Civil Engineering

The School of Civil, Environmental, and Infrastructure Engineering provides educational opportunities that will prepare students for effective and productive careers in Civil Engineering and other related professions. Continued professional growth, discovery, innovation and development of technologies, and service to the community are characteristics of this area of study.

The primary mission of the school is to prepare students for careers that will span forty years or more. Most civil and environmental engineers will be employed by public agencies at all levels of government, by various industries, and by a variety of large and small consulting firms. Virtually all of this practice relates in some way to the health, safety, and welfare of the general public. Those involved in this field will need to possess the ability to conceptualize, plan, design, and construct new and innovative works and systems. Technical knowledge of great sophistication will be needed, as well as an understanding of the interrelated social, political, and environmental issues that will be key elements in the decision making process.

Preparing engineers for this role requires a broad liberal education program as well as one of technical depth and breadth. The undergraduate core curriculum is broad-based and includes courses in mathematics, science, communication, and social science. The civil engineering curriculum begins with fundamental engineering skills and ends with a two-semester capstone design experience. Students are required to take courses in environmental engineering, geotechnical engineering, hydraulic engineering, structural engineering, and surveying.

Program Educational Objectives

The educational goal of the undergraduate civil engineering program is to provide a quality civil engineering education that will prepare our graduates to become practicing professionals able to meet the technological challenges of the 21st century. To this end we strive to instill in our graduates the knowledge, skills, attitudes, and ethical and social values necessary to be successful civil engineering practitioners. Also, we seek to provide the necessary academic background for successful graduate study in engineering or other fields. To meet this goal, we have defined the following objectives that describe what our graduates are expected to attain within three to five years after graduation.

1. Become productive professionals and successfully formulate cost-effective solutions to real-world problems that are fundamental to civil engineering and related fields.
2. Successfully pursue advanced degrees, professional licensure and professional development activities that support life-long learning.
3. Successfully serve the public and improve the quality of life by acting in a professional, safe, and ethical manner.
4. Advance towards leadership positions through effective contribution to multidisciplinary teams.

The program is designed to provide the students with the broad educational background essential to civil engineering practice with emphases in the areas of environmental engineering, geotechnical engineering, hydraulic engineering, and structural engineering. Students may choose to specialize in the area of Environmental Engineering. The program offers sufficient number of courses in the structural engineering area to qualify for structural engineer (SE) license exam.

The School of Civil, Environmental, and Infrastructure Engineering offers a program leading to a Bachelor of Science degree in Civil Engineering. Students may choose to earn a Bachelor of Science degree in Civil Engineering with specialization in Environmental Engineering.
The undergraduate program in civil engineering is accredited by the Engineering Accreditation Commission of ABET, abet.org.

### Bachelor of Science (B.S.) in Civil Engineering Degree Requirements

<table>
<thead>
<tr>
<th>Degree Requirements</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>University Core Curriculum Requirements</td>
<td>39</td>
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<tr>
<td>Foundation Skills</td>
<td>13</td>
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<td>Fine Arts</td>
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<tr>
<td>Human Health (BIOL 202 or an approved substitute)</td>
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<tr>
<td>Requirements for Major in Civil Engineering</td>
<td>(9) + 88</td>
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<tr>
<td>Basic Sciences</td>
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<tr>
<td>CHEM 200, CHEM 201, CHEM 210</td>
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<tr>
<td>Mathematics</td>
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Degree Requirements | Credit Hours
---|---
MATH 150, MATH 250, MATH 251, MATH 305 | (3) + 11
ENGR 351 | 3
Required Engineering Courses: ENGR 250, ENGR 261, ENGR 350A, ENGR 370A | 12
Required CE Courses: | 41
CE 251, CE 263, CE 301, CE 310, CE 310L, CE 320, CE 320L, CE 330, CE 340, CE 418, CE 421, CE 442, CE 444, CE 474, CE 495A, CE 495B | 39
Technical Elective: | 12
Total | 127

1 Courses required for the major will apply toward nine hours of University Core Curriculum, making a total of 39 in that area. Number of UCC credit hours required for transfer students admitted under capstone option may be less than 39.

2 Required only for students who have completed less than 26 credit hours after high school graduation.

3 School requirements for University Core Curriculum are more restrictive than those of the University as a whole. Students should consult advisor for approved courses. Students transferring from other programs or institutions will be required to meet the University Core Curriculum requirements for engineering students.

4 Approved technical electives: CE 331 and CE 400-level courses.

5 Total number of credit hours required for graduation may be different for transfer students. However, all students are required to complete all major specific math, science, and engineering courses.

### B.S Civil Engineering - Environmental Engineering Specialization Degree Requirements

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Requirements for Major in Civil Engineering: (9) + 88

| Basic Sciences                                                                     | (6) + 9      |
| CHEM 200, CHEM 201, CHEM 210                                                        | (3) + 4      |
| PHYS 205A,B, PHYS 255A,B                                                            | (3) + 5      |
| Mathematics                                                                         | (3) + 14     |
| MATH 150, MATH 250, MATH 251, MATH 305                                               | (3) + 11     |
| ENGR 351                                                                            | 3            |
| Required Engineering Courses: ENGR 250, ENGR 261, ENGR 350A, ENGR 370A               | 12           |
| Required CE Courses: CE 251, CE 263, CE 301, CE 310, CE 310L, CE 320, CE 320L, CE 330, CE 340, CE 418, CE 421, CE 442, CE 444, CE 474, CE 495A, CE 495B | 41           |
| Technical Elective                                                                  | 4            |

Total: 127

1 Courses required for the major will apply toward nine hours of University Core Curriculum, making a total of 39 in that area. Number of UCC credit hours required for transfer students admitted under capstone option may be less than 39.
2 Required only for students who have completed less than 26 credit hours after high school graduation.

3 School requirements for University Core Curriculum are more restrictive than those of the University as a whole. Students should consult advisor for approved courses. Students transferring from other programs or institutions will be required to meet the University Core Curriculum requirements for engineering students.

4 Approved technical electives: CE 410, CE 412, CE 413, CE 416, CE 419, CE 422, CE 471, CE 472, CE 473, and ME 416.

5 Total number of credit hours required for graduation may be different for transfer students. However, all students are required to complete all major specific math, science, and engineering courses.

Capstone Option for Transfer Students

The SIU Capstone Option is available to students who have earned an Associate in Engineering Sciences (A.E.S.) degree with a minimum cumulative 2.0/4.0 GPA on all accredited coursework prior to the completion of the A.E.S., as calculated by SIU. The Capstone Option reduces the University Core Curriculum requirements from 39 to 30 hours, therefore reducing the time to degree completion. Students interested in the Capstone Option should contact the School of Civil, Environmental and Infrastructure Engineering Advisement Office to develop a personal coursework pathway to degree completion.

Technical Enhancement Program

The objective of the Technical Enhancement Program (TEP) is to encourage students to enhance their technical and soft skills, thus improving their marketability upon graduation. This program is available to freshmen only. Students must fulfill the requirements of the program in order to receive a certificate of completion from the School. The School of Civil, Environmental and Infrastructure Engineering has developed this program in collaboration with its Professional Advisory Board. For additional details and how to participate, please contact the School or visit the School website at engineering.siu.edu/civil.

Civil Engineering Courses

CE251 - Probability & Statistics 251-1 Introduction to Probability and Statistics for Engineering. An introduction to probability and statistics, with emphasis on engineering applications. Univariate and bivariate statistics, simple linear regression, examination of regression residuals, measurement errors, uncertainty propagation, axioms of probability, independence of events, conditional probability and Bayes' rule. Prerequisite: MATH 150 with a grade of C or better.

CE263 - Basic Surveying 263-3 Basic Surveying. An introductory course designed to introduce the principles, theory and equipment of surveying. Development of survey field practices on the earth’s surface and subsurface and related computations. Prerequisite: MATH 111 with a grade of C or better.

CE301 - Intro to Sustainability 301-2 Introduction to Resource Sustainability in Civil and Environmental Engineering. An introduction to sustainable use of resources, economics of sustainable design, life cycle assessment, consideration of sustainability in various civil engineering applications, case studies on resource sustainability. Prerequisite: ECON 240.

CE310 - Environmental Engineering 310-3 Environmental Engineering. Basic engineering aspects of water, land, and air pollution and control. Problems, sources, and effects of pollution. Major state and federal regulations relating to environmental issues. Prerequisites: MATH 250 with a grade of C or better; CHEM 210; completion of or concurrent enrollment in CE 251; and concurrent enrollment in CE 310L.

CE310L - Environmental Engineering Lab 310L-1 Environmental Engineering Laboratory Experiments. Prerequisite: MATH 250 with a grade of C or better; CHEM 210; completion of or concurrent enrollment in
CE 251; concurrent enrollment in CE 310. If CE 310 is dropped CE 310L must also be dropped. Lab fee: $30.

**CE320 - Soil Mechanics** 320-3 Soil Mechanics. Physical and mechanical properties of soils, soil classification, flow through soils, effective stresses, geostatic stress and stresses due to applied loads, one-dimensional consolidation, introduction to shear strength, and soil compaction. Prerequisite: ENGR 350A; completion of or concurrent enrollment in CE 251; concurrent enrollment in CE 320L.

**CE320L - Soil Mechanics Lab** 320L-1 Soil Mechanics Laboratory Experiments. Prerequisites: ENGR 350A; completion of or concurrent enrollment in CE 251; concurrent enrollment in CE 320. If CE 320 is dropped CE 320L must also be dropped. Lab fee: $30.


**CE331 - Transportation Engineering** 331-3 Transportation Engineering. Introduction to geometric design, earth work, drainage and traffic. Basic design principles for each area and their application to typical problems. Prerequisite: completion of or concurrent enrollment in CE 330.


**CE392 - CE Co-op Education** 392-1 to 6 Civil Engineering Cooperative Education. Supervised work experience in industry, government or professional organization. Students work with on-site supervisor and faculty adviser. Reports are required from the student and the employer. Hours do not count toward degree requirements. Mandatory Pass/Fail. Restricted to sophomore standing.


**CE412 - Contaminant Transport** 412-3 Contaminant Fate, Transport and Remediation in Groundwater. Mathematics of flow and mass transport in the saturated and vadose zones; retardation and attenuation of dissolved solutes; flow of nonaqueous phase liquids; review of groundwater remediation technologies; review of flow and transport models. Prerequisite: CE 310 and 320, or consent of instructor for non CE majors.

**CE413 - Collection Systems Design** 413-3 Collection Systems Design. Design of waste water and storm water collection systems including installation of buried pipes. Determination of design loads and flows, system layout and pipe size. Prerequisite: CE 310 and ENGR 370A.

**CE416 - Surface Water Quality** 416-3 Surface Water Quality Modeling. Quantification of physical, biological, and chemical processes occurring in natural freshwater ecosystems. Mathematical analysis of the effects due to conservative and non-conservative pollutant loadings to lakes and rivers. Detailed study of dissolved oxygen mass balance modeling and eutrophication. Prerequisite: CE 310; concurrent enrollment allowed in CE 418 or GEOL 416 or GEOL 418.

**CE418 - Water & Wastewater Treatment** 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, chlorination and residuals management. Prerequisite: CE 310, ENGR 370A and completion of/concurrent enrollment in ENGR 351.

**CE419 - Advanced Water Wastewtr Trtmt** 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: CE 418.
CE421 - Foundation Design 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.

CE422 - Environmental Geotechnology 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: CE 310, 320.

CE423 - Geotechnical Engr Prof Practic 423-3 Geotechnical Engineering in Professional Practice. Application of principles of geotechnical engineering in a real-world setting; planning, managing and executing geotechnical projects; developing proposals and geotechnical project reports; interpreting and using recommendations developed by geotechnical engineers; total quality management, professional liability and risk management. Prerequisite: CE 320, 421 or concurrent enrollment or consent of instructor.

CE426 - Seepage and Slope Stability 426-3 Seepage and Slope Stability Analysis. (Same as CE 526) Seepage through soils; numerical and physical modeling of two-dimensional flow; basic mechanism of slope stability analysis; analytical methods in analyzing slopes; slope stabilization. Prerequisite: CE 320.

CE431 - Pavement Design 431-3 Pavement Design. Design of highway pavements including 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.

CE432 - CADD for Civil Engineers 432-3 Computer Aided Design and Drawing (CADD) for Civil Engineers. A study of civil engineering drawings and their relationship to engineering design in the CADD environment. Emphasis is on the skills associated with developing and understanding technical drawings, including construction plans and related documents, for engineering design. Computer based design and drawing techniques and related software. Includes 3 hours lab per week. Prerequisite: Completion of or concurrent enrollment in CE 263.


CE442 - Structural Steel Design 442-3 Structural Steel Design. An introduction to structural steel design with an emphasis on buildings. Design of structural members and typical welded and bolted connections in accordance with the specifications of the Steel Construction Manual of the American Institute of Steel Construction (AISC). Design project and report required. Prerequisite: CE 340.

CE444 - Reinforced Concrete Design 444-3 Reinforced Concrete Design. Behavior and strength design of reinforced concrete beams, slabs, compression members, and footings. Prerequisite: CE 340.


CE447 - Seismic Design of Structures 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: CE 442 or CE 444, concurrent enrollment or consent of instructor.

CE448 - Structural Design Hwy Bridges 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 girders, prestressed and post-tensioned concrete girders; substructure includes abutments, wingwalls, piers, and footings. Prerequisite: CE 442 or 444 or concurrent enrollment, or consent of instructor.

CE451 - Intro to Finite Elements 451-3 Introduction to Finite Elements in Engineering Applications. (Same as CE 551) An introduction to finite element techniques and computer methods in finite element applications. Theory and structure of algorithms for one-dimensional and multi-dimensional problems. Applications in solid mechanics, structural analysis, groundwater and fluid flow, and heat transfer. Prerequisite: ENGR 351.

CE471 - Groundwater Hydrology 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: ENGR 370A or consent of instructor.

CE472 - Open Channel Hydraulics 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: CE 474 or consent of instructor.

CE473 - Hydrologic Analysis & Design 473-3 Hydrologic Analysis and Design. Hydrological cycle, stream-flow analysis, hydrograph generation, frequency analysis, flood routing, watershed analysis, urban hydrology, flood plain analysis. Application of hydrology to the design of small dams, spillways, drainage systems. Prerequisite: ENGR 370A.


CE486 - Nondestructive Eval Engr Matls 486-3 Nondestructive Evaluation of Engineering Materials. (Same as ME 486) Overview of common nondestructive evaluation (NDE) techniques, such as visual inspection, eddy current, X-ray, and ultrasonics, to measure physical characteristics of and to detect defects in engineering materials. Laboratory experiments include contact ultrasonic, magnetic particle, liquid penetrant, and infrared thermography methods of testing. Prerequisites: CE 320 and CE 330 with grades of C or better.

CE492A - Special Probs-Structural Engr 492A-1 to 4 Special Problems in Civil Engineering. Selected engineering topics or problems in structural engineering. Four hours maximum credit. Not for graduate credit. Special approval needed from the instructor.

CE492B - Special Probs-Hydraulic Engr 492B-1 to 4 Special Problems in Civil Engineering. Selected engineering topics or problems in hydraulic engineering. Four hours maximum credit. Not for graduate credit. Special approval needed from the instructor.

CE492C - Spec Probs-Environmental Engr 492C-1 to 4 Special Problems in Civil Engineering. Selected engineering topics or problems in environmental engineering. Four hours maximum credit. Not for graduate credit. Special approval needed from the instructor.

CE492D - Special Prob-Applied Mechanics 492D-1 to 4 Special Problems in Civil Engineering. Selected engineering topics or problems in applied mechanics. Four hours maximum credit. Not for graduate credit. Special approval needed from the instructor.
CE492E - Spec Prob-Geotechnical Engr 492E-1 to 4 Special Problems in Civil Engineering. Selected engineering topics or problems in geotechnical engineering. Four hours maximum credit. Not for graduate credit. Special approval needed from the instructor.

CE492F - Spec Prob-Computatnl Mechanics 492F-1 to 4 Special Problems in Civil Engineering. Selected engineering topics or problems in computational mechanics. Four hours maximum credit. Not for graduate credit. Special approval needed from the instructor.

CE492G - Special Probs-Surveying Engr 492G-1 to 4 Special Problems in Civil Engineering. Selected engineering topics or problems in surveying engineering. Four hours maximum credit. Not for graduate credit. Special approval needed from the instructor.

CE495A - Civil Engineering Design 495A-3 Civil Engineering Design. Engineering ethics and professionalism. Project development skills, feasibility and cost-estimation, project management, autocad applications in civil engineering. Selection of projects, formation of design teams, development of a design proposal. Written and oral presentations of the design proposal. Not for graduate credit. Prerequisite: PHYS 205B and PHYS 255B with a grade of C or better, completion of/concurrent enrollment in CE 301, 320, 330, 418, 442 or 444, and 474.

CE495B - Civil Engineering Design 495B-3 Civil Engineering Design. A capstone design experience using a team approach for the preliminary and final design of a civil engineering project. Documentation of all stages of the design project. Written and oral presentation of the final design. Not for graduate credit. Prerequisite: CE 495A, completion of/concurrent enrollment in CE 421 and 442 or 444.

Civil Engineering Faculty

Chevalier, Lizette R., Professor and Associate Provost for Academic Programs, Civil Engineering, Ph.D., Michigan State University, 1994; 1995. Environmental restoration of groundwater aquifers, experimental investigation of immiscible flow, and numerical modeling of subsurface transport.

Fakhraei, Habibollah, Assistant Professor, Civil Engineering, Ph.D., Syracuse University, 2016; 2019. Environmental engineering, environmental modeling, biogeochemistry, aquatic chemistry, water quality modeling, air pollution effects, GIS, geostatistical analysis, hydrology, numerical optimization.

Hsiao, J. Kent, Professor, Civil Engineering, Ph.D., University of Utah — Salt Lake City, 2000; 2001. Structural earthquake engineering, structural reliability, structural design of buildings and bridges using steel, reinforced or prestressed concrete, masonry, and wood.

Kalra, Ajay, Assistant Professor, Civil Engineering, Ph.D., University of Nevada, 2011; 2015. Hydraulics and Water Resources Engineering, hydro-climatology, urban sustainability, water-energy-climate nexus, probabilistic forecasting and downscaling, surface water and groundwater interactions.

Kassimali, Aslam, Professor and Distinguished Teacher, Civil Engineering, Ph.D., University of Missouri, 1976; 1980. Structural engineering, nonlinear structural analysis, structural dynamics and stability.

Kolay, Prabir, Associate Professor, Civil Engineering, Ph.D., Indian Institute of Technology, IIT BoM.B.A.y, 2001; 2010. Geotechnical Engineering, Soil Stabilization, utilization of recycled concrete aggregate (RCA) and coal ash, unsaturated soil, thermal properties of soil, and numerical modeling.

Kumar, Sanjeev, Professor, Distinguished Teacher, Director, and Interim Associate Dean. Civil Engineering, Ph.D., University of Missouri Rolla, 1996; 1998. Dynamic soil-structure interaction, piles under lateral loads, settlement prediction of landfills, hydraulic conductivity of clay barriers, seismic analysis and design of landfills, ground motion amplification in soils, liquefaction of silts and sands and machine foundations.

Liu, Jia, Assistant Professor, Civil Engineering, Ph.D., University of Houston, 2014; 2015. Environmental Engineering, renewable energy production, microbial fuel cell, water/wastewater treatment and groundwater/soil remediation, material development for energy safety and environmental pollution detection.

Puri, Vijay K., Professor, Civil Engineering, Ph.D., University of Missouri-Rolla, 1984; 1986. Geotechnical engineering, soil dynamics, machine foundations, liquefaction of soils.

Shams, Mehnaz, Assistant Professor, Civil Engineering, Ph.D., Washington State University, 2019; 2020. Environmental engineering, Fate and transport of emerging pollutants in surface water, Plastic pollution
and prevention, Water/wastewater treatment, Environmental chemistry, Storm water management, Electrochemical remediation.

**Shin, Sangmin**, Assistant Professor, Civil Engineering, Ph.D., Korea Advanced Institute of Science and Technology (KAIST), 2015; 2021. Integrated water resources modeling and management, Critical interdependent infrastructure systems, Socio-environmental hydrology, Cyber-physical systems, Urban sustainability and resilience, Water-energy-food nexus, Multi-objective optimization and decision making, Real-time system control, Systems thinking and analysis.

**Tezcan, Jale**, Professor, Civil Engineering, Ph.D., Rice University, 2005; 2005. Non-linear structural behavior, neural networks in system identification and structural control, rehabilitation, and retrofitting of structures damaged by earthquakes.


**Emeriti Faculty**

**Bravo, Rolando**, Associate Professor, Emeritus, Civil Engineering, Ph.D., University of Houston, 1990; 1991.

**Butson, Gary J.**, Associate Professor, Emeritus, Civil Engineering, Ph.D., University of Illinois at Urbana-Champaign, 1981; 1992.

**Cook, Echol E.**, Professor, Emeritus, Civil Engineering, Ph.D., Oklahoma State University, 1970; 1971.

**DeVantier, Bruce A.**, Associate Professor, Emeritus, Civil Engineering, Ph.D., University of California-Davis, 1983; 1983.

**Evers, James L.**, Associate Professor, Emeritus, Civil Engineering, Ph.D., University of Alabama, 1969; 1969.

**Frank, Roy R., Jr.**, Assistant Professor, Emeritus, Civil Engineering, M.S., Southern Illinois University Carbondale, 1983; 1984.

**Ray, Bill T.**, Associate Professor, Emeritus, Civil Engineering, Ph.D., University of Missouri-Rolla, 1984; 1985.

**Rubayi, Najim**, Professor, Emeritus, Civil Engineering, Ph.D., University of Wisconsin, 1966; 1966.

**Sami, Sedat**, Professor, Emeritus, Civil Engineering, Ph.D., University of Iowa, 1966; 1966.

**Yen, Max Shing-Chung**, Professor, Emeritus, Civil Engineering, Ph.D., Virginia Polytechnic Institute, 1984; 1984.

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Last updated: 03/10/2021

**Southern Illinois University**

Carbondale, IL 62901
Phone: (618) 453-2121

**Catalog Year Statement:**

Students starting their collegiate training during the period of time covered by this catalog (see bottom of this page) are subject to the curricular requirements as specified herein. The requirements herein will extend for a seven calendar-year period from the date of entry for baccalaureate programs and three years for associate programs. Should the University change the course requirements contained herein subsequently, students are assured that necessary adjustments will be made so that no additional time is required of them.