# Civil Engineering (CE)

## Courses

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<th>Course Code</th>
<th>Course Title</th>
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<tr>
<td>CE A201</td>
<td>Introduction to Civil Engineering</td>
<td>1</td>
<td>Corequisites: ENGR A151 with a minimum grade of C and MATH A251 with a minimum grade of C or concurrent enrollment.</td>
</tr>
<tr>
<td>CE A206</td>
<td>Civil Engineering 3D Modeling</td>
<td>1</td>
<td>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.</td>
</tr>
<tr>
<td>CE A310</td>
<td>Introduction to Geotechnical Engineering</td>
<td>3</td>
<td>Prerequisites: CE A334 with a minimum grade of C and ES A331 with a minimum grade of C.</td>
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<tr>
<td>CE A310L</td>
<td>Introduction to Geotechnical Engineering Lab</td>
<td>1</td>
<td>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.</td>
</tr>
<tr>
<td>CE A334</td>
<td>Properties of Materials</td>
<td>2</td>
<td>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.</td>
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<tr>
<td>CE A334L</td>
<td>Properties of Materials Laboratory</td>
<td>1</td>
<td>Introduces the theory and procedures of laboratory testing of civil engineering materials. This course is taught in conjunction with CE A334 Properties of Materials.</td>
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<tr>
<td>CE A341</td>
<td>Environmental Engineering</td>
<td>3</td>
<td>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).</td>
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<tr>
<td>CE A351</td>
<td>Structural Analysis</td>
<td>4</td>
<td>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.</td>
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<tr>
<td>CE A403</td>
<td>Arctic Engineering</td>
<td>3</td>
<td>Prerequisites: ES A331 with a minimum grade of C.</td>
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<tr>
<td>CE A410</td>
<td>Foundation Engineering</td>
<td>3</td>
<td>Prerequisites: CE A310 with a minimum grade of C.</td>
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<tr>
<td>CE A414</td>
<td>Soil Strength and Slope Stability</td>
<td>3</td>
<td>Prerequisites: CE A310 with a minimum grade of C and ES A331 with a minimum grade of C.</td>
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<tr>
<td>CE A420</td>
<td>Fundamentals of Transportation Engineering</td>
<td>3</td>
<td>Prerequisites: ES A210 with a minimum grade of C and GEO A155 with a minimum grade of C.</td>
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</tbody>
</table>
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
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 A341 Transportation Engineering 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 A442 Environmental Engineering Design 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 A449 Environmental Engineering 3 Credits
Introduces 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**
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. These topics 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**
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 A475 Design of Ports and Harbors 3 Credits**
Introduces planning and design of port and harbor facilities.

**May Be Stacked With:** CE A675

**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 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
 Covers fundamental equations for different finite elements and computer modeling of engineering structures using these elements. Basic finite elements for truss, beam, frame, and triangular plane elements are discussed and applied. The use of finite element software to solve a variety of structural engineering problems is discussed.
 Special Note: Requires knowledge of matrix structural analysis.
 Registration Restrictions: Graduate standing

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 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. These topics will be explored in association with current peer-reviewed literature. Appropriately designed considerations will be evaluated.  
Registration Restrictions: Graduate standing in the College of Engineering or instructor approval  
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 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 a 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 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
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 in 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 A675 Design of Ports and Harbors 3 Credits
Introduces planning and design of port and harbor facilities.  
Registration Restrictions: Graduate standing in the College of Engineering or instructor approval  
May Be Stacked With: CE A475

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 in the College of Engineering  
May Be Stacked With: CE A476

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
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 in the College of Engineering or instructor approval

Crosslisted With: AE A681

CE A682 Ice Engineering 3 Credits
Introduces factors governing design of engineering works contending with the presence of ice. Includes fundamental ice properties, ice processes, ice navigation and control of ice in channels, structural and non-structural ice control measures, ice jams, bearing capacity of floating ice sheets, and ice forces on riverine and ocean structures.

Registration Restrictions: Graduate standing with a baccalaureate degree in engineering or junior or senior standing in an accredited undergraduate program in engineering having completed a mechanics of materials course with a minimum grade of C

Crosslisted With: AE A682

CE A683 Arctic Hydrology and Hydraulic Engineering 3 Credits
Introduces aspects of hydrology and hydraulics unique to engineering problems of the Arctic and near Arctic with emphasis on Alaska conditions including information from Canada and other circumpolar countries.

Registration Restrictions: Graduate standing with a baccalaureate degree in engineering or physical science, or junior or senior standing in an accredited undergraduate program in engineering having completed a water resources course with a minimum grade of C

Crosslisted With: AE A683

CE A684 Arctic Utility Distribution 3 Credits
Introduces physical principles and current practices associated with the planning and design of safe, efficient and affordable water supply, fire protection, wastewater collection and disposal, and solid waste disposal works in cold regions with a view toward conditions in rural arctic Alaska.

Registration Restrictions: Graduate standing with a baccalaureate degree in engineering or physical science, or junior or senior standing in an accredited undergraduate program in engineering having completed a water resources course with a minimum grade of C

Crosslisted With: AE A684

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 in 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