

CIVIL ENGINEERING

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Overview

Mission Statement

The mission of the Department of Civil Engineering:

- deliver high-quality comprehensive degree programs (BS, MS, MEng, PhD) to all of our students at both the undergraduate and graduate levels
- matriculate students who excel in professional practice and leadership and who possess compassion and respect for people of all cultural backgrounds
- teach our classes with excellence, whether in a traditional classroom setting or online
- offer our students state-of-the-art laboratories, equipment and classrooms with the latest technology needed for a complete learning experience
- develop ambitious and innovative research programs involving both faculty and students through funding from federal, state and local sources
- provide supportive mentoring and guidance to our students through teaching, research and advising
- produce students who can work as leading professionals in civil engineering and in many other fields for which civil engineering knowledge can be a foundation

Undergraduate Information

The CU Denver undergraduate civil engineering curriculum places balanced emphasis on five principal areas of civil engineering practice: structures, transportation, environmental, water resources and geotechnical engineering. In each of these areas, the student receives instruction in planning, design and analysis methods. Relevant computing skills are taught early in the program of study and used frequently in subsequent courses. The department also offers undergraduate degrees with industry-backed curriculum in construction engineering and management and construction management.

A minimum of 130 semester hours is required to earn a bachelor of science in civil engineering degree. The bachelor of science in construction engineering and management requires a minimum of 128 semester hours, and the bachelor of science in construction management requires a minimum of 120 semester hours. The department provides advising to help students develop an efficient study plan. The student must satisfactorily complete all the course work in the curriculum, satisfy all university graduation requirements, and maintain at least a 2.0 GPA in the civil engineering courses.

Programs

- Civil Engineering, BS (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-engineering-design-computing/civil-engineering/civil-engineering-bs/>)
- Construction Engineering and Management, BS (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-engineering-design-computing/civil-engineering/construction-management-bs/>)
- Construction Management, BS (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-engineering-design-computing/civil-engineering/construction-management-bs/>)
- Construction Management Minor (<http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-engineering-design-computing/civil-engineering/construction-management-minor/>)

departments/college-engineering-design-computing/civil-engineering/construction-engineering-management-bs/)

Faculty

Professors:

Yail Jimmy Kim, PhD, Queen's University, Professional Engineer (PEng)-Canada

Wesley Marshall, PhD, University of Connecticut, PE-Connecticut

David C. Mays, PhD, University of California at Berkeley, PE-Colorado, California

Kevin L. Rens, PhD, Iowa State University, PE-Colorado

Associate Professors:

Caroline Clevenger, PhD, Stanford University, PE, RA-Colorado

Arunprakash Karunanithi, PhD, University of Connecticut

Chengyu Li, PhD, Arizona State University; PE-Colorado, North Carolina, New Mexico, Washington; SE-Utah, Arizona, Washington

Assistant Professors:

Moatassem Abdallah, PhD, University of Illinois at Urbana-Champaign

Heidi Brothers, PhD, University of Cincinnati

Allison Goodwell, PhD, University of Illinois at Urbana-Champaign

Frederick R. Rutz, PhD, University of Colorado, PE-Colorado

Professors Emeriti:

Paul E. Bartlett, MS, University of Colorado, PE-Colorado

Nien-Yin Chang, PhD, Ohio State University, Professional Engineer (PE)-Ohio and Colorado

James C.Y. Guo, PhD, University of Illinois at Urbana-Champaign, PE-Colorado

David W. Hubly, PhD, Iowa State University, PE-Colorado

Bruce N. Janson, PhD, University of Illinois at Urbana-Champaign

Lynn E. Johnson, PhD, Cornell University, PE-Connecticut

Oren G. Strom, PhD, University of Texas at Austin

Civil Engineering (CVEN)

CVEN 1025 - Civil Engineering Graphics and Computer Aided Design (3 Credits)

Introduces microcomputer-based, menu-driven, 2-D and 3-D computer-aided design systems; standard Civil Engineering industry details and some three-dimensional modeling of solid objects; principles on engineering drawing and descriptive geometry with applications specifically geared for civil engineers. Prereq: High School Geometry and Algebra. Max Hours: 3 Credits.

Grading Basis: Letter Grade

CVEN 1067 - Introduction to Civil Engineering (1 Credit)

Introduces civil engineering and the many career choices in this broad field. Covers the history of the profession, current civil engineering projects, societal and global implications, technologies used, professional ethics, sustainability, and licensure. Max hours: 1 Credit.

Grading Basis: Letter Grade

CVEN 1800 - Special Topics (1-6 Credits)

Repeatable. Max Hours: 9 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 9.

CVEN 1840 - Independent Study (1-6 Credits)

This category is intended for topics which students may wish to pursue on their own initiative, with guidance from a professor who agrees to limited consultation on the work and to award credit when the project is completed. Departmental approval is required. Repeatable. Max Hours: 9 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 9.

CVEN 2121 - Analytical Mechanics I (3 Credits)

A vector treatment of force systems and their resultants; equilibrium of trusses, beams, frames, and machines, including internal forces and three-dimensional configurations, static friction, properties of areas, distributed loads and hydrostatics. Prereq: PHYS 2311 with a C- or higher and Prereq/Coreq: MATH 2411. Cross-listed with MECH 2023. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: PHYS 2311 with a C- or higher. Prereq/Coreq: MATH 2411.

CVEN 2200 - Computing Methods in Civil Engineering (3 Credits)

Introduces MATLAB computer programming for engineering applications. Students will learn programming concepts such as relational and logical operations, branching statements and loops. They will apply these concepts in the MATLAB platform to write programs to solve several engineering problems. Prereq: CVEN 1025 and MATH 2411. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 1025 and MATH 2411 with a C- or higher

CVEN 2212 - Surveying for Construction and Engineering (2 Credits)

Survey observations used by engineers and surveyors using levels and total stations to make sure things are put in the right place and leveled; analysis and adjustment of measured loops, traverses; areas and volumes; methods used in construction; analysis of error sources; and presentation of results. Course includes a required lab section. Max hours: 2 Credits.

Grading Basis: Letter Grade

CVEN 2214 - Surveying for Engineering (1 Credit)

Survey observations used by engineers and surveyors using levels and total stations to make sure things are put in the right place and leveled; analysis and adjustment of measured loops, traverses; areas and volumes; methods used in construction; analysis of error sources; and presentation of results. This course does not include a lab. Max hours: 1 Credit.

Grading Basis: Letter Grade

CVEN 2800 - Special Topics (1-6 Credits)

Repeatable. Max Hours: 9 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 9.

CVEN 2840 - Independent Study (1-6 Credits)

This category is intended for topics which students may wish to pursue on their own initiative, with guidance from a professor who agrees to limited consultation on the work and to award credit when the project is completed. Departmental approval is required. Repeatable. Max Hours: 9 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 9.

CVEN 3111 - Analytical Mechanics II (3 Credits)

A vector treatment of dynamics of particles and rigid bodies, including rectilinear translation, central-force, general motion of particles, kinematics of rigid bodies, the inertia tensor, plane motion of rigid bodies; energy and momentum methods for particles, systems of particles and rigid bodies. Prereq: CVEN 2121 or MECH 2023 and MATH 2411 with a C- or better. Cross-listed with MECH 2033. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 2121 or MECH 2023 and MATH 2411 with a C- or better.

CVEN 3121 - Mechanics of Materials (3 Credits)

Mechanical properties of materials, stresses and strains in members subjected to tension, compression and shear, combined stresses, flexural and shearing stresses in beams, deflections of beams, column analysis, principal stresses. Prereq: CVEN 2121 or MECH 2023 and MATH 2411 with a C- or better. Cross-listed with MECH 3043. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 2121 or MECH 2023 and MATH 2411 with a C- or better.

CVEN 3141 - Introduction to Structural Materials (2 Credits)

To learn the fundamental characteristics of structural materials, including steel, concrete, masonry, timber, and composites; to learn how to test structural materials in the laboratory; and to learn how to interpret test data for engineering applications. After completing this course, students are expected to understand the behavior of structural materials and establish necessary background for structural design courses. Prereq or Coreq: CVEN 3121 or MECH 3043. Max Hours: 2 Credits.

Grading Basis: Letter Grade

Prereq or Coreq: CVEN 3121 or MECH 3043.

CVEN 3200 - Computational Methods for Civil Engineers (3 Credits)

This course introduces advanced programming and data analysis skills pertinent to the range of civil engineering disciplines. Topics will include numerical methods, statistical analysis, and programming techniques for measurements and data collection. Languages and tools may include Excel, Matlab, Python, and Arduino. Prereq: (IWKS 2300 or ENGR 1100) and (MATH 3800 or CVEN 3611) with a C- or higher. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: (IWKS 2300 or ENGR 1100) and (MATH 3800 or CVEN 3611) with a C- or higher.

CVEN 3212 - Plane Surveying For GIS Majors (3 Credits)

This course will present the concepts and practical materials for surveying instruments, survey data collection methods and data processing with applications in GIS. It will cover the shape of the Earth theory, Map projections, Datum, 2D and 3D coordinate transformation methods and coordinate geometry problems. Prereq: MATH 1401 and 2411. Max Hours: 3 Credits.

Grading Basis: Letter Grade

CVEN 3313 - Fluid Mechanics (3 Credits)

Fundamentals of fluid mechanics. Topics include fluid properties, hydrostatics, the continuity principle, the energy principle, the momentum principle, similitude and dimensional analysis, drag, and friction for laminar and turbulent flow in closed conduits. Prereq: CVEN 2121 or MECH 2023 with a C- or higher. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: MECH 2023 or CVEN 2121 with a C- or higher

CVEN 3323 - Hydrosystems Engineering (3 Credits)

Civil engineering hydraulics applied to the hydrologic cycle; surface- and groundwater resources; precipitation, streamflow, and groundwater measurements; and basics of reservoir operation, open channel hydraulics, and storm water design. Prereq: CVEN 3313 and ENGR 1100 or IWKS 2300 with a C- or higher. Restriction: Restricted to Civil Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3313 and ENGR 1100 or IWKS 2300 with a C- or higher.

Restriction: Restricted to Civil Engineering majors.

CVEN 3401 - Introduction to Environmental Engineering (3 Credits)

Introduces students to the broad field of environmental engineering. Topics include essential chemical, biological, and risk assessment concepts needed for addressing environmental problems. Major unit operations and processes used for treating wastewater and potable drinking water. An overview of technologies used for treating particulate and gaseous air pollutants, managing solid wastes, and remediating hazardous wastes. The course also introduces environmental sustainability, green engineering, life cycle assessment and other systems oriented concepts. Prereq: CHEM 1130 or CHEM 2031 or ENGR 1130 with a C- or better. Cross-listed with CVEN 5401. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CHEM 1130 or CHEM 2031 or ENGR 1130 with a C- or better.

CVEN 3414 - Water Supply and Distribution Systems (3 Credits)

Planning and design for potable water supply and distribution. Topics include the civil engineering design process, pressurized pipe networks, pump selection, water demand estimation, surface- and groundwater resources, and reservoir operation. Design project and field trip required. Prereq: CVEN 3313 with a C- or higher. Coreq: CVEN 2200. Restriction: Restricted to Civil Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3313 with a C- or higher Coreq: CVEN 2200 Restriction: Restricted to Civil Engineering Majors

CVEN 3505 - Structural Analysis (3 Credits)

The focus of this course is on the understanding of structural analysis principles and application of techniques. We will build upon topics initiated in prerequisite courses. Topics include: Introduction to loads, structural idealization, analysis of trusses, arches, beams and frames, cables, influence lines, beam deflections, and introductions to matrix analysis and computer-assisted analysis. The course will be fast-paced and mathematically rigorous. Prereq: CVEN 3121 or MECH 3043 with a C- or higher. Restriction: Restricted to Civil or Construction Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3121 or MECH 3043 with a C- or higher Restriction:

Restricted to Civil or Construction Engineering majors.

CVEN 3602 - Transportation Engineering (3 Credits)

This course will introduce you to the concepts and methods of transportation engineering, planning and management. This course will emphasize traffic engineering. Topics will include vehicle dynamics, traffic flow fundamentals, accident analysis, signal timing, highway capacity analysis, level of service analysis, freeway operations, and evaluation procedures for alternative transportation projects. Prereq: C- or better in MATH 1401 or Junior Standing or instructor permission. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: C- or better in MATH 1401 or Junior Standing or instructor permission

CVEN 3611 - Engineering Statistics (3 Credits)

Covers statistical methods for engineering studies. Topics include common probability distributions, sample design, descriptive statistics, hypothesis testing of one or two populations, tests of discrete versus continuous random variables, analysis of variance, linear and non-linear multiple regression models, non-parametric tests of fit. Prereq: Math 1401 Calculus I and Math 2411 Calculus II. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: MATH 1401 and MATH 2411

CVEN 3718 - Geotechnical Engineering I (3 Credits)

Soil formation, phase diagram, soil constituents and behavior, description of soils, classification, clay minerals, compaction, soil improvement, capillarity, shrinkage, swell, collapsible soil, frost action, flow through porous media, and consolidation. Lab experiments, including specific gravity, grain size analysis, liquid and plastic limits, and consolidation, are to be conducted in concert with the lectures. Prereq: CVEN 3121 or MECH 3043 with a C- or higher. Pre or Coreq: CVEN 3313. Restriction: Restricted to Civil or Construction Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3121 or MECH 3043 with a C- or higher Pre or Coreq:

CVEN 3313 Restriction: Restricted to Civil or Construction Engineering majors

Typically Offered: Fall, Spring.

CVEN 3800 - Special Topics: 3800 (1-6 Credits)

Repeatable. Max Hours: 6 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 6.

Restrictions: Restricted to majors within the College of Engineering, Design and Computing.

CVEN 3840 - Independent Study (1-8 Credits)

This category is intended for topics which students may wish to pursue on their own initiative, with guidance from a professor who agrees to limited consultation on the work and to award credit when the project is completed. Departmental approval is required. Repeatable. Max Hours: 9 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 9.

Restrictions: Restricted to majors within the College of Engineering, Design and Computing.

CVEN 4000 - Senior Seminar (0 Credits)

Required for all Civil Engineering majors. This course is generally taken the semester of graduation. To complete this course one must complete the fundamentals of engineering exam from the national council of examiners for engineering and surveying, attend any required course meetings, and complete an ethics assignment. Failure to attend the required meeting(s) of this course will delay graduation. Prereq or Coreq: CVEN 4067. Max hours: 0 Credits.

Grading Basis: Letter Grade

Prereq or Coreq: CVEN 4067

Typically Offered: Fall, Spring.

CVEN 4025 - Autocad Civil 3d & Advanced Civil Engineering Graphics (3 Credits)

Lectures target civil engineering industry specific site information modeling software and geospatial industry specific geographical information systems software to elevate students' knowledge of each software to an in-depth understanding. Laboratory exercises will focus on civil drafting and design, producing documentation, and general project workflows. Additional laboratory exercises will focus on geospatial data creation, data management, and cartographic display. Prereq: CVEN 1025. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 1025

CVEN 4067 - Senior Design Projects (3 Credits)

Senior civil engineering students, working in teams, are assigned significant open-ended design problems requiring the synthesis of material learned in previous engineering courses for solution. Design teams work independently under the supervision of a civil engineering faculty member. Prereq: Graduation Agreement and one design course. Co-req: A second design course. Restriction: Restricted to Civil Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 4427 or 4565 or 4575 or 4585 or 4602 or 4738 with a C- or higher Coreq: CVEN 4427 or 4565 or 4575 or 4585 or 4602 or 4738 Restrictions: Restricted to Civil Engineering majors.

CVEN 4077 - Engineering Economy (3 Credits)

Applies economic and financial principles to evaluation of engineering alternatives. Calculation of annual costs, present worth and prospective rates of return on investment. Review of systems analysis techniques, including simulation, linear programming, and project scheduling. Prereq: Junior standing. Cross-listed with MECH 4147. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Restriction: Restricted to junior standing majors in the College of Engineering, Design and Computing

CVEN 4087 - Engineering Contracts (3 Credits)

Laws met by the practicing engineer, types of contracts, specification writing, laws on contracts, agency, partnership, sales and property, with primary emphasis on rights and duties of the engineer. Prereq: Senior standing. Cross-listed with CVEN 5087. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Restriction: Restricted to senior standing majors in the College of Engineering, Design and Computing

CVEN 4230 - Construction Engineering Systems (3 Credits)

Course provides an introduction to construction engineering management including building mechanical and electrical systems. Restrictions: Restricted to Junior standing or higher. Max hours: 3 Credits.

Grading Basis: Letter Grade

Restrictions: Restricted to Junior standing or higher.

CVEN 4388 - Site Engineering (3 Credits)

Course introduces the fundamentals of site engineering which require understanding and interpreting landforms, slopes, contour lines, grading, drainage, and earthwork to storm water management, hydrology reports, designing roadways, and street networks. Other topics include designing for ADA and concepts of sustainability in site design. Note: CAD experience is recommended. Cross-listed with CVEN 5388. Max Hours: 3 Credits.

Grading Basis: Letter Grade

CVEN 4424 - Field Methods for Sustainable Development: Colombia (3 Credits)

Course will introduce students to international sustainable development in both lab and field work in Colombia, partnering with communities on sustainable development projects across cultures and disciplines both within and outside of engineering, and emphasizing community interaction. Travel fees are required. Note: Personal essay, letter of recommendation, and interview with instructor required. Cross-listed with CVEN 5424. Max Hours: 3 Credits.

Grading Basis: Letter Grade

CVEN 4426 - Pipe Network and Sewer Design (3 Credits)

Design of pressurized pipe networks for water supply and sanitary sewers for wastewater collection. Topics include the civil engineering design process, estimation of water and wastewater design loads, and design of pressurized pipe networks and sanitary sewers including pump selection, service reservoirs, lift stations, and relevant software. Design project and field trip required. Prereq: CVEN 3313 and Prereq or Coreq: ENGR 1100 or IWKS 2300 with a C- or better. Cross-listed with CVEN 5426. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3313. Prereq or Coreq: ENGR 1100 or IWKS 2300 with a C- or better.

CVEN 4427 - Storm Water System Design (3 Credits)

This course covers urban watershed analysis, design rainfall and hydrologic losses, flood frequency and design event, rational method for peak runoff prediction, street hydraulic capacity and safety, culvert hydraulics, street inlet collection system, and storm sewer system design and flow analysis. Prereq: CVEN 3323 and senior standing. Restriction: Restricted to Civil Engineering majors. Cross-listed with CVEN 5427. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3323 with a C- or higher Restriction: Restricted to Civil Engineering majors

CVEN 4537 - Numerical Methods for Engineers (3 Credits)

Introduces numerical analysis. Solution of linear and non-linear equation systems. Numerical methods for ordinary and partial differential equations. Engineering applications. Prereq: CSCI 1410, MATH 3191 and 3200. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CSCI 1410, MATH 3191 and MATH 3200 with a C- or higher

CVEN 4565 - Timber Structure Design (3 Credits)

Design of wood roof, wall, and floor systems including beams, columns, trusses, diaphragms and shear walls for vertical and lateral loads. Connection design, glued-laminated members, plywood, and engineered lumber are incorporated. Prereq: CVEN 3505 and CVEN 3141 with a C- or higher. Restriction: Restricted to Civil or Construction Engineering majors. Cross-listed with CVEN 5565. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3505 and 3141 with a C- or higher Restriction: Restricted to Civil or Construction Engineering majors

CVEN 4575 - Structural Steel Design (3 Credits)

Design of structural steel members and their connections. Prereq: CVEN 3505 and 3141 with a C- or higher. Restriction: Restricted to Civil or Construction Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3505 and 3141 with a C- or higher Restriction: Restricted to Civil or Construction Engineering majors

CVEN 4585 - Reinforced Concrete Design (3 Credits)

The course objective is to introduce the students to the principles of structural design in reinforced concrete. The course emphasizes determining loads for structural design and using these loads to design reinforced concrete members. Prereq: CVEN 3505 and 3141 with a C- or higher. Restriction: Restricted to Civil or Construction Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3505 and 3141 with a C- or higher Restriction: Restricted to Civil or Construction Engineering majors

CVEN 4590 - Design of Prestressed Concrete (3 Credits)

To learn the basic concepts of analysis and design of prestressed concrete, which is reinforced concrete in which steel is tensioned against the concrete, thereby introducing compression in concrete and hence overcoming the tensile weakness of concrete relative to its compressive strength. Cross-listed with CVEN 5590. Prereq: CVEN 4585 with a C- or better. Restriction: Restricted to Civil or Construction Engineering majors. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 4585 with a C- or better. Restriction: Restricted to Civil or Construction Engineering majors.

CVEN 4591 - Design of Composite Structures (3 Credits)

The objective of this course is to provide engineering students with an overall awareness of the application and design of composite structures. Practical examples are discussed based on theory. Prereq: CVEN 4585 with a C- or better. Restriction: Restricted to Civil or Construction Engineering majors. Cross-listed with CVEN 5591. Max hours: 3 Credits Grading Basis: Letter Grade

Prereq: CVEN 4585 with a C- or better. Restriction: Restricted to Civil or Construction Engineering majors.

CVEN 4602 - Highway Engineering (3 Credits)

Evaluates alternate highway routes. Discusses highway drainage, finance, maintenance, pavement design, traffic operations and principles of economic analysis. Analyses of the impact of the highway on the environment. Cross-listed with CVEN 5602. Prereq: CVEN 3602 with a C- or better. Restriction: Restricted to Civil or Construction Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3602 with a C- or better Restriction: Restricted to Civil or Construction Engineering majors.

CVEN 4612 - Traffic Impact Assessment (3 Credits)

Covers (1) procedures to satisfy state and local requirements for transportation impact studies, (2) methods to perform trip generation, distribution, and traffic assignment for impact analyses, and (3) analysis of transportation impacts on residential communities, mode choice, regional business (downtown or suburban), peak and off-peak travel times, noise, safety, parking and pedestrians. A course project requires students to develop an application of analysis software to a case study area. Prereq: CVEN 3602 with a C- or better. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3602 with a C- or better.

CVEN 4621 - Highway Capacity Analysis (3 Credits)

Covers the principles and applications of highway capacity analysis for freeways and arterials, ramps and interchanges, weave and merge sections, signalized and unsignalized intersections, roundabouts, pedestrian areas and transit. Emphasis is on level-of-service analysis procedures in the Highway Capacity Manual, although other approaches are also discussed. Additional topics include roadway characteristics, vehicle dynamics, human factors, speed and volume studies, travel time surveys and traffic flow characteristics. Prereq: CVEN 3602 with a C- or better. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3602 with a C- or better.

CVEN 4719 - Design & Construction of Geosynthetic Soil Structures (3 Credits)

Theory of reinforced soil; Mechanical and hydraulic properties of geosynthetics; Soil-geosynthetic interaction behavior; Design concepts of GRS structures; Design and construction of GRS retaining walls; Design and construction of GRS embankments and slopes; Design and Construction of GRS foundations. Prereq: CVEN 3718 and 4728. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 3.

Prereq: CVEN 3718 and 4728 with a C- or higher

CVEN 4728 - Geotechnical Engineering II (2 Credits)

Shear behavior and strength, and basic applications of shear strength (such as earth pressure and retaining structures, bearing capacity of footings, and slope stability). Lab experiments, including permeability, direct shear, unconfined compression, and triaxial tests, are to be conducted in concert with the lectures. Prereq: CVEN 3708/3718. Restriction: Restricted to Civil Engineering majors. Max hours: 2 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3708/3718 with a C- or higher Restriction: Restricted to Civil Engineering majors

Typically Offered: Fall, Spring.

CVEN 4738 - Intermediate Foundation Engineering (3 Credits)

Applies principles of soil mechanics to the analysis and design of foundations and earth structure. Theories of consolidation, earth pressure, slope stability, and bearing capacity. Studies settlement of structures, shallow and deep foundations, retaining walls and excavations. Cross-listed with CVEN 5738. Prereq: CVEN 3141 and 3718 with a C- or higher. Restriction: Restricted to Civil or Construction Engineering majors. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 3141 and 3718 with a C- or higher Restriction: Restricted to Civil or Construction Engineering majors.

CVEN 4780 - Engineering Geology (3 Credits)

Studies geology as utilized in engineering and environmental practice. Emphasizes a conceptual integration of geologic materials, processes, and rates of change as a basis for successful application of geologic knowledge to environmental planning and engineering design projects. Prereq: MATH 2411 and CVEN 2121. Cross-listed with CVEN 5780 and GEOL 4780, 5780. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CVEN 2121 and MATH 2411 with a C- or higher

CVEN 4800 - Special Topics (3 Credits)

Supervised study of special topics of interest to students under guidance of instructor. Prereq: Permission of instructor. Repeatable. Max Hours: 9 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 9.

Restrictions: Restricted to majors within the College of Engineering, Design and Computing.

CVEN 4840 - Independent Study (1-6 Credits)

This category is intended for topics which students may wish to pursue on their own initiative, with guidance from a professor who agrees to limited consultation on the work and to award credit when the project is completed. Departmental approval is required. Repeatable. Max Hours: 9 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 9.

Restrictions: Restricted to majors within the College of Engineering, Design and Computing.

CVEN 4939 - Internship (1-3 Credits)

Civil Engineering undergraduate internship. Department consent required. Max hours: 6 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 6.

Construction Engineering and Management (CEMT)

CEMT 1000 - Introduction to Construction Management (1 Credit)

Course provides an introduction to the construction industry and project management. Student will learn basic CM terminology, roles and responsibilities associated with a construction project, and construction documents. Max hours: 1 Credits.

Grading Basis: Letter Grade

CEMT 2100 - Construction Management Fundamentals (3 Credits)

This course focuses on introducing the field of construction engineering and management. Topics will include introduction to construction management and work process; drawings; cost estimating; project planning and control; construction operations and job site management; quality and safety management; and building information modeling.

Course participants will gain knowledge about construction engineering and management through lectures, exercises, class presentations, projects and group activities. Course includes a field trip to a construction site and guest speakers from the construction industry as the course time allows. Max hours: 3 Credits.

Grading Basis: Letter Grade

CEMT 2300 - Heavy Civil Construction and Equipment (3 Credits)

Course includes an introduction to heavy civil construction equipment, materials, labor and methods. Students will learn to perform comparative cost analysis for owning and operating heavy equipment; and perform the proper selection, applications, utilization and productivity of heavy equipment with the associated labor and logistics. Max hours: 3 Credits.

Grading Basis: Letter Grade

CEMT 3100 - Field Engineering and Management (3 Credits)

se includes an overview of field engineering and management. Students will assess basic design of temporary structures, quality assurance and quality control, and materials testing and processing. Students will learn the fundamentals of soils engineering. Students will be able to apply surveying concepts and generate site layout. Students will learn the basics of safety, accident prevention, risk management, and regulatory compliance on construction sites. Prereq: CEMT 2100 or CVEN 4230. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CEMT 2100 or CVEN 4230.

CEMT 4067 - Construction Senior Capstone (3 Credits)

Students will work in teams to formulate or design a construction project requiring the synthesis of material learned in previous courses. The student teams will establish goals, plan and accomplish tasks, meet deadlines, analyze risk and uncertainty, and demonstrate leadership and management skills. Teams will coordinate and communicate with a range of stakeholders and give final presentations. Prereq: CEMT 2100 or CVEN 4230. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CEMT 2100 or CVEN 4230.

CEMT 4231 - Construction Materials and Methods (3 Credits)

This course serves as an introduction to the primary materials and methods used to construct buildings and infrastructure across the United States, including concrete, wood and steel. Students explore processes related to specifying and installing materials, as well as analyze various material performance characteristics. Students are required to complete lectures, videos and class activities. Students also research and present information on a wide range of materials and construction processes.

Prereq: CEMT 2100 or CVEN 4230. Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CEMT 2100 or CVEN 4230.

CEMT 4232 - Construction Planning and Control (3 Credits)

This course presents knowledge on planning and controlling of construction projects. Students will learn the basics of construction planning to develop work breakdown structure and activity list, estimate activity cost and duration, and identify job logic and precedence relationships. Several scheduling techniques will be presented in this class, including bar chart, network scheduling, uncertainty in scheduling (PERT), limited resources scheduling, resource leveling, line of balance, and time-cost tradeoff analysis. Furthermore, this class will provide knowledge on cash flow analysis and construction control techniques such as Earned Value method. Students will acquire skills on the use of currently available computer scheduling and planning software such as Primavera 6 and Navisworks Manage to create 5D models to visualize sequence of the construction activities. In addition, students will forms teams and work on a project throughout the semester to apply the skills that they learn in class. Cross-listed with CVEN 5232. Prereq: CEMT 2100 or CVEN 4230 and a statistics course (MATH 2830, 3800, CVEN 3611, ELEC 3817, or BANA 2010). Max Hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CEMT 2100 or CVEN 4230 and a statistics course (MATH 2830, 3800, CVEN 3611, ELEC 3817, or BANA 2010)

CEMT 4233 - Construction Cost Estimating (3 Credits)

This course presents the application of scientific principles to rough and detailed cost estimating for construction. The course starts with an introduction to estimating and how it fits in bid/proposal process and construction management. Quantity take offs, putting costs to those quantities, overhead costs, cost markups and profits; and computerized estimating will be explored. The project includes quantity take and cost estimate for the concrete and metals portion of an actual project. Prereq: CEMT 2100 or CVEN 4230. Max hours: 3 Credits

Grading Basis: Letter Grade

Prereq: CEMT 2100 or CVEN 4230.

CEMT 4234 - Sustainable Construction (3 Credits)

This course will serve as an introduction to major components and technologies used in sustainable design and construction to create healthy, environmentally-sensitive built environments. Content focuses on construction processes, renewable energy systems, healthy buildings, natural and cultural resources, and traditional as well as cutting-edge building techniques. Course participants will gain knowledge about effective sustainable practices through active learning by engaging in case studies, class presentations, and group activities. Numerous guest speakers will share first-hand experience regarding implementation and professional practice of sustainable principles in the real-world. Prereq: CEMT 2100 or CVEN 4230. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CEMT 2100 or CVEN 4230.

CEMT 4236 - Project Management Systems (3 Credits)

Address the basic nature of managing projects and the advantages and disadvantages to this approach. Introduce the characteristics, techniques, and problems associated with initiating, planning, executing, controlling, and closeout of projects. Learn about the International Standards of PM and how to use them. Develop a management perspective about projects to help develop future project managers. Max Hours: 3 Credits.

Grading Basis: Letter Grade

CEMT 4239 - Introduction to Temporary Structures and Construction Engineering (3 Credits)

This course will introduce the many types of temporary structures that are integral in the completion of construction projects. The temporary structures to be discussed include but are not limited to formwork, falsework, scaffolding, Support of Excavation (SOE), and equipment bridges. Construction Engineering will also be introduced including the application of structural engineering to crane picks and demolitions. The course includes planning, management and design aspects. The project includes the delivery of a formwork design that stresses the importance of constructability, cost, while providing updates throughout the project to the instructor. Cross-listed with CEMT 5239. Prereq: CEMT 2100 with a C- or better and junior standing or higher. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CEMT 2100 with a C- or better and junior standing or higher.

CEMT 4240 - Building Information Modeling (BIM) (3 Credits)

Building Information Modeling is an advanced approach to facility design and construction using object-oriented 3-D models. It can be integrated in the design and construction for analytical purposes, including design, visualization, quantity takeoff, cost estimating, planning, and facility management. Prereq: CEMT 2100 or CVEN 4230. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CEMT 2100 or CVEN 4230.

CEMT 4242 - Construction Safety (3 Credits)

This course is a study of safety practices in the construction industry and the specific safety procedures used in safety management of a construction project. Topics include safety risks inherent in construction projects, the roles of government, the judicial system, the insurance industry, designers and project owners in safety management and the economic impact of injuries. Advanced topics include safety risk quantification and analysis, design for safety and emerging technologies. Prereq: CEMT 2100 or CVEN 4230. Max hours: 3 Credits.

Grading Basis: Letter Grade

Prereq: CEMT 2100 or CVEN 4230.

CEMT 4939 - Internship (1-6 Credits)

Construction Engineering and Management Internship. Repeatable. Max hours: 6 Credits.

Grading Basis: Letter Grade

Repeatable. Max Credits: 6.