

# Civil Engineering (CE)

---

## Courses

### **CE A201 Introduction to Civil Engineering 1 Credit**

Introduces students to roles, responsibilities, and capabilities of the various civil engineering sub-disciplines including structural, geotechnical, transportation, environmental, and water resources engineering.

**Prerequisites:** ENGR A151 with a minimum grade of C and ES A106 with a minimum grade of C and (MATH A251 with a minimum grade of C or concurrent enrollment or MATH A251F with a minimum grade of C or concurrent enrollment).

### **CE A206 Civil Engineering 3D Modeling 1 Credit**

Focuses on using computer-aided design (CAD) software as tools for designing civil engineering projects. Topics include working with points, creating and analyzing surfaces, modeling road corridors, creating parcel layouts, performing grading and volume calculations, and to layout pipe networks.

**Prerequisites:** (ENGR A105B with a minimum grade of C or ES A106 with a minimum grade of C) and CE A201 with a minimum grade of C and GEO A155 with a minimum grade of C.

### **CE A310 Introduction to Geotechnical Engineering 3 Credits**

Introduces fundamentals of geotechnical engineering, including identification and classification of soil, physical and mechanical properties of soil, subsurface exploration, laboratory testing techniques, seepage, compaction, stresses in soil, soil consolidation, drained and undrained shear strength of soil, and cold regions special issues such as frost action.

**Registration Restrictions:** Admission to the Bachelor of Science in Civil Engineering or the Master of Science in Civil Engineering

**Prerequisites:** CE A334 with a minimum grade of C and ES A331 with a minimum grade of C.

### **CE A310L Introduction to Geotechnical Engineering Lab 1 Credit**

Introduces the theory and procedures of routine soil tests. Provides hands-on experience of soil testing. Introduces skills on how to write a soil testing report. This course is taught in conjunction with CE A310 Introduction to Geotechnical Engineering.

**Corequisites:** CE A310.

### **CE A334 Properties of Materials 2 Credits**

Introduces experimental investigation of the properties of civil engineering materials and the basic principles of mechanics. Discusses bonding and structure of materials at the molecular level and relationship to engineering properties. Discusses concrete mix design, asphalt testing and the use of standard testing procedures for analyzing other engineering materials.

**Registration Restrictions:** Admission to the Bachelor of Science in Civil Engineering or the Master of Science in Civil Engineering

**Prerequisites:** CE A201 with a minimum grade of C or concurrent enrollment and ES A302 with a minimum grade of C or concurrent enrollment and ES A331 with a minimum grade of C or concurrent enrollment.

### **CE A334L Properties of Materials Laboratory 1 Credit**

Introduces the theory and procedures of laboratory testing of civil engineering materials. Gain hands-on experience of laboratory testing of civil engineering materials. This course is taught in conjunction with CE A334 Properties of Materials.

**Corequisites:** CE A334.

### **CE A341 Environmental Engineering 3 Credits**

Introduces fundamentals of environmental engineering, including theory and application of water and wastewater, solid waste and air quality engineering practice. Discusses natural processes that influence pollutant fate and use of these processes in engineered systems for pollution control.

**Prerequisites:** CHEM A106 with a minimum grade of C and CHEM A106L with a minimum grade of C and (MATH A251 with a minimum grade of C or MATH A251F with a minimum grade of C).

### **CE A351 Structural Analysis 4 Credits**

Introduces techniques for the analysis of statically determinate and indeterminate structures to include beams, trusses and frames. Discusses internal force resultants, shear, normal and moment diagrams, deflections, internal stresses. Discusses indeterminate analysis of structures using classical and modern computational methods.

**Prerequisites:** ES A331 with a minimum grade of C.

### **CE A403 Arctic Engineering 3 Credits**

Introduces students to a broad spectrum of engineering challenges unique to cold regions. Discusses physical principles and practical data collection methods, analyses, designs and construction methods. Students gain a working knowledge of cold regions engineering problems and modern solutions as a basis for more detailed study.

**Registration Restrictions:** Admission to the Bachelor of Science in Civil Engineering and junior or senior standing

**May Be Stacked With:** CE A603

**Prerequisites:** CE A310 with a minimum grade of C and CE A310L with a minimum grade of C.

### **CE A410 Foundation Engineering 3 Credits**

Reviews slope stability analysis. Introduces bearing capacity of soils and effects of settlements on structure. Discusses design of footings and rafts, pile and pier foundations, retaining walls and anchored bulkheads, and foundations in frozen soils. Addresses construction problems in foundation engineering.

**Prerequisites:** CE A310 with a minimum grade of C.

### **CE A414 Soil Strength and Slope Stability 3 Credits**

Covers advanced knowledge of soil shear strength properties; analysis of slope stability, including seismic stability and design of slope stabilization; case histories study and applications to cold regions engineering problems.

**Registration Restrictions:** Senior in civil engineering or instructor permission.

**May Be Stacked With:** CE A614

**Prerequisites:** CE A310 with a minimum grade of C.

**CE A420 Fundamentals of Transportation Engineering 3 Credits**

Introduces multi-modal transportation systems, including highways, airports, railroads and water transportation. Discusses factors that influence planning, design and operation of these systems. Emphasizes highway systems.

**Prerequisites:** ES A210 with a minimum grade of C and GEO A155 with a minimum grade of C.

**CE A421 Design of Highways 3 Credits**

Discusses fundamental aspects of transportation engineering in the design of highway systems. Addresses the design of geometric elements of streets and highways with the focus on safety, efficiency and pavement design. Topical areas include roadway functional classification, traffic controls, vertical and horizontal alignments, cross-section, interchanges, and intersections.

**Prerequisites:** CE A206 with a minimum grade of C and CE A310 with a minimum grade of C and CE A420 with a minimum grade of C.

**CE A423 Traffic Engineering 3 Credits**

Provides instruction in the study and analysis of traffic flow theory and the design of traffic control systems. Covers signalization, capacity analysis, traffic accident analysis and other safety considerations.

**Special Note:** Not available for credit to students who have completed CE A623.

**May Be Stacked With:** CE A623

**Prerequisites:** CE A420 with a minimum grade of C.

**CE A424 Pavement Design 3 Credits**

Provides instruction on the current practices of analysis and design of highway and airport pavements. Includes theoretical and practical approaches for the design of flexible and rigid pavements. Materials characterization, load considerations, empirical and mechanistic design methods as well as rehabilitation are covered.

**Special Note:** Not available for credit to students who have completed CE A624.

**May Be Stacked With:** CE A624

**Prerequisites:** CE A334 with a minimum grade of C.

**CE A425 Highway Engineering 3 Credits**

Introduces the design of geometric elements of streets and highways with emphasis on safety and efficiency. Roadway functional classification, design controls, vertical and horizontal alignments, cross sections, interchanges and intersections are topics covered in this course.

**Special Note:** Not available for credit to students who have completed CE A625.

**May Be Stacked With:** CE A625

**Prerequisites:** CE A420 with a minimum grade of C or CE A421 with a minimum grade of C.

**CE A428 Highway Safety 3 Credits**

Examines highway safety principles in the planning and operation of highway facilities, based on the national standards addressed in the AASHTO (American Association for State Highway and Transportation Officials) Highway Safety Manual.

**Special Note:** Not available for credit to students who have completed CE A628.

**May Be Stacked With:** CE A628

**Prerequisites:** CE A420 with a minimum grade of C.

**CE A432 Steel Design 3 Credits**

Introduces structural design philosophies and current practices related to steel design. Utilizes the American Institute of Steel Construction (AISC) specification to discuss the design of basic structural elements in steel including tension members, fasteners, welds, column buckling, beam behavior, beam-columns and composite floor systems.

**Prerequisites:** CE A351 with a minimum grade of C.

**CE A433 Reinforced Concrete Design 3 Credits**

Introduces structural design philosophies and current practices in reinforced concrete design. Utilizes the American Concrete Institute (ACI) specifications and standard practices for the design of basic structural elements in concrete including beams, columns, beam-columns and slabs-on-grade.

**Prerequisites:** CE A351 with a minimum grade of C.

**CE A437 Project Planning 1 Credit**

Introduces civil engineering project planning and analysis. Defines scope of work and develops goals, objectives and criteria for evaluation and implementation of civil engineering projects.

**Prerequisites:** CE A206 with a minimum grade of C and (CE A410 with a minimum grade of C or concurrent enrollment or CE A420 with a minimum grade of C or concurrent enrollment or CE A432 with a minimum grade of C or concurrent enrollment or CE A433 with a minimum grade of C or concurrent enrollment or CE A442 with a minimum grade of C or concurrent enrollment or CE A461 with a minimum grade of C or concurrent enrollment or CE A464 with a minimum grade of C or concurrent enrollment).

**CE A438 Design of Civil Engineering Systems 3 Credits**

Provides an opportunity for civil engineering students to collaborate in multidisciplinary teams to design a complex civil engineering system that meets client needs while protecting public health and safety.

**Registration Restrictions:** Senior standing

**Prerequisites:** CE A437 with a minimum grade of C and (CE A410 with a minimum grade of D or CE A420 with a minimum grade of D or CE A432 with a minimum grade of D or CE A433 with a minimum grade of D or CE A442 with a minimum grade of D or CE A461 with a minimum grade of D or CE A464 with a minimum grade of D).

**Attributes:** UAA Integrative Capstone GER.

**CE A439 Loads on Structures 3 Credits**

Provides fundamental background on reliability analysis and statistical development of loads and load combinations. Covers the computation of loads on structures using ASCE7, Minimum Design Loads for Buildings and Other Structures, structural design philosophies (ASD and LRFD), and load path evaluation in common structural systems. Topics include a variety of environmental loads that affect structures (dead, live, soil, flood, snow, wind, and seismic), and probable combinations of them.

**Special Note:** Not available for credit to students who have completed CE A639.

**Registration Restrictions:** Senior standing

**May Be Stacked With:** CE A639

**Prerequisites:** CE A351 with a minimum grade of C.

**CE A442 Environmental Engineering Design 3 Credits**

Presents design methods for pollution control and remediation systems. Applies theories and principles for the design of engineering systems for environmental protection, management and control. Includes water and wastewater treatment and solid waste management.

**Prerequisites:** CE A341 with a minimum grade of C and ES A341 with a minimum grade of C.

**CE A446 Biological Treatment Processes 3 Credits**

Theory and design of aerobic and anaerobic process for the treatment of wastewater including activated sludge, various surface film reactors, sludge digestion and disposal, and nutrient removal.

**May Be Stacked With:** CE A646

**Prerequisites:** CE A442 with a minimum grade of C.

**CE A451 Advanced Structural Analysis 3 Credits**

Introduction of the Direct Stiffness Method (Matrix Analysis Method) with computer solutions for two-dimensional and three-dimensional linear-elastic frame and truss structures. Topics include shear deformations, elastic supports and connections, support settlements, thermal loads, and energy formulations of force-displacement relationships.

**Registration Restrictions:** MATH A314 is recommended

**May Be Stacked With:** CE A651

**Prerequisites:** CE A351 with a minimum grade of C.

**CE A454 Timber Design 3 Credits**

Covers essentials of structural design in timber including building code requirements and standard practice for the design of basic structural elements, connections and shearwall lateral force resisting systems.

**May Be Stacked With:** CE A654

**Prerequisites:** CE A351 with a minimum grade of C.

**CE A461 Hydraulic Analysis and Design 3 Credits**

Presents analysis and design techniques for hydraulic facilities including water storage, conveyance, and pumping systems. Industry-standard computer software for hydraulic design will also be introduced.

**Prerequisites:** ES A341 with a minimum grade of C.

**CE A462 Surface Water Dynamics 3 Credits**

Covers open channel flow theory including: steady and unsteady flow, water surface profiles and the impact of hydraulic structures; sediment transport under open channel flow.

**May Be Stacked With:** CE A662

**Prerequisites:** ES A341 with a minimum grade of C.

**CE A464 Hydrologic Analysis and Design 3 Credits**

Presents fundamental concepts of hydrologic cycle, including precipitation, snow cover, evaporation, and groundwater hydraulics. Explains techniques of statistical hydrology and the usage of simulation models. The design of simple hydraulic structures will also be introduced.

**Prerequisites:** ES A341 with a minimum grade of C.

**CE A476 Coastal Engineering 3 Credits**

Applies linear and nonlinear wave theory to the study of coastal processes and the design of coastal structures; wave transformation processes including wind generation, refraction and diffraction.

**May Be Stacked With:** CE A676

**Prerequisites:** ES A341 with a minimum grade of C.

**CE A479 Sediment Transport and Coastal Processes 3 Credits**

Investigates sediment transport and coastal processes on beaches and in riverine/estuarine environments. Includes study of underlying hydrodynamic principles and engineering practices that are used to understand and solve sediment transport and coastal problems.

**May Be Stacked With:** CE A679

**Prerequisites:** ES A341 with a minimum grade of C.

**CE A603 Arctic Engineering 3 Credits**

Introduces students to a broad spectrum of engineering challenges unique to cold regions. Discusses physical principles and practical data collection methods, analyses, designs and construction methods. Students gain a working knowledge of cold regions engineering problems and modern solutions as a basis for more detailed study.

**Special Note:** Not available for credit to students who have completed CE A403.

**Registration Restrictions:** Graduate standing with a baccalaureate degree in engineering

**May Be Stacked With:** CE A403

**CE A610 Engineering Seismology 3 Credits**

Covers the internal structure of the earth, the causes, and the occurrence of earthquakes including seismic waves and their propagation, seismograms with special emphasis to strong ground motion measurements, accelerometers, and seismic networks. Introduces seismic data processing and interpretation of strong motion records, estimation of ground motion parameters, and their spatial variabilities. Discusses the concepts of probabilistic and deterministic seismic hazard assessment with special reference to Alaska.

**Registration Restrictions:** Graduate standing or instructor approval

**Prerequisites:** CE A310 with a minimum grade of C.

**CE A611 Geotechnical Earthquake Engineering 3 Credits**

Covers earthquakes and seismology, strong ground motion measurement, seismic hazard analysis, ground response analysis, dynamic soil properties, liquefaction, soil-structure interaction, seismic slope stability, and seismic design of retaining structures, with applications to cold regions geotechnical earthquake engineering problems.

**Registration Restrictions:** Graduate or senior standing and admission to the Master of Science in Civil Engineering or the Bachelor of Science in Civil Engineering, or instructor approval

**Prerequisites:** CE A310 with a minimum grade of C.

**CE A612 Advanced Foundation Design 3 Credits**

Presents the analysis, design, and construction aspects of deep foundations and other special topics of deep foundations related to cold regions engineering. Specifically, this course will cover lateral earth pressures, lateral support systems, single pile and pile group behavior under vertical and lateral loads, including static and dynamic loading conditions, and the latest development in soil improvement and ground modification techniques. Special foundation engineering issues related to cold regions will also be discussed.

**Registration Restrictions:** Graduate standing or admission to the Bachelor of Science in Civil Engineering or instructor permission.

**Prerequisites:** CE A410 with a minimum grade of C.

**CE A614 Soil Strength and Slope Stability 3 Credits**

Covers advanced knowledge of soil shear strength properties; analysis of slope stability, including seismic stability and design of slope stabilization; case histories study and applications to cold regions engineering problems.

**Registration Restrictions:** Graduate standing or instructor approval.

**May Be Stacked With:** CE A414

**Prerequisites:** CE A310 with a minimum grade of C.

**CE A623 Traffic Engineering 3 Credits**

Provides instruction in the study and analysis of traffic flow, theory, and the design of traffic control systems. Covers signalization, capacity analysis, traffic accident analysis and other safety considerations.

**Special Note:** Not available for credit to students who have completed CE A423.

**Registration Restrictions:** Graduate standing

**May Be Stacked With:** CE A423

**CE A624 Pavement Design 3 Credits**

Introduces current practices of analysis and design of highway and airport pavements. Includes theoretical and practical approaches for the design of flexible and rigid pavements. Materials characterization, load considerations, empirical and mechanistic design methods, and rehabilitation are also covered.

**Special Note:** Not available for credit to students who have completed CE A424.

**Registration Restrictions:** Graduate standing

**May Be Stacked With:** CE A424

**CE A625 Highway Engineering 3 Credits**

Introduces the design of geometric elements of streets and highways with emphasis on safety and efficiency. Covers roadway functional classification, design controls, vertical and horizontal alignments, cross sections, interchanges and intersections.

**Special Note:** Not available for credit to students who have completed CE A425.

**Registration Restrictions:** Graduate standing

**May Be Stacked With:** CE A425

**CE A628 Highway Safety 3 Credits**

Highway safety principles in the planning, operational and existing conditions based on the national standards addressed in the AASHTO (American Association of State Highway and Transportation Officials) Highway Safety Manual. Application of these principles to highway facilities.

**Special Note:** Not available for credit to students who have completed CE A428.

**Registration Restrictions:** Graduate standing or instructor approval

**May Be Stacked With:** CE A428

**CE A630 Advanced Mechanics of Materials 3 Credits**

Covers advanced topics in the mechanics of solids, including both equilibrium and energy approaches. Provides in-depth study of topics introduced in previous courses such as bending of beams, torsion, and plane stress and strain. Additionally covers 3-D stress and strain analysis, yield and failure criteria, and time-dependent deformations.

**Registration Restrictions:** Graduate standing and instructor permission.

**Crosslisted With:** ME A630.

**CE A634 Structural Earthquake Engineering 3 Credits**

Introduces basic seismic concepts and design principles. Criteria for design and construction of structure subject to earthquake ground motions. Also includes technology for reducing earthquake loads through seismic isolation.

**Registration Restrictions:** Graduate standing or instructor approval

**Prerequisites:** CE A351 with a minimum grade of C.

**CE A637 Earthquake Resistant Structural Design 3 Credits**

Covers the special structural detail requirements for earthquake design in steel, concrete, timber, and masonry.

**Registration Restrictions:** Graduate standing or undergraduate senior standing, or instructor approval

**Prerequisites:** CE A351 with a minimum grade of C and CE A432 with a minimum grade of C and CE A433 with a minimum grade of C.

**CE A639 Loads on Structures 3 Credits**

Provides a fundamental background on reliability analysis and statistical development of loads and load combinations. Covers the computation of loads on structures using ASCE 7 (American Society of Civil Engineers), Minimum Design Loads for Buildings and Other Structures, structural design philosophies, and load path evaluation in common structural systems. Topics include a variety of environmental loads that affect structures (dead, live, soil, flood, snow, wind, and seismic) and probable combinations of them.

**Special Note:** Not available for credit to students who have completed CE A439. Additional coursework will be required in the area of structural reliability analysis for students enrolled in CE A639.

**Registration Restrictions:** Graduate standing or instructor approval

**May Be Stacked With:** CE A439

**CE A645 Chemical and Physical Water and Wastewater Treatment Processes 3 Credits**

Covers theory and design of chemical and physical unit processes utilized in the treatment of water and wastewater. Covers advanced theory of common unit processes including sedimentation, flotation, precipitation, disinfection, filtration and aeration. Explores these topics in association with current peer-reviewed literature. Evaluates appropriate design considerations.

**Registration Restrictions:** Graduate standing and admission to the College of Engineering, or instructor approval

**CE A646 Biological Treatment Processes 3 Credits**

Theory and design of aerobic and anaerobic process for the treatment of wastewater including activated sludge, various surface film reactors, sludge digestion and disposal, and nutrient removal.

**Registration Restrictions:** Graduate standing

**May Be Stacked With:** CE A446

**CE A648 Solid Waste Systems and Technologies 3 Credits**

Discusses planning, collecting and disposing of solid waste; techniques and design considerations of collection, transportation, disposal and resource recovery; solid waste environmental regulations and relationships to water, air, and land pollution; and hazardous waste management.

**Registration Restrictions:** Graduate standing or instructor approval



**CE A651 Advanced Structural Analysis 3 Credits**

Introduces the Direct Stiffness Method (Matrix Analysis Method) with computer solutions for two-dimensional and three-dimensional linear-elastic frame and truss structures. Topics include shear deformations, elastic supports and connections, support settlements, thermal loads, and energy formulations of force-displacement relationships.

**Registration Restrictions:** Graduate standing or instructor approval.

**May Be Stacked With:** CE A451

**CE A652 Advanced Steel Design 3 Credits**

Covers advanced structural design in steel, including building code requirements and standard practice for the design of steel structures and connections. Introduces seismic design of steel building structures.

**Special Note:** Requires knowledge of steel design. Can request instructor approval if the prerequisite is not met.

**Registration Restrictions:** Graduate standing or instructor approval

**Prerequisites:** CE A432 with a minimum grade of C.

**CE A654 Timber Design 3 Credits**

Covers essentials of structural design in timber including building code requirements and standard practice for the design of structural elements, connections and shearwall lateral force resisting systems.

**Special Note:** Requires knowledge of structural analysis.

**Registration Restrictions:** Graduate standing

**May Be Stacked With:** CE A454

**CE A662 Surface Water Dynamics 3 Credits**

Covers open channel flow theory including: steady and unsteady flow, water surface profiles and the impact of hydraulic structures; sediment transport under open channel flow.

**Special Note:** Requires knowledge of fluid mechanics.

**Registration Restrictions:** Graduate standing and admission to the College of Engineering

**May Be Stacked With:** CE A462

**CE A663 Ground Water Dynamics 3 Credits**

Covers fundamentals of geohydrology, hydraulics of flow through porous media, well hydraulics, ground water pollution, and ground water resources development.

**Special Note:** Requires knowledge of fluid mechanics.

**Registration Restrictions:** Graduate standing

**CE A676 Coastal Engineering 3 Credits**

Applies linear and nonlinear wave theory to the study of coastal processes and the design of coastal structures; wave transformation processes including wind generation, refraction and diffraction.

**Special Note:** Requires knowledge of fluid mechanics.

**Registration Restrictions:** Graduate standing and admission to the College of Engineering

**May Be Stacked With:** CE A476

**CE A677 Coastal Measurements and Analysis 3 Credits**

Covers theory and use of modern instrumentation, sampling and measurement techniques, and methods of analysis for quantitative study of coastal ocean physical processes.

**Registration Restrictions:** Graduate standing or instructor approval

**CE A679 Sediment Transport and Coastal Processes 3 Credits**

Investigates sediment transport and coastal processes on beaches and in riverine/estuarine environments. Includes study of underlying hydrodynamic principles and engineering practices that are used to understand and solve sediment transport and coastal problems.

**Registration Restrictions:** Graduate standing and admission to the Master of Science in Civil Engineering, or instructor approval

**May Be Stacked With:** CE A479

**CE A681 Frozen Ground Engineering 3 Credits**

Covers physical, thermal, and mechanical properties of frozen soils, frost action, heat flow in soils, thaw behavior of frozen ground, foundations in frozen ground, construction ground freezing, pavement design, earthwork, and field investigations.

**Special Note:** Requires knowledge in soil mechanics.

**Registration Restrictions:** Graduate standing

**CE A686 Civil Engineering Project 3 Credits**

Civil and Arctic Engineering project arranged among the advisor, graduate advisory committee and student to solve a practical engineering problem.

**Registration Restrictions:** Graduate standing with a minimum of 9 graduate credits.

**CE A690 Selected Topics in Civil Engineering 3 Credits**

Facilitates graduate level analysis and/or design pertaining to a selected topic in Civil Engineering.

**Special Note:** May be repeated once with a change of subtitle.

**Registration Restrictions:** Graduate standing, admission to the College of Engineering, or instructor approval

**CE A698 Individual Research 1-9 Credits**

A course to be designed between the student and faculty member to allow students the chance to pursue advanced research interests in engineering at the MS level.

**Registration Restrictions:** Graduate standing and instructor permission

**CE A699 Thesis 1-9 Credits**

Individual study of an advanced engineering problem resulting in a thesis.

**Registration Restrictions:** Graduate standing and instructor approval