Civil Engineering (4300)

4300:101. Tools for Civil Engineering I. (3 Credits)
Corequisites: 3450:149. 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 II. (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 and admission to the College of Engineering. 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)
Prerequisite: 4300:202 and admission to the College of Engineering 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 the College of Engineering. Limiting equilibrium within a soil mass. Design of retaining walls, bulkheads, shallow, deep foundation systems. Slope stability. Laboratory study of soil properties and behavior.

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 the College of Engineering. 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 the College of Engineering. 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 the College of Engineering. 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 the College of Engineering. 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 the College of Engineering. 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 the College of Engineering. 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 modeling 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: 4300:314 and admission to the College of Engineering. Review of design principles: urban hydraulics, stream channel mechanics, sedimentation, coastal engineering.

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 the College of Engineering 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.

4300:490. Senior Design in Civil Engineering. (3 Credits)
Prerequisites: senior standing and admission to the College of Engineering. A civil engineering design project that emphasizes interdisciplinary teamwork to solve a substantial, currently relevant problem.

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.