

CIVIL ENGINEERING (CE)

CE F112 Elementary Surveying

3 Credits

Offered Spring

Basic plane surveying; use of transit, level, theodolite and total station. Traverses, public land system, circular curves, cross-sectioning and earthwork.

Prerequisites: MATH F152X.

Lecture + Lab + Other: 2 + 3 + 0

CE F302 Fundamentals of Transportation Engineering

3 Credits

Offered Spring

Introduces multi-modal transportation systems including highways, airports railroads and water transportation. Factors that influence planning, design and operation of these systems is discussed. Highway systems are emphasized in the course.

Prerequisites: CE junior standing.

Lecture + Lab + Other: 3 + 0 + 0

CE F326 Introduction to Geotechnical Engineering

4 Credits

Offered Spring

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, and drained and undrained shear strength of soil.

Prerequisites: ES F331; GE F261.

Lecture + Lab + Other: 3 + 3 + 0

CE F331 Structural Analysis

3 Credits

Offered Spring

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: ES F209; ES F331.

Lecture + Lab + Other: 2 + 3 + 0

CE F334 Properties of Materials

3 Credits

Offered Fall

Properties of engineering materials. Bonding, crystal and amorphous structures. Relationships between microstructure and engineering properties. Modification of properties and environmental serviceability. Concrete and asphalt mixes.

Corequisite: ES F331.

Lecture + Lab + Other: 2 + 3 + 0

CE F341 Environmental Engineering

4 Credits

Offered Spring

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

Prerequisites: CHEM F106X; or graduate standing.

Lecture + Lab + Other: 3 + 3 + 0

CE F344 Water Resources Engineering

3 Credits

Offered Fall

Fundamentals of engineering hydrology and hydraulic engineering. Water cycle and water balance, precipitation, evaporation, runoff, statistical methods, flood control, open channels and groundwater.

Prerequisites: ES F341.

Lecture + Lab + Other: 3 + 0 + 0

CE F405 Design of Highways and Streets

3 Credits

Offered Fall

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.

Corequisite: CE F302.

Lecture + Lab + Other: 2 + 3 + 0

CE F406 Traffic Engineering

3 Credits

Operation and control of transportation systems with emphasis on traffic on highways and streets. Traffic control devices, data collection, capacity and level of service analysis, intersection signalization, traffic impact analysis, accident analysis and other safety considerations.

Prerequisite: CE F302.

Stacked with CE F606.

Lecture + Lab + Other: 2 + 3 + 0

CE F422 Foundation Engineering

3 Credits

Offered Fall

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, foundations on frozen soils, and construction problems in foundation engineering.

Prerequisites: CE F326; ES F301.

Lecture + Lab + Other: 3 + 0 + 0

CE F424 Introduction to Permafrost Engineering (a)

3 Credits

Offered Fall

Introduction to permafrost and frozen ground engineering, types of permafrost and ways of its formations, factors important for permafrost existence, hazards related to permafrost, index, thermal, and mechanical properties of frozen and thawing soils, methods of thermal analysis of soil freezing and thawing, foundations design alternatives, pipelines, roads and airfields in the permafrost region.

Prerequisites: CE F326.

Recommended: CE F422; GE F384.

Stacked with CE F624.

Lecture + Lab + Other: 3 + 0 + 0

CE F432 Steel Design

3 Credits

Offered Fall

Introduces structural design philosophies and current practices related to steel design. Utilizes the 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 F331; ES F331.

Lecture + Lab + Other: 2 + 3 + 0

CE F433 Reinforced Concrete Design

3 Credits

Offered Spring

Introduces structural design philosophies and current practices related to reinforced concrete design. Utilizes the ACI 318 Specification to discuss the behavior of reinforced concrete members and their design including flexural members, such as rectangular, T-beams, and one-way slabs, and axial members. Crack control, anchorage, development lengths and deflections are also covered.

Prerequisites: CE F331; ES F331.**Lecture + Lab + Other:** 3 + 0 + 0**CE F434 Timber Design**

3 Credits

Offered Fall Odd-numbered Years

Design loads. Building systems and loading path. Physical and mechanical properties of wood. Design values and adjustment factors. Design of axial members, beams and columns. Connection details. Design of wood frame structures. Current National Design Specifications (NDS) for Wood Construction used.

Prerequisites: CE F331; ES F331.**Lecture + Lab + Other:** 3 + 0 + 0**CE F435 Design and Construction of Bridges**

3 Credits

Offered Spring

Design-build technology for bridge structures is introduced. A bridge system is developed for a given crossing with predetermined specifications. Alternate designs are developed. These alternatives are based on design calculations, prepared drawings and suitability. Design ideas are developed and tested to verify if the idea meets the design assumptions. Techniques in design, fabrication, fund raising, project management, fiscal responsibility, safety, public speaking and teamwork are learned and used during the semester. The final structure will be load tested and graded based on meeting the goals of the specification.

Prerequisites: Permission of instructor.**Recommended:** CE F432.**Lecture + Lab + Other:** 1 + 6 + 0**CE F437 Design of Engineered Systems I**

3 Credits

Offered Fall

Critical skills for a successful engineer with emphasis on: project planning; preliminary investigations; permitting; reading, interpreting, and creating plans and specification; use and technical applications of AutoCAD; proposal writing and project management; continuing education and professional registration. Civil engineering major with senior standing; COJO F131X or COJO F141X; WRTG F111X or WRTG F211X or WRTG F212X or WRTG F213X or WRTG F214X.

Lecture + Lab + Other: 3 + 0 + 0**CE F438 Design of Engineered Systems II (O, W)**

3 Credits

Offered Spring

System design principles using service learning projects with civil and environmental engineering focus. Practical applications of concepts covered in CE F437: ethics, liability and legal principles to professional practice. Emphasis on teamwork and leadership.

Prerequisites: COJO F131X or COJO F141X; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; CE F405 or CE F422 or CE F432 or CE F433 or CE F434 or CE F442 or CE F445; CE F437.**Lecture + Lab + Other:** 3 + 0 + 0**CE F442 Environmental Engineering Design**

3 Credits

Offered Fall

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, water and wastewater treatment and solid waste management.

Prerequisites: CE F341.**Lecture + Lab + Other:** 3 + 0 + 0**CE F443 Air Pollution Management**

3 Credits

Offered Spring Odd-numbered Years

Air pollution topics including the quantity and quality of atmospheric emissions and their effects on the human environment. Identification and location of sources, measurement of quality and conformance with standards. Legal considerations of Clean Air Act and Amendments and local regulations. Evaluation of stationary and moving sources. Meteorology and modeling requirements. Control mechanisms for gases and particulates.

Prerequisites: CHEM 106X; graduate standing.**Recommended:** MATH F252X.**Stacked with** ENVE F643.**Lecture + Lab + Other:** 3 + 0 + 0**CE F445 Hydrologic Analysis and Design**

3 Credits

Offered Spring

Design and analysis; extended coverage of hydrologic concepts from CE F344. Precipitation, snow cover and evaporation analysis; groundwater hydraulics; runoff analysis and prediction; statistical hydrology; application of simulation models. Design of structures such as culverts, reservoirs, wells, pumps and pipe networks.

Prerequisites: CE F344.**Lecture + Lab + Other:** 2 + 3 + 0**CE F451 Construction Cost Estimating and Bid Preparation**

3 Credits

Offered Fall

Compilation and analysis of the many items that influence and contribute to the cost of projects to be constructed. Preparation of cost proposals and study of bidding procedures.

Recommended: College math.**Lecture + Lab + Other:** 3 + 0 + 0**CE F463 Groundwater Dynamics**

3 Credits

Offered Fall Even-numbered Years

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

Corequisites: CE F344.**Stacked with** CE F663.**Lecture + Lab + Other:** 3 + 0 + 0

CE F470 Civil Engineering Internship

1 Credit

Supervised engineering field and work experience. Assignments individually arranged with cooperating agencies and must include data collection and reporting. As part of the requirements for earning credit, the student must have a letter of release from the company, prepare a written report and make an oral presentation. Program must be approved in advance by the department. This course is graded Pass/Fail.

Prerequisites: Upper division standing; permission of department coordinator.

Lecture + Lab + Other: 0 + 3 + 0

CE F471 Field Practicum

1 Credit

Offered Fall

Introduction to field data collection techniques used in civil engineering sub-disciplines such as structural, traffic, water, environmental and materials; preliminary data analysis and descriptive statistics.

Prerequisites: Senior standing in CEE program.

Lecture + Lab + Other: 0 + 3 + 0

CE F490 Civil Engineering Seminar

0.5 Credit

Offered Fall

CE F490-F491, together, constitute the standard one-year engineering seminar. The class is designed to provide the student with exposure to the latest information available from researchers and practicing professionals in industry.

Prerequisites: Junior/senior standing.

Lecture + Lab + Other: 0.5 + 0 + 0

CE F491 Civil Engineering Seminar

0.5 Credit

Offered Spring

CE F490-F491, together, constitute the standard one-year engineering seminar. The class is designed to provide the student with exposure to the latest information available from researchers and practicing professionals in industry.

Prerequisites: Junior/senior standing.

Lecture + Lab + Other: 0.5 + 0 + 0

CE F492 Seminar

1-3 Credits

Lecture + Lab + Other: 0 + 0 + 0

CE F492P Seminar

1-3 Credits

Lecture + Lab + Other: 0 + 0 + 0

CE F601 Engineering Research Communication

3 Credits

Offered Spring

Oral and written communication techniques to describe results on current issues in environmental science and engineering.

Prerequisites: Graduate Standing.

Lecture + Lab + Other: 3 + 0 + 0

CE F603 Arctic Engineering (a)

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.

Lecture + Lab + Other: 3 + 0 + 0

CE F605 Pavement Design

3 Credits

Offered As Demand Warrants

Provides instruction on the current practices of analysis and design of highway and airport pavements. The instruction 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.

Lecture + Lab + Other: 3 + 0 + 0

CE F606 Traffic Engineering

3 Credits

Operation and control of transportation systems with emphasis on traffic on highways and streets. Traffic control devices, data collection, capacity and level of service analysis, intersection signalization, traffic impact analysis, accident analysis and other safety considerations.

Prerequisite: CE F302.

Stacked with CE F406.

Lecture + Lab + Other: 2 + 3 + 0

CE F607 GIS Applications in Civil Engineering

3 Credits

Offered Fall As Demand Warrants

Theories and advanced methods of Geographic Information Systems for civil engineering practice. Students will apply and execute concepts related to data integration, analysis and management in the ArcGIS suite during labs.

Prerequisites: Graduate standing in CE.

Lecture + Lab + Other: 2 + 3 + 0

CE F620 Construction Project Management

3 Credits

Offered As Demand Warrants

Construction equipment, methods, planning and scheduling, construction contracts, management and accounting, construction estimates, costs, and project control.

Recommended: ESM F450 or equivalent.

Lecture + Lab + Other: 3 + 0 + 0

CE F622 Foundations and Retaining Structures

3 Credits

Offered As Demand Warrants

Advanced study of shallow and deep foundations; analyses and design of retaining walls, free-standing sheet-pile walls, braced excavations, slurry walls, tied-back retention systems, reinforced earth, frozen soil walls, anchored bulkheads, and cellular cofferdams.

Prerequisites: CE F422.

Lecture + Lab + Other: 3 + 0 + 0

CE F624 Introduction to Permafrost Engineering (a)

3 Credits

Offered Fall

Introduction to permafrost and frozen ground engineering, types of permafrost and ways of its formations, factors important for permafrost existence, hazards related to permafrost, index, thermal, and mechanical properties of frozen and thawing soils, methods of thermal analysis of soil freezing and thawing, foundations design alternatives, pipelines, roads and airfields in the permafrost region.

Prerequisites: Training or experience in soil mechanics.

Stacked with CE F424.

Lecture + Lab + Other: 3 + 0 + 0

CE F625 Soil Stabilization and Embankment Design

3 Credits

Offered As Demand Warrants

Soil and site improvement using deep and shallow compaction, additives, pre-loading, vertical and horizontal drains, electro-osmosis and soil reinforcement, dewatering and stabilization; embankment design, earth pressure theories and pressure in embankment, embankment stability, embankment construction, control and instrumentation.

Prerequisites: CE F422.**Lecture + Lab + Other:** 3 + 0 + 0**CE F626 Thermal Geotechnics**

3 Credits

Offered As Demand Warrants

Fundamentals of thermal regimes of soils and rocks. Thermal impact of structures on soils. Thawing of permafrost beneath roads, buildings and around pipelines. Natural and artificial freezing of soils. Engineering means to maintain thermal regime of soils. Thermal design considerations.

Prerequisites: CE F326; CE F422.**Cross-listed with** GE F626.**Lecture + Lab + Other:** 3 + 0 + 0**CE F627 Geotechnical Earthquake Engineering**

3 Credits

Offered As Demand Warrants

Introduction to soil dynamics and geotechnical aspects of earthquakes; influences of soils on ground motion, determination of soil response under strong seismic motion, causes of soil failures, soil liquefaction, lateral spreading, the seismic response of earth structures, and seismic-deformation procedures for slopes.

Prerequisites: CE F326.**Lecture + Lab + Other:** 3 + 0 + 0**CE F628 Unsaturated Soils Mechanics**

3 Credits

Offered As Demand Warrants

Fundamentals of soil behavior under load; pore pressure during monotonic loading; Ladd's "Simple Clay" model; densification and drained cyclic loading of sand; undrained cycle loading of soil.

Prerequisites: CE F326.**Lecture + Lab + Other:** 3 + 0 + 0**CE F630 Advanced Structural Mechanics**

3 Credits

Offered As Demand Warrants

Shear and torsion, nonsymmetrical bending, shear center, curved beams, introduction to composite material mechanics, application in bridge engineering.

Prerequisites: Math F302; ES F331.**Recommended:** Graduate standing in engineering.**Lecture + Lab + Other:** 3 + 0 + 0**CE F631 Advanced Structural Analysis**

3 Credits

Offered Spring Odd-numbered Years

Derivation of the basic equations governing linear structural systems. Application of stiffness and flexibility methods to trusses and frames. Solution techniques utilizing digital computers. Planar structures and space structures (trusses and frames) will be covered. Both exact and approximate solution techniques will be reviewed.

Prerequisites: CE F331.**Lecture + Lab + Other:** 3 + 0 + 0**CE F633 Theory of Elastic Stability**

3 Credits

Offered Spring Odd-numbered Years

The theory and implementation of the buckling of slender elements will be covered. Both lateral and local buckling concepts will be discussed. Emphasis will be placed on developing the ability to evaluate if a member is likely to buckle. The course will cover elastic and inelastic buckling of columns. Other topics include lateral torsional buckling of beams, potential buckling of beam-columns and rigid frame members and the buckling of non standard shapes.

Prerequisites: CE F331; CE F432; MATH F302.**Lecture + Lab + Other:** 3 + 0 + 0**CE F634 Structural Dynamics**

3 Credits

Offered As Demand Warrants

This course covers the theory of structural dynamics. Subjects include equations of motion for un-damped single and multiple degree of freedom systems. Free vibration and response to harmonic and periodic excitations will be studied. Response to arbitrary, step and pulse type excitations are studied in preparation for a study of earthquake type loading. The basic concepts related to the interaction of a structure to an earthquake event will be discussed.

Prerequisites: ES F210; CE F331; MATH F302.**Lecture + Lab + Other:** 3 + 0 + 0**CE F635 Numerical Methods for Geomechanics and Soil-Structure Interaction**

3 Credits

Offered As Demand Warrants

Applications of numerical methods for problems involving seepage, consolidation, foundation on expansive soils and pile installation. Finite difference and element methods, non-linear analysis techniques, elasto-plastic formulation with a tangent stiffness approach, seepage analysis, flow-deformation, coupled analysis, models for soil-structure interaction, solution accuracy and reliability.

Prerequisites: CE F326; graduate standing.**Recommended:** MATH F302.**Lecture + Lab + Other:** 3 + 0 + 0**CE F637 Earthquakes: Seismic Response of Structures**

3 Credits

Offered As Demand Warrants

Fundamentals of structural earthquake engineering: strong ground motion phenomena; dynamic analysis of structural systems for seismic motion; response spectrum and time history methods, design of structural systems for lateral forces; shearwalls and diaphragms; moment-resistive frames, braced frames; current design criteria and practice; connection details, serviceability requirement; story drift, non-structural building elements; soil-structure interaction.

Prerequisites: ES F210.**Lecture + Lab + Other:** 3 + 0 + 0**CE F640 Prestressed Concrete**

3 Credits

Offered As Demand Warrants

Theory and practice of prestressed concrete design. Pre-tensioning and post-tensioning. Anchorage of steel. Materials, design specifications. Application in bridges, tanks and slabs.

Prerequisites: CE F331; CE F433.**Recommended:** Graduate standing.**Lecture + Lab + Other:** 3 + 0 + 0

CE F646 Structural Composites

3 Credits

Offered As Demand Warrants

The basics of structural composite theory. Basic design procedures related to structural composite members and the structural analysis of members made of various materials to create laminates or sandwich panels will be covered.

Prerequisites: ES F331; CE F331.**Lecture + Lab + Other:** 3 + 0 + 0**CE F650 Bridge Engineering**

3 Credits

Offered As Demand Warrants

Covers structural systems, loading and analysis by influence lines. Slab and girder bridges considering composite design, prestressed and concrete bridges and how these bridges are designed and rated using AASHTO specifications.

Prerequisites: CE F432; CE F433.**Lecture + Lab + Other:** 3 + 0 + 0**CE F652C Pre-Construction Contracts**

1 Credit

Offered As Demand Warrants

Provides an introduction to determining scope and scheduling needs for architectural and engineering contracts and other design-related contracts. A review of type of contracts and procurement methods available. Handling changes within the pre-construction contract.

Lecture + Lab + Other: 4.5 + 0 + 0**CE F659A Mentoring**

1 Credit

Offered As Demand Warrants

This course will provide insight into how to "train the trainer." It will incorporate the role of HR in department and relevant case studies to enable students to understand key principles, and learn skills and behaviors to enhance knowledge transfer.

Lecture + Lab + Other: 4.5 + 0 + 0**CE F660A Project Management Boot Camp**

1 Credit

Offered As Demand Warrants

This course provides "basic training" in project management fundamentals, with emphasis on the management of engineering and construction projects. Much of the discussion is centered on the "triple constraint" of cost, schedule, and quality/scope. Topics include project characteristics; the project life cycle; project organizations, teams and leadership; planning, monitoring and controlling each element of the triple constraint; and project termination and phase-out. Planning issues include the project charter and scope statement, the work breakdown structure, and both network- and non-network-based scheduling techniques.

Lecture + Lab + Other: 4.5 + 0 + 0**CE F661 Advanced Water Resources Engineering**

3 Credits

Offered Spring Odd-numbered Years

Engineering hydraulics and hydrology including use of standard computer models to solve water resource engineering problems.

Recommended: Permission of instructor.**Lecture + Lab + Other:** 3 + 0 + 0**CE F662 Open Channel and River Engineering**

3 Credits

Offered Spring Even-numbered Years

Principles of open channel flow, specific energy, hydraulic jump, transitions and controls, uniform and non-uniform flows, steady and unsteady flows, numerical solution for unsteady flows. River engineering, stream channel mechanics, and mechanics of sedimentation.

Recommended: Permission of instructor.**Lecture + Lab + Other:** 3 + 0 + 0**CE F663 Groundwater Dynamics**

3 Credits

Offered Fall Even-numbered Years

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

Corequisites: CE F344.**Stacked with** CE F463.**Lecture + Lab + Other:** 3 + 0 + 0**CE F664 Sediment Transport**

3 Credits

Offered Spring Even-numbered Years

Fundamentals of sediment transport processes in rivers, oceans and reservoirs. Bed-load and suspended-load transports. Mechanics of turbidity currents. Reservoir sedimentation. Numerical modeling.

Prerequisites: Graduate standing.**Lecture + Lab + Other:** 3 + 0 + 0**CE F665 Introduction to Watershed Hydrology**

3 Credits

A broad view of the water cycle at the watershed scale and introduction to the quantitative relations between components of the water cycle. Emphasis is placed on precipitation, evapotranspiration, water in soils and stream response to water-input events. Offered Fall Even-numbered Years

Prerequisites: MATH F253X; PHYS F211X.**Lecture + Lab + Other:** 3 + 0 + 0**CE F682 Ice Engineering (a)**

3 Credits

Offered Spring Odd-numbered Years

The factors governing design of marine structures, which must contend with the presence of ice. Topics include ice growth, ice structure, mechanical properties and their dependence on temperature and structure, creep and fracture, mechanics of ice sheets, forces on structures, and experimental methods.

Prerequisites: ES F331, MATH F253X, training or experience in soil mechanics.**Lecture + Lab + Other:** 3 + 0 + 0**CE F683 Arctic Hydrology and Hydraulic Engineering (a)**

3 Credits

Offered Fall Odd-numbered Years

Aspects of hydrology and hydraulics unique to engineering problems of the north. Although the emphasis will be on Alaskan conditions, information from Canada and other circumpolar countries will be included in the course.

Prerequisites: CE F344.**Lecture + Lab + Other:** 3 + 0 + 0

CE F684 Arctic Utility Distribution (a)

3 Credits

Offered As Demand Warrants

Practices and considerations of utility distribution in Arctic regions.

Emphasis on proper design to include freeze protection, materials, energy conservation and system selection.

Prerequisites: ES F341.

Lecture + Lab + Other: 3 + 0 + 0

CE F685 Topics in Frozen Ground Engineering (a)

3 Credits

Offered As Demand Warrants

Selected frozen ground foundation engineering problems will be explored in depth including refrigerated foundations and pile foundations.

Prerequisites: CE F424 or CE F624.

Lecture + Lab + Other: 3 + 0 + 0

CE F692 Seminar

1-3 Credits

Lecture + Lab + Other: 0 + 0 + 0

CE F698 Non-Thesis Research/Project

1-6 Credits

Lecture + Lab + Other: 0 + 0 + 0

CE F699 Thesis

1-15 Credits

Lecture + Lab + Other: 0 + 0 + 0