

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 MATH A251 with a minimum grade of C or concurrent enrollment and ES A106 with a minimum grade of C and GEO A155 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.

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.

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

CE A351 Structural Analysis 3 Credits

Introduces techniques for the analysis of statically determinate and indeterminate structures to include beams, trusses and frames. Reviews internal force resultants, shear and moment diagrams, deflections, internal stresses. Discusses indeterminate analysis of structures, including methods of consistent deflections and slope-deflection. Provides an introduction to matrix methods.

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

May Be Stacked With: CE A603

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 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

Essentials of structural design in reinforced concrete including building code requirements and standard practice for the design of basic structural elements.

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

Integrative capstone course 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. Students apply knowledge and skills learned in their undergraduate curriculum.

Prerequisites: 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.

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 A445 Chemical and Physical Water and Wastewater Treatment Processes 3 Credits

The theory and design of chemical and physical unit processes utilized in the treatment of water and wastewater. Advanced theory of common unit processes including sedimentation, floatation, precipitation, disinfection, filtration and aeration will be explored in association with current peer-reviewed literature. Appropriate design considerations will be evaluated.

May Be Stacked With: CE A645

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

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

This course 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

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 A475 Design of Ports and Harbors 3 Credits

Introduction to planning and design of port and harbor facilities.

Registration Restrictions: Senior standing in BS Civil Engineering program.

May Be Stacked With: CE A675

Prerequisites: ES A341 with a minimum grade of C.

CE A476 Coastal Engineering 3 Credits

Application of 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

Investigation of sediment transport and coastal processes on beaches and in riverine/estuarine environments. 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 level 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 A631 Structural Finite Elements 3 Credits

Fundamental equations for different finite elements as well as computer modeling of engineering structures using these elements are examined. Basic finite elements for truss, beam, frame and triangular plane elements are discussed in detail. The use of finite element software to solve a variety of structural engineering problems is discussed. The results of actual analysis are critically examined in class.

Prerequisites: CE A351 with a minimum grade of C.

CE A633 Structural Dynamics 3 Credits

Introduces the theory of structural dynamics, including single and multiple-degree-of-freedom systems subjected to earthquake and other dynamic excitations, with emphasis on application to analysis and design of civil engineering structures.

Prerequisites: CE A351 with a minimum grade of C and MATH A302 with a minimum grade of C.

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 level or undergraduate senior standing, or instructor approval.

Prerequisites: CE A351 with a minimum grade of C and CE A633 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 level 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

The theory and design of chemical and physical unit processes utilized in the treatment of water and wastewater. Advanced theory of common unit processes including sedimentation, floatation, precipitation, disinfection, filtration and aeration will be explored in association with current peer-reviewed literature. Appropriate design considerations will be evaluated.

Registration Restrictions: Graduate standing in Civil Engineering or instructor permission.

May Be Stacked With: CE A445

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

Advanced structural design in steel, including building code requirements and standard practice for the design of steel structures and connections.

Registration Restrictions: Graduate standing or instructor approval.

CE A653 Advanced Reinforced Concrete Design 3 Credits

Provides advanced instruction in the design of reinforced concrete structural elements. Topics include deep beams, slender columns, shear walls and two-way slabs. Provides an introduction to the principles and standards of practice for the design of pre-stressed concrete members.

Registration Restrictions: Graduate standing or instructor permission.

Students should have previously completed a course on the design of reinforced concrete structures and also have a working knowledge of the ACI 318 standard of practice.

CE A654 Timber Design 3 Credits

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 A454

Registration Restrictions: Graduate standing in CE or permission of instructor.

CE A662 Surface Water Dynamics 3 Credits

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

Registration Restrictions: Graduate standing in Civil Engineering

May Be Stacked With: CE A462

Prerequisites: ES A341 with a minimum grade of C.

CE A663 Ground Water Dynamics 3 Credits

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

Prerequisites: ES A341 with a minimum grade of D.

CE A675 Design of Ports and Harbors 3 Credits

Introduction to planning and design of port and harbor facilities.

Registration Restrictions: Graduate standing in Engineering or instructor permission.

May Be Stacked With: CE A475

Prerequisites: ES A341 with a minimum grade of C.

CE A676 Coastal Engineering 3 Credits

Application of 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.

Registration Restrictions: Graduate standing in Civil Engineering

May Be Stacked With: CE A476

Prerequisites: ES A341 with a minimum grade of C.

CE A677 Coastal Measurements and Analysis 3 Credits

Review of and practice with modern instrumentation, equipment, sampling and measurement techniques, and methods of analysis for quantitative study of coastal ocean physical processes.

Registration Restrictions: Upper class or graduate standing in Geomatics, Engineering, or Natural Sciences.

CE A679 Sediment Transport and Coastal Processes 3 Credits

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

Registration Restrictions: Graduate standing in civil engineering or instructor permission.

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.

Registration Restrictions: Admission to the Master of Science in Civil Engineering or instructor approval.

Prerequisites: CE A310 with a minimum grade of C.

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

Study of selected topics in Civil Engineering.

Special Note: May be repeated once for credit with a different topic.

Registration Restrictions: Graduate standing or instructor permission.

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