR 351 or concurrent enrollment in ENGR 351.

500-1 to 4 Seminar. Collective and/or individual study of selected issues and problems relating to various areas of civil engineering. Restricted to graduate standing.


511-3 Nanotechnology and Subsurface Remediation. Conventional and emerging nanotechnology-based remediation technologies for subsurface environment; review of current soil and groundwater remediation technologies; sediment remediation, nano-synthesis, characterization and nanotechnology-driven remediation technologies and materials. Special approval needed from the instructor.

512-3 Environmental Engineering Chemistry. Fundamentals as well as frontiers in aquatic chemistry, environmental organic chemistry, and environmental biochemistry. Topics include thermodynamics and kinetics of redox reactions, linear free energy relations, abiotic organic compound transformations, stoichiometry, energetics and kinetics of microbial reactions, biochemical basis of the transformation of key organic and inorganic pollutants in the environment. Prerequisite: CE 418 or consent of instructor.

516-3 Water Quality Modeling. Water quality factors and control methods. Technical, economic, social and legal aspects concerned with implementation of various engineered systems for water quality management. Case studies. Prerequisite: 418.


518-3 Advanced Biological Treatment Processes. The biochemical and microbial aspects of converting substrate to bacterial cell mass or products and its use in various phases of industry (both fermentation and wastewater treatment). Design of activated sludge and trickling filter plants from lab data obtained on explicit wastes from both industry and municipalities. Prerequisite: 418.

519-3 Triple E Sustainability - Environment Energy and Economy. Principles, goals, and practical applications of sustainable development; major theories and issues related to sustainability in the areas of environmental resource use, energy production, and process life cycle analysis; identify and design sustainable approaches on common areas of interest to the society, such as buildings, transportation, food, industry processes, and ecology. Special approval needed from the instructor.


521-3 Soil Improvement. Methods of soil stabilization, compaction, dynamic compaction, chemical treatment, compaction piling, stone columns, dewatering, soil reinforcement with stirrups, geomembranes and geogrids, ground freezing, stabilization of industrial wastes. Prerequisite: CE 320, CE 421.

522-3 Advanced Foundation Engineering. Case histories of foundation failure, bearing capacity theories, shallow foundations, deep foundations, piles under vertical and horizontal loads, pier foundations, foundations for difficult soil conditions, soil improvement. Prerequisite: 421.

523-3 Soil Dynamics. Problems in dynamic loading of soils, dynamic soil properties, liquefaction, dynamic earth pressure, foundations for earthquake and other dynamic loads. Prerequisite: CE 320 and CE 421.
524-3 **Advanced Soil Testing.** Review of basic laboratory tests on soils, hands-on training for performing advanced laboratory tests on soils such as: triaxial compression, flexible wall permeability, one-dimensional consolidation, and California bearing ratio, understanding ASTM standards, sample preparation, data reduction and interpretation, and development of detailed laboratory test reports. Prerequisites: CE 421, or consent of instructor.

525-3 **Foundations for Dynamic Loads.** Dynamic loads due to natural and man-made phenomena, damage to humans and the environment, property loss, analytical models for response analysis of foundation-soil systems for steady state, seismic and impact loads, design criteria, determination of soil properties, stiffness and damping of foundation-soil systems, design of shallow and deep foundations for various types of dynamic loads, computer applications, case histories of damage. Prerequisites: CE 421 and CE 445 or consent of instructor.

530-3 **Advances in Materials and Testing,** An introduction to advances in concrete technology; High strength concrete; Light-weight concrete; Cement and polymer composites; and Non-destructive testing. Fundamental concepts, manufacture, performance, testing, design methodology and applications. Prerequisite: CE 330 or equivalent or consent of instructor.


542-3 **Nonlinear Structural Analysis.** Analysis of the nonlinear response of framed structures subjected to static and dynamic loads. Structural idealizations. Response calculation by incremental and iterative techniques. Instability phenomena of snap-through and bifurcation. Post-buckling behavior. Approximate formulations. Detection of instability under dynamic loads. Prerequisite: CE 441 or CE 551 or consent of instructor.


545-3 **Advanced Steel Design.** Economical use of high strength steel; behavior and design bolted and welded building connections; plate girders and composite steel-concrete beams; brittle fracture and fatigue; and low-rise and industrial-type buildings. Prerequisite: CE 442.

551-3 **Finite Element Analysis.** (Same as Mechanical Engineering 565). Finite element analysis as a stress analysis or structural analysis tool. Derivation of element stiffness matrices by various means. Application to trusses, plane stress/strain and 3-D problems. Dynamic and material nonlinearity problems. Prerequisite: Civil Engineering 350 and Mathematics 305.

552-3 **Theory of Elasticity.** Stress and strain equations of elasticity; equilibrium equations; compatibility equations; stress functions; applications of elasticity in solving engineering problems in two and three dimensions. Prerequisite: CE 350 and Mathematics 305.

553-3 **Theory of Plasticity.** (Same as Mechanical Engineering 513) Criteria for onset of yielding, isotropic and kinematic strain hardening; flow rules for plastic strains; elastic plastic bending and torsion, slip line field theory; plane stress problems; limit analysis. Prerequisite: CE 350 and Mathematics 305 or consent of instructor.

554-3 **Experimental Mechanics.** An introduction of various experimental techniques that are commonly used to determine properties such as deformation, straining, surface contour, etc. The topics to be covered include the principles of strain gage technology, theory of photoelasticity, piezoelectric accelerometer, laser based interferometry, image processing and analysis, and reverse mechanics. The specific areas of practical application for each type of experimentation will be discussed. Prerequisite: CE 350.


557-3 **Advanced Mechanics of Materials.** (Same as Mechanical Engineering 566). Advanced topics in mechanics of materials including: elasticity equations; torsion of non-circular sections; generalized bending including curved beams and elastic foundations; shear centers; failure criteria including yielding, fracture and fatigue; axisymmetric problems including both thick and thin walled bodies; contact stresses; and stress concentration. Prerequisite: CE 350 and Engineering 222.

570-3 **Sedimentation Engineering.** Introduction to the transport of granular sediment by moving fluids; analysis of regional degradation, aggradation and local scour in alluvial channels; investigation of sediment sources, yield and control. Prerequisite: CE 474 or consent of instructor.

571-3 **Water Resources Systems Engineering and Management.** Philosophy of water resources planning; economic, social and engineering interactions related to water quantity; quantitative optimal planning methodologies for the design and operation of hydrosystems; guest lecturers; projects/case studies. Prerequisite: CE 474 or consent of instructor.

572-3 **Advanced Hydraulic Design.** Design and analysis of stormwater control and conveyance systems, dams, spillways, outlet works, stilling basins, culverts and other complex hydraulic systems. Prerequisite: CE 474 or consent of instructor.

573-3 **Modeling of Hydrosystems.** Hydraulic and hydrologic modeling; theory and application of common surface and subsurface flow models such as HEC–RAS,
HEC–6, FLDWAV, DAMBRK, MODFLOW and MODPATH. Prerequisite: CE 474 or consent of instructor.

592-1 to 5 Special Investigations in Civil Engineering. Advanced Civil Engineering Topics and/or problems in (a) Structural Engineering, (b) Hydraulic Engineering, (c) Environmental Engineering, (d) Geotechnical Engineering, (e) Fluid Flow Analysis, (f) Computational Mechanics, (g) Composite Materials, and (h) Stress Analysis. Restricted to graduate standing. Special approval needed from the instructor.

593-3 Civil Engineering Project. Advanced project on topics such as case studies, engineering design, testing and analysis methods, computer modeling. Or any other topic focusing on engineering practice. Detailed project report is required. Special approval needed from instructor.

599-1 to 6 Thesis. 601-1 per semester Continuing Enrollment. For those graduate students who have not finished their degree programs and who are in the process of working on their dissertation, thesis, or research paper. The student must have completed a minimum of 24 hours of dissertation research, or the minimum thesis, or research hours before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only.