CIVIL ENGINEERING (4300)

4300:101 Introduction to Civil Engineering Fundamentals (3 Credits)
Corequisite: 3450:149 or higher math or appropriate AP test score. Introduction to Civil Engineering. Basic concepts of civil engineering practice including communication skills, problem solving skills, professional ethics/goals, and teamwork. Introduction to professional level software including spreadsheets, database, and mathematical computation.

4300:102 Tools for Civil Engineering (3 Credits)
Prerequisite: 4300:101. Building on concepts of engineering practices learned in Tools I further developing communication skills, problem solving skills, professional ethics/goals, statistics and model-building, and teamwork. Advanced use of professional level software including CAD, MATLAB and Excel.

4300:201 Statics (3 Credits)
Corequisites: 3450:222 and 3650:291. Forces, resultants, couples; equilibrium of force systems; distributed forces; centers of gravity; analysis of simple structures; moments of inertia; kinematics.

4300:202 Introduction to Mechanics of Solids (3 Credits)
Prerequisite: 4300:201. Axial force, bending moment diagrams, axial stress and deformation; stress-strain diagrams; torsion; flexural stress; flexural shearing stress; compound stresses; indeterminate beams; columns.

4300:306 Theory of Structures (3 Credits)
Prerequisite: 4300:202. Stability and determinacy; statically determinate trusses and frames; approximate frame analysis influence lines; moving loads; virtual work analysis; moment area theorem; theorem of three moments; moment distribution for continuous beams and frames.

4300:313 Soil Mechanics (3 Credits)
Prerequisites: 4300:202 and admission to an engineering major within the College of Engineering and Polymer Science or permission. Physical properties of soils. Soil water and groundwater flow. Stresses, displacements, volume changes, consolidation within a soil mass. Soil strength. Compaction.

4300:314 Geotechnical Engineering (3 Credits)
Prerequisites: 4300:313 and admission to an engineering major within the College of Engineering and Polymer Science. Limiting equilibrium within a soil mass. Design of retaining walls, bulkheads, shallow, deep foundation systems. Slope stability.

4300:321 Introduction to Environmental Engineering (3 Credits)
Prerequisites: 3150:153 and 3450:222. Basic principles of ecosystems, microbiology, chemical reactions, and material flow that environmental engineers use to protect our water, air and soil.

4300:323 Water Supply & Pollution Control (3 Credits)
Prerequisite: 4300:321 and admission to an engineering major within the College of Engineering and Polymer Science. Pre/Corequisite: 3450:335. Water and wastewater characteristics, criteria, quantities and distribution. Water and wastewater treatment process flowsheets, design and operation. Wastewater and residue disposal.

4300:341 Hydraulic Engineering (3 Credits)
Prerequisites: 4600:310 and admission to an engineering major within the College of Engineering and Polymer Science. This course will focus on presentation and application of fundamental hydraulic principles in both the classroom and laboratory. Examination of flow in pipelines and pipe networks, pumps and pumping stations, hydrology, flow in open channels, groundwater hydraulics, and design of hydraulic structures will be studied. Emphasis will be placed on proper application of principles, data interpretation and analysis, problem solving, and report writing.

4300:361 Transportation Engineering (3 Credits)
Prerequisites: junior standing and admission to an engineering major within the College of Engineering and Polymer Science. Introductory survey of transportation topics including transportation planning requirements and techniques, introduction to design of highways, airports and railroads and introduction to traffic engineering.

4300:380 Engineering Materials Laboratory (3 Credits)
Prerequisites: 4300:202 and admission to an engineering major within the College of Engineering and Polymer Science. Fundamentals and applications of materials science, mechanics of solids and study of laboratory instrumentation and standard techniques in testing of engineering materials.

4300:401 Steel Design (3 Credits)
Prerequisites: 4300:306 and admission to an engineering major within the College of Engineering and Polymer Science. Tension, compression members; open web joists; beams; bearing plates; beam-columns; bolted, welded connections.

4300:403 Reinforced Concrete Design (3 Credits)
Prerequisites: 4300:306 and admission to an engineering major within the College of Engineering and Polymer Science. Ultimate strength analysis and design; compression steel; diagonal tension; stirrups; development length; one-way slab; T-beams; two-way slabs; columns; isolated and combined footings.

4300:404 Advanced Structural Design (3 Credits)
Prerequisites: 4300:401 and 4300:403. Composite design; plate girders; plastic design; cantilever retaining walls; torsion in R/C members; deflection of R/C members; continuous girder bridge design.

4300:407 Advanced Structural Analysis (3 Credits)

4300:414 Design of Earth Structures (3 Credits)
Prerequisite: 4300:314 or permission. Design of earth structures: dams, highway fills, cofferdams, etc. Embankment construction techniques, quality control, embankment analysis, instrumentation, foundation soil stabilization, seepage analysis and control. Design problem. Graduate students will perform more advanced analysis and design.

4300:418 Soil & Rock Exploration (3 Credits)
Prerequisite: 4300:314 or permission. Site exploration criteria and planning. Conventional boring, sampling and in situ testing methods. Theory and application of geophysics and geophysical methods including seismic, electrical resistivity, gravity, magnetic and radioactive measurements. Air photo interpretation.
4300:423 Chemistry for Environmental Engineers (3 Credits)
Prerequisite: One year of college chemistry. General, physical, organic biochemistry, equilibrium, and colloid chemistry concepts applied to Environmental Engineering. Concepts are used in water and wastewater laboratory.

4300:424 Water-Wastewater Laboratory (1 Credit)
Corequisite: 4300:323 or permission. Analysis of water and wastewater.

4300:426 Environmental Engineering Design (3 Credits)
Prerequisite: 4300:323. An introduction to the physical, chemical and biological processes utilized in the treatment of water and wastewater, with design parameters emphasized.

4300:427 Water Quality Modeling & Management (3 Credits)
Prerequisite: 4300:323. Analysis and simulation of the physical, chemical and biochemical processes affecting stream quality. Development of management strategies based upon the application of water quality modeling techniques to environmental systems.

4300:428 Hazardous & Solid Wastes (3 Credits)
Prerequisite: senior standing or permission of instructor. Hazardous and solid waste quantities, properties and sources are presented. Handling, processing, storage and disposal methods are discussed with non-technical constraints outlined.

4300:441 Hydraulic Design (3 Credits)
Prerequisite: 4300:341. Collection and critical evaluation of hydraulic data related to actual design problem selected by instructor. Development and analysis of design alternatives. Preparation of reports.

4300:443 Applied Hydraulics (3 Credits)
Prerequisites: 4300:341 and admission to an engineering major within the College of Engineering and Polymer Science. Review of design principles: urban hydraulics, stream channel mechanics, sedimentation, coastal engineering.

4300:445 Hydrology (3 Credits)

4300:448 Hydraulics Laboratory (1 Credit)
Prerequisite: 4300:341. Introduction to laboratory and field devices for hydraulic measurements. Reduction and presentation of hydraulic data. Individual assignments of study models of hydraulic structures.

4300:450 Urban Planning (2 Credits)
Historical developments in urban planning; urban planning techniques and patterns; comprehensive master planning studies; planning regulations; design problems; class projects; class project presentation.

4300:451 Computer Methods of Structural Analysis (3 Credits)

4300:452 Structural Vibrations & Earthquakes (3 Credits)

4300:453 Optimum Structural Design (3 Credits)
Prerequisite: 4300:306. Basic concepts in structural optimization. Mathematical programming methods including unconstrained minimization, multidimensional minimization and constrained minimization.

4300:454 Advanced Mechanics of Materials (3 Credits)

4300:463 Transportation Planning (3 Credits)
Prerequisite: 4300:361. Theory and techniques for development, analysis and evaluation of transportation system plans. Emphasis on understanding and using tools and professional methods available to solve transportation planning problems, especially in urban areas.

4300:464 Highway Design (3 Credits)
Prerequisite: 4300:361. Study of modern design of geometrical and pavement features of highways. Design problem and computer use. Graduate students will produce a more complete design.

4300:465 Pavement Engineering (3 Credits)
Prerequisite: 4300:361. Theories of elasticity, of viscoelasticity and of layered systems as applied to pavements. Pavement materials characterization; pavement design, pavement restoration for rigid and flexible pavements.

4300:466 Traffic Engineering (3 Credits)
Prerequisite: 4300:361. Vehicle and urban travel characteristics, traffic flow theory, traffic studies, accidents and safety, traffic signs and marking, traffic signal planning, traffic control and transportation administration.

4300:467 Advanced Highway Design (3 Credits)
Prerequisites: 4300:464, autoCAD capability, or permission. Computer-aided geometrical design of highways including survey data input, digital terrain modeling, cross-section templates, horizontal and vertical roadway design, earthwork computations, and advanced topics.

4300:468 Highway Materials (3 Credits)
Prerequisites: 4300:361 and 4300:380 or permission. Properties of aggregates, manufacture and properties of portland cement concrete, properties of asphaltic materials, design and testing of hot mix asphalt pavement mixes and of surface treatments. Laboratory preparation of specimens and determination of properties. Graduate student requirement. Graduate students will be required to perform an additional eight-hour asphalt laboratory (Abson recovery of asphalt from solution) and to prepare a paper on a highway materials topic.

4300:471 Construction Administration (3 Credits)
Prerequisites: senior standing and admission to an engineering major within the College of Engineering and Polymer Science or permission. Organization for construction, construction contracts, estimating, bidding, bonds and insurance. Construction financial management and supervision of construction, scheduling using critical path method.

4300:472 Construction Engineering (3 Credits)
Prerequisite: senior standing or permission. Construction equipment selection and management. Techniques of various engineering construction operations including blasting, tunneling, concrete framework and dewatering.
4300:473 Construction Materials (2 Credits)  
Prerequisites: 4300:380, 4200:305. Composition, structure and mechanical behavior of structural materials such as concrete, wood, masonry, plastics and composite materials. Discussion of applications and principles of evaluating material properties.

4300:474 Underground Construction (2 Credits)  
Prerequisite: 4300:314. Description of practices and techniques of underground construction. Selection of proper method for individual job. Design of underground openings, support systems and linings.

4300:480 Reliability-Based Design (4 Credits)  
Prerequisite: 3470:261 and senior standing. Probability concepts in civil engineering. Risk analysis and reliability based design.

4300:482 Special Projects: Civil Engineering (1-3 Credits)  
Prerequisites: senior standing and permission. Directed individual or group research or study in student's field of interest. Topic subject to approval by adviser.

4300:489 Fundamental of Engineering Exam Review (0 Credits)  
Prerequisite: Senior standing. This course is intended to prepare civil engineering students for the Fundamentals of Engineering Exam, which is to be taken prior to graduation.

4300:490 Senior Design in Civil Engineering (3 Credits)  
Prerequisites: senior standing and admission to an engineering major within the College of Engineering and Polymer Science. A civil engineering design project that emphasizes interdisciplinary teamwork to solve a substantial, currently relevant problem.  
**Gen Ed:** Tier 3 - Complex Systems

4300:497 Honors Project (1-3 Credits)  
(May be repeated for a total of six credits) Prerequisite: senior standing in Honors Program. Individual creative project or design relevant to civil engineering, supervised by faculty member of the department.