CIVIL ENGINEERING MAJOR

Suggested Course Sequence

<table>
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<th>3rd-Class Year</th>
<th>2nd-Class Year</th>
<th>1st-Class Year</th>
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<tr>
<td>Chem 200</td>
<td>Aero Engr 315</td>
<td>Academy Opt/Design Opt</td>
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<tr>
<td>Civ Engr 330</td>
<td>Beh Sci 310</td>
<td>Astro Engr 310</td>
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<tr>
<td>Econ 201</td>
<td>Biology 315</td>
<td>Bas Sci Opt</td>
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<tr>
<td>Engineering Opt</td>
<td>Civ Engr 361</td>
<td>Civ Engr 474</td>
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<td>English 211</td>
<td>Civ Engr 362</td>
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<td>Engr Mech 220</td>
<td>Civ Engr 372</td>
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<td>Law 220</td>
<td>Civ Engr 373</td>
<td>Design Opt</td>
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<td>Math 243</td>
<td>Civ Engr 390</td>
<td>English 411</td>
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<td>Math 245</td>
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<td>MSS 415/416</td>
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<td>MSS 200</td>
<td>History 300</td>
<td>Philos 310</td>
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<tr>
<td>Physics 215</td>
<td>Math 356</td>
<td>Soc Sci 412</td>
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<td>Pol Sci 211</td>
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CIVIL ENGINEERING (Civ Engr)

Offered by the Department of Civil and Environmental Engineering (DFCE).

**Civ Engr 215. Computer Applications for Civil Engineers.** Application of commercially available computer-based tools for solving common types of Civil Engineering problems. Emphasizes use of spreadsheet and relational database software for information input, data handling, and professional output. Introduces geospatial mapping capabilities using GIS technologies, Component, architectural and engineering modeling using state-of-the-art computer-aided design (CAD) software, including presentation and working drawings.

**Civ Engr 330. Elementary Structural Analysis.** Static analysis of determinate structures. Stresses and deformations in beams, trusses and frames.

**Civ Engr 351. Civil Engineering Practices - Field Engineering.** This two-phase course includes Operation Civil Engineering Air Force (OpsCEAF) and a three-week field experience at the Academy Field Engineering and Readiness Laboratory (FERL). Second-class cadets spend first period at a government facility working on a project in the civil engineering field. Participants will be scheduled for a second or third summer period leadership program. The three-week field experience introduces surveying, construction materials, design of concrete mixes and hands-on construction using metal, timber, asphalt and concrete, and working knowledge of environmental systems. Students construct various projects that they will design in later civil and environmental engineering courses. OpsCEAF is in lieu of Operation Air Force (Mil Tng 301). OpsCEAF credit is Pass/Fail. Civ Engr 351 is graded.

**Civ Engr 352. Lightweight Concrete Design, Analysis and Construction.** The design analysis and construction of the concrete canoe is an integration of several course experiences and develops students’ understanding of fundamental concepts in concrete, structural design, hydraulics and computer applications. Students learn skills in project management, design, concrete technology, material testing and physical construction. Students use computer...
tools such as computer aided design to complete three-dimensional modeling, project management software to develop and track the progress of the project, spreadsheets to design concrete mix, and structural analysis packages to determine forces within the structure. Extensive time is spent in the laboratory testing the engineering properties of the concrete mixes and composite materials.

**Civ Engr 355. Blast Effects and Protective Structures.** The purpose of this course is to educate cadets on protective design strategies to mitigate blast damage and progressive collapse of structures. An understanding of the principals covered in this course is critical for the safe design of USAF structures that may be subjected to blast events. Topics include: computation of blast loads on structures, computation of blast-loaded structural components’ dynamic responses, design of structural components to achieve prescribed levels of performance for specific blast scenarios, and analyses of structures to determine potential for progressive collapse.

**Civ Engr 361. Fundamental Hydraulics.** Introduction of the principles of incompressible fluid mechanics. Topics include: fluid properties, pressure measurement and manometry, hydrostatics, forces on submerged surfaces, buoyancy and stability, continuity, the energy equation, pipe flow, pipe networks, impulse-momentum principle, and open channel flow. Hydraulics laboratories with reports.

**Civ Engr 362. Introduction to Environmental Engineering.** Fundamental theory and principles and preliminary design of unit operations in environmental engineering. Topics include air and water pollution, municipal and hazardous waste treatment, water chemistry, microbiology, mass balance, reactor theory and kinetics, and physical process theory.

**Civ Engr 365. Sustainability and Green Engineering.** Students in this course will learn about sustainability and green engineering principles as they relate to manufacturing, the built environment, and energy. The course will outline commonly employed green engineering principles, metrics, and assessment techniques. Topics associated with the built environment may focus on High Performance and Sustainable Buildings, as well as Leadership in Energy and Environmental Design (LEED) accredited professionals’ examination topics. Traditional, renewable, and sustainable energy sources will be discussed along with the requisite background necessary to understand climate change as a motivating factor and energy and power consumption. The course is case study-based and will include multiple student projects on course topics that have Air Force implications.


**Civ Engr 390. Introduction to Soil Mechanics.** Engineering properties of soils, soil classification, compaction, hydraulic conductivity, consolidation, shear strength and introduction to slope stability and foundation design. Soils laboratories with reports.

**Civ Engr 405. Civil Engineering Seminar.** A course designed to give civil engineering majors the opportunity to synthesize and apply the concepts they have learned throughout their undergraduate education. Topics discussed include engineering ethics and those that students may encounter in the Air Force after graduation.

**Civ Engr 463. Wastewater Treatment Plant Design.** Design of facilities for physical, chemical and biological treatment of wastewater; and treatment and disposal of sludge. Coverage of advanced wastewater treatment and land
treatment systems. Lab exercises analyze raw sewage with data being used for the design processes. Final design project consists of a complete wastewater treatment plant design.

**Civ Engr 464. Architectural Design.** Design of a commercial building. Uses computer-aided-design and drafting (CADD) software in developing design: site plan, functional layout, framing, energy and HVAC, aesthetic design, landscaping and mechanical planning. Produces set of design working drawings by end of course.

**Civ Engr 467. Water Treatment Principles and Design.** Introduces advanced reactor analysis, including equilibrium thermodynamics, kinetics, ideal reactors, and non-ideal reactor analysis. Applies these principles to the design of water treatment unit operation, including those used for treatment of drinking water and remediation of contaminated waters. Topics include the design of adsorption, ion exchange, reverse osmosis, air stripping, coagulation and sedimentation, filtration, and disinfection processes. Includes two complete design exercises.


**Civ Engr 480. Project Management and Contract Administration.** Final course in the civil and environmental engineering capstone sequence. First-class students integrate discipline-specific design work from previous courses through a semester project. Students take an owner’s project requirements through stages of scope definition, budgeting and planning, conceptual design, scheduling and construction contract administration. Students apply engineering standards and consider realistic issues including engineering economics, constructability, environmental requirements, sustainability and safety. The course addresses and applies management topics and concepts of planning, organizing, leading and controlling in the context of a capstone engineering project. Course concludes with a project competition involving construction industry professionals. Serves as a core replacement for Mgt 400 for civil engineering and environmental engineering majors.

**Civ Engr 485. Construction Project Management.** Emphasizes the methods and materials of construction as well as the management practices required to run a successful construction project. Topics include construction materials, project planning, scheduling, cost estimating and field engineering. A semester project, in the form of a detailed study of a major construction project, complements the classroom experience.

**Civ Engr 486. Applied Construction Practices.** Students in this course will learn about construction processes and project delivery methods. Their work will be in preparation to form one or more teams to compete in the annual Associated Schools of Construction regional student competition each February. The cadet teams will play the role of construction or design-build firms competing to win a project award. Student products will include a qualifications package, site plans, conceptual architectural and/or engineering designs, cost estimates, project schedules and construction plans. The students will also present their plans to a panel of industry representatives. They will compete against other teams from universities across the western U.S. The deliverables include the final versions of all cadet work and their lessons learned for next year’s teams.

**Civ Engr 486x. Applied Construction Practices.** Students learn about construction processes and project delivery methods. Their work is in preparation to form one or more teams to compete in the annual Associated Schools of Construction regional student competition each February. The teams play the role of construction or design-build firms competing to win a project award. Student products will include a qualifications package, site plans, conceptual architectural and/or engineering designs, cost estimates, project schedules and construction plans. Students also present their plans to a panel of industry representatives. They compete against other teams from
universities across the western United States. Deliverables include the final versions of all student work and their lessons learned for next year’s teams.

**Civ Engr 488. Pavement Design and Rehabilitation.** Fundamental theory and design principles of flexible and rigid pavements covering traffic characteristics (loads and repetitions), airfield and highway pavement design, pavement evaluation and maintenance, and pavement rehabilitation techniques. The course content may include traffic operations (safety, volume, flow, and level of service) and roadway geometrics (intersections and horizontal and vertical alignment).

**Civ Engr 491. Foundation Engineering.** Students design a facility foundation. Topics include site investigation, bearing capacity and settlement, analysis and design of deep and shallow foundations. Introduction to lateral earth pressures.

**Civ Engr 492. Earth Structures.** Estimate/predict lateral earth pressures, analyze slope stability, design embankments, design retaining walls and summarize current research on retaining wall design.

**Civ Engr 495. Special Topics.** Selected topics in civil engineering.

**Civ Engr 499. Independent Study.** Individual study and research in an advanced civil engineering topic approved by the department head.